SILK SCREEN PRINTING PROCESS

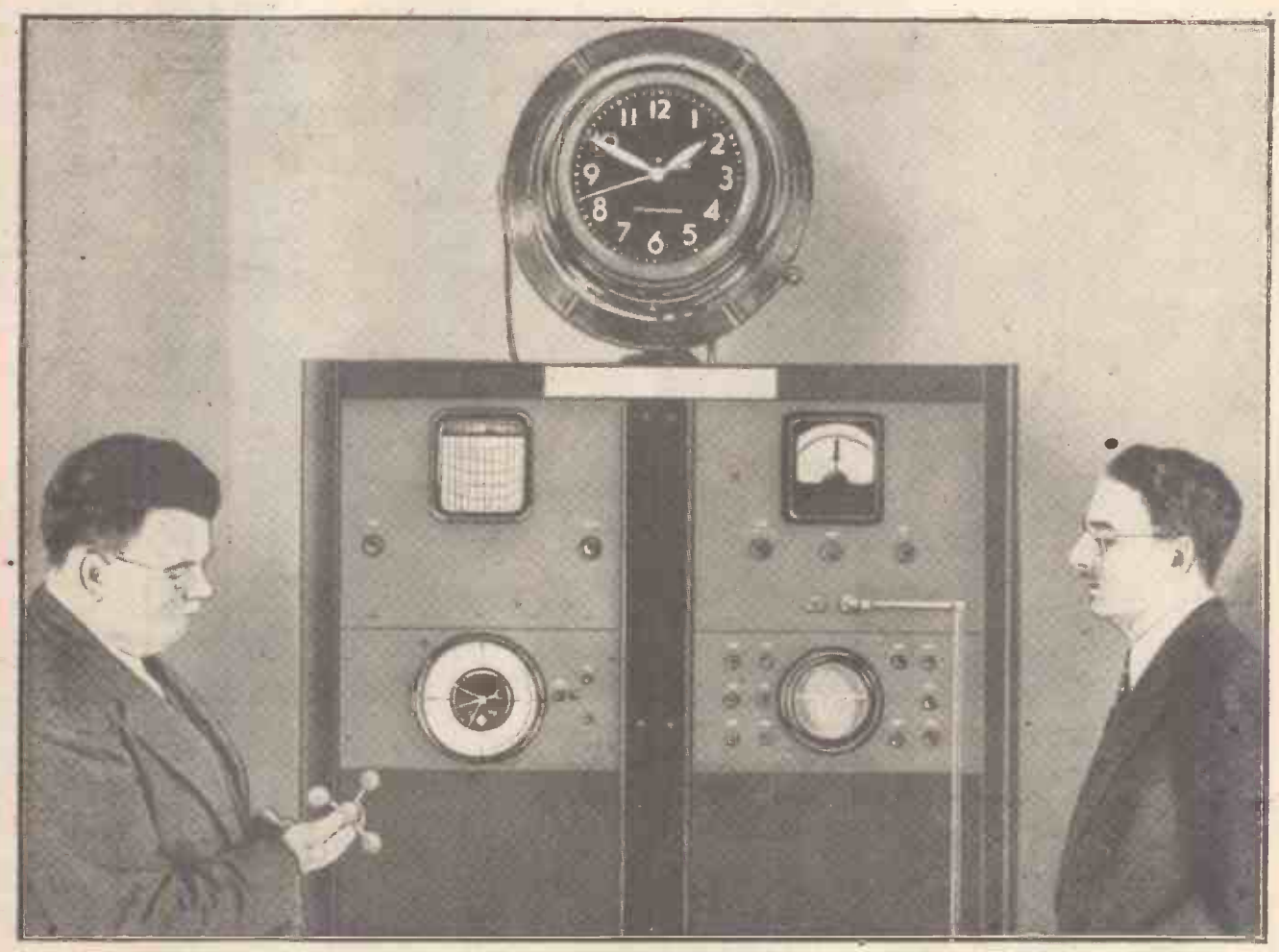
NEWNES

PRACTICAL MECHANICS

9D

EDITOR : F. J. CAMM

JUNE 1949



THE ATOMIC CLOCK. FOR DETAILS SEE PAGE 276.

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PRACTICAL MECHANICS

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

Editor: F. J. CAMM

VOL. XVI JUNE, 1949 No. 188

FAIR COMMENT

By THE EDITOR

Model Engineering Practice: New Series

IN the next issue of this journal a new series entitled *Model Engineering Practice*, upon which I have been engaged for some time, will commence. The series was really suggested to me by Mr. W. J. Bassett-Lowke about two years ago during the Model Engineer Exhibition, when he was inspecting some of my own models. He was kind enough to comment that the large number of models I had made would form the subject of an exhibition on their own!

It was his opinion that as model engineering practice differed in many important respects from skilled workshop practice it would be of great service to amateurs if there existed a comprehensive source of information on it.

A model engineer, for example, often must build up a complicated shape, because it would not pay him to make a pattern and have a casting made from it. The model engineer has not available all of the machine tools with which a factory is equipped, nor in some cases can he afford a full kit of handtools. His lathe is not the complicated device used in the tool-room; he has not a milling or shaping machine, and he must perforce cut gears by means of an overhead attachment to the lathe.

In this new series, therefore, I shall deal with tools and their use; the equipment of the home workshop; the production of simple castings from home-made moulds; pattern making; lathework, including wood-turning; hand processes such as filing, scraping, and lapping; drilling; screw cutting; soldering, brazing, and welding; riveting; finishing, including simple electro-plating; sheet metal work; gear cutting; making and reading drawings; model standards; marking out; workshop calculations; and give examples of the methods employed in making model locomotives, model boats, model aeroplanes, and other working models. Where necessary the work will be photographed in progress in my own workshop.

Many readers, since the first issue of this journal went to press, have been attracted to the fascinating hobby of model engineering, and some as a result have made engineering their profession. During that time I have received numerous requests for an encyclopædic work on the subject and, indeed, model suppliers have many times suggested that I should prepare such a manuscript.

Now that it is complete I hope that model engineers, and particularly members of model engineering clubs, will make the fact known that publication commences with the July issue.

Prize for Lathe Design

THERE are on the market many excellent lathes at quite modest price suitable for amateurs, and my advice to those wishing to take up model engineering is always to buy the best lathe that can be afforded.

The sphere of model making which can be undertaken without a lathe is strictly limited. There are, however, many who either have not the money to purchase a lathe or who prefer to make one, if they have the machine-shop facilities. Home-made lathes, however, are seldom satisfactory, for the simple reason that few have the facilities for machining the castings and aligning the heads. If this part of the work is to be put out the final bill is greater than the cost of a lathe.

There is a demand for a small and simple lathe somewhere between the watchmaker's lathe and the somewhat larger centre lathe. Following up our very successful competition for fountain-pen designs, I now invite readers to submit designs for such a lathe, with the incentive of a £20 prize for the winner. Other designs published will be paid for.

It is important to note that the design must comply with the following conditions:

1. It must be a workmanlike tool, and not a crude affair mounted on a converted sewing-machine stand.
2. It must have a fully compound slide-rest, be screw-cutting and back-geared.
3. It must have a draw-spindle headstock and tailstock suitable for standard collets.
4. It should be of 3½in. centre height and have a gap bed. It must have a screwed tail-stock spindle.
5. Additional marks will be awarded for useful attachments such as gear-cutting, keyway-cutting, etc.
6. Drawings must be to scale—preferably half size.
7. The lathe may be bench mounted or designed as an integral unit with its stand.
8. A pump for delivering cutting lubricant must be incorporated.
9. The lathe must be capable of operation by treadle or electric motor.
10. Entries must be received not later than September 1st, 1949. Drawings should be sent rolled and addressed to "Lathe," The Editor, PRACTICAL MECHANICS, Geo. Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

Radio Control of Models

THE radio control of models is developing. Several successful radio-controlled model aircraft are now being regularly flown by members of the S.M.A.E. A national contest for such models is to be held under the auspices of the Society this year for the first time, and there is an international contest at Paris on June 12th, where this country, it is hoped, will be represented. Some of the members of the Society have also successfully operated radio-controlled model boats. One, indeed, has full differential left and right rudder control, as well as stop, start, and reverse motor control.

It should be pointed out that such models are very costly and difficult to adjust. The Radio Controlled Models Association has been formed to foster interests.

Control-line Flying

APROPOS my comments on control-line flying in the April issue, I have received a few letters from enthusiasts expressing the opinion that it is not dangerous when undertaken under conditions recommended by the S.M.A.E. My only concern is that the authorities may once again ban the flying of petrol models unless this new pastime is conducted under rigid conditions. Experienced aero-modellers will naturally take every precaution to ensure that their tethered models are flown under conditions of safety so far as the spectators are concerned. It must be remembered, however, that there are many persons flying control-line models who are not members of clubs, and it is these who are likely to be a source of danger to spectators and to themselves, and thus bring the sport into disrepute. It is this promiscuous flying of what can be a dangerous sport which I know is agitating the minds of the authorities. Not all of these model flyers are experienced; indeed, many of them are schoolboys.

One letter I received from R. S. Lowe, of Camberwell, S.E.5, is typical of the viewpoint of schoolboys. He expressed his views in somewhat violent language, a mere display of uninformed criticism by an inexperienced beginner, which schoolboys as well as others presume is an effective way of disarming too shrewd a criticism; he finally withdraws his arguments and apologises for them! I think that the S.M.A.E. will support me when I say that they as well as I am opposed to *uncontrolled* model flying, which many presume to think is *control-line* flying. There certainly should be some age-limit imposed or some examination so that the enthusiast can demonstrate his ability to indulge in control-line flying with safety to himself and to others. Some form of licence, in other words—each licensee to give an undertaking not to fly such models except under agreed rules.—F.J.C.

THE Silk Screen Process

Operational Details and Applications

By OUR SPECIAL CORRESPONDENT

IT is impossible to say who actually invented the silk screen process, but according to Mr. Young, one of the directors of Silk Screen Arts, Ltd., of Shirley, who recently conducted me over his factory that I might see the process in operation, the art of printing designs through open stencils, upon which modern practice is really based, dates back to ancient times. The method used in those days involved the cutting of open designs in stiffened fabric or lacquered papyrus, after which the colour was applied to the receiving surface by brushing or stippling. The early stenciller also had to devise a method of holding the design together after the unwanted parts of the stencil had been cut away, and in some instances human hair was used as strengthening ties. Apparently the stencil cutter pulled out strands of his own hair as he worked. It is from primitive methods such as these that the modern methods of silk screen printing have been developed.

Many Applications

Providing a reasonably smooth or soft surface is available it is possible to process direct, and without any transferring, on to such widely different materials such as plywood, plastics, perspex, metals and sheet or plate glass. Mr. Young informed me that he had introduced a method of laying down a specially pigmented ink on previously treated aluminium so that the printed design would not flake off when the aluminium was bent but would stretch like elastic.

Mounting the Silk

Briefly, silk screen printing apparatus consists of a wooden frame hinged at one end to a flat bed over which is stretched the "screen" of silk. In Fig. 2 a workman is seen testing the silk for tightness. It should be free from wrinkles, otherwise it will spoil the stencil. The bed to which the frame is attached is generally faced with aluminium or glass. The material on to which the design is to be printed is then fitted into registers on the bed, the screen with the stencil attached is closed over it and a rubber-edged squeegee is used to press the paint through to the printing materials. Fig. 4 shows this operation in progress. On the left an operator is seen inserting the printing material under the silk screen ready for printing, whilst on the right the design is being pressed through the screen by means of the squeegee. Note that the squeegee is drawn towards the operator.

Stencils

Of the various types of stencil used in silk screen printing the simplest is of course the paper stencil. This is cut by hand from a sheet of thin paper, and loose centres are held in position by means of "ties" of paper left in as in ordinary stencils. The completed stencil is then backed by a piece of plain paper and placed on the bed of the machine, the screen is closed and the paint run over and pressed through it by means of the squeegee. The tacky nature of the paint makes the stencil stick to the silk. As an alternative gum is sometimes used to fasten the stencil to the silk. A sharp knife is then used to cut away the paper "ties," care being taken not to damage the silk in the process.

Use of "Profilm"

If more detail is required in the design than can be obtained with a paper stencil the stencil is cut on "Profilm." This consists of thin transparent paper having a waxed film adhering to it. On top of the wax is a thin paper sheet coated with shellac. As the complete "film" is transparent it is placed over the original drawing whilst being cut. The shellac-coated surface is placed uppermost on the design and the stencil is cut into it. Extreme care must be shown by the cutter, as he must only exert sufficient pressure on the knife in order to cut through the shellac and layer of paper and leave the tissue backing intact. The unwanted portions of the stencil are then removed. The method of attaching this type of stencil to the screen differs from the previous method in that it is ironed into the silk with a warm flat-iron. Upon removal of the melted wax backing sheet the shellac paper stencil is left adhering firmly to the silk. Once the printing has been completed the silk can be washed out with spirit and the silk used again. As against the use of the stencil, it is possible to paint over the silk screen leaving untouched the portions through which the printing is done. With this method, however, it is not easy to make corrections, so it is seldom used. Obviously, each colour that goes to make up the design requires a separate stencil. Referring to Fig. 4, a number of drying racks can be seen in the background. As one colour is printed it is placed in these racks until they are full. The first printed sheet is then dry and the second colour can be applied. In this way very little time is lost in the drying process. I saw a number of finished posters, each having the appearance of being hand-painted, and the perfect register of the colour speaks for the efficiency of silk screen printing seen.

Fig. 1.—Preparing the stencil from the finished design.

Photographic Stencils

Photographic stencils are sometimes used, and these are applied to the silk in various ways. The silk can be photographically sensitised and the design printed on it by exposure to light, as in the normal photographic process. When the image is developed the light-hardened gelatine remains in the silk, the washing process leaving gaps through which the paint is squeezed during printing. This method has a number of disadvantages, chief being that it is impossible to obtain perfect colour register.

This method has now been superseded, and the film image is now laid on a temporary paper support and not direct on to the silk. The wet gelatine film is then pressed into the silk. As the film dries the temporary paper support comes away. This method gives a really sharp stencil and perfect colour register. Non-distorting supports prevent distortion of the silk during the drying process.

Speed of the Process

That orders can be speedily carried out is proved by the fact that given a fairly simple design a good operator can turn out 1,000 printed copies a day. As an instance of this a firm approached Mr. Young during the power cut, when the use of machinery was considerably restricted, with an order for 70,000 display posters. Silk Screen Arts, Ltd., working on hand-operated screens, managed to complete the run in just over four days. This firm have certainly done quite a lot of pioneering in the field of silk screen printing. During the war their secret method of printing on glass was of consider-

SHOWING OPERATIVES AT WORK IN THE VARIOUS DEPARTMENTS OF THE SILK SCREEN ARTS, FACTORY AT SHIRLEY, CROYDON.

Fig. 3.—The art department where a team of highly qualified draughtsmen and draughtswomen are busily employed producing elaborate designs ready for stencilling.

Fig. 2.—(Above) An operative testing the silk for tightness. It should be free from wrinkles, otherwise it will spoil the stencil. The illustration also shows a stencil about to be fitted to the stretched silk web.

Fig. 4.—(Above) On the left of the photograph the operator is shown inserting the printing materials under the silk screen ready for printing, whilst on the right the design is being pressed through the screen by means of a squeegee.

Fig. 5.—(Left) Showing plastic tablecloths of polyvinyl chloride being printed. Two operators manipulate the squeegee and lift the frame clear after each print.

Fig. 6.—Showing how photographic methods are used for producing silk screen stencils.

able use to the Ministry of Aircraft Production. They were entrusted with the job of producing a number of maps of the Berlin area, the drafting and production of which entailed a great deal of original creative work. Stencils, 3ft. square, were prepared, and these were printed in an acid-resisting substance on to sheets of glass and subsequently acid-etched. These maps were then used in conjunction with the famous "magic-eye" radar equipment in training air-crews.

Silk screen printing can also be applied to the stencilling of vacuum cleaner bags, destination indicators on buses; in fact, its scope is almost unlimited.

Thus, whilst the general principles of modern silk screen printing are known to most people in the display business, firms like Silk Screen Arts, Ltd., are continually experimenting and making refinements in the process, and such developments are closely guarded secrets.

Designing

Fig. 3 shows the design department, where a team of highly qualified draughtsmen and draughtswomen produce the elaborate drawings ready for the stencil cutter. In Fig. 5 plastic tablecloths of polyvinyl chloride are shown being printed. Two operators manipulate the squeegee and lift the frame clear after each print. Not only posters but all kinds of decorative work, such as curtains, etc., can be printed by silk screen.

The process can also be used for printing lace silhouettes and other intricate patterns on plastic tablecloths as well as applying colour to plastic buttons and heavy plastic sheeting. It also has many applications in the games room where chess and dart boards can be printed directly on to wood. In the textile industry designs can be produced on ties, scarves, etc.; in fact, its uses are legion.

Thus it rests with the user to work out how the process can best be adapted to suit his own particular needs. Moreover, even a short run will prove economical with the silk screen process.

Producing the Silk

It is interesting to note that Switzerland provides the best silks for silk screen printing. Eighteen weave is considered the most suitable for the process, but organdie and voile can be used for coarser work. Substitutes for the silk have been produced, though varying weather has had a bad effect on them and they have a tendency to sag and distort after very little use.

Notes and News

New Aircraft Engine

IT was recently announced in New York by the Curtiss-Wright Corporation that a new aircraft engine has been produced which will enable U.S. bombers to fly nearly 14,000 miles without refuelling. Known as the "Turbo Cyclone 18," the engine harnesses exhaust gases previously wasted in a normal petrol engine.

New Conveyor Installation

THE largest coil of conveyor belting yet produced at the Dunlop factory in Cambridge Street, Manchester, has been delivered to the Gas Light and Coke Company's works at Beckton. Its dimensions are: Length, 2,000ft.; width, 30in.; plies, 5; duck, 28ozs.; rubber on face, $\frac{3}{16}$in.; rubber on back, $\frac{1}{16}$in.; weight, 6½ tons; diameter of coil, 10ft. 6in. The rubber cover of $\frac{3}{16}$in. on the face is specially designed to convey hot coke. It will be used almost entirely for renewals on coke conveyors associated with the horizontal retort houses at Beckton, and some perhaps on the plant for conveying coal, of which about 5,000 tons are carbonised there daily at the present time.

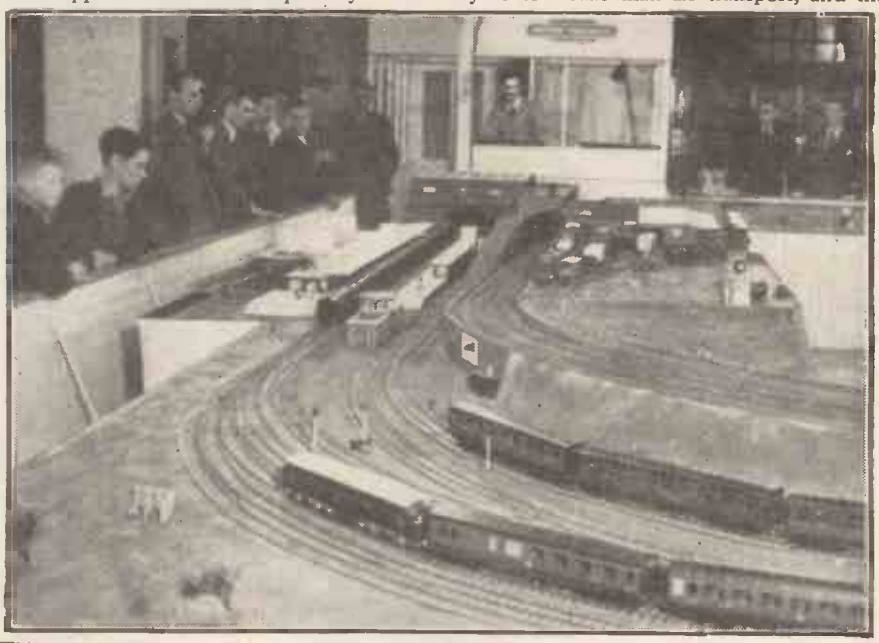
Eight-ton Lorry by Air to Ecuador

FLYING over roadless jungle country a "Bristol" Freighter aircraft recently delivered an eight-ton oilfields lorry to a new Shell oilfield in Ecuador.

The lorry, a large Leyland Super Beaver export-type vehicle with a specially equipped oilfields body, was too heavy and too wide for even the Freighter to handle in one load. Cab and body, complete steering unit, two outside rear wheels, winch, front mudguards, two tool lockers and the complete front axle were stripped off and flown separately. The Leyland front axle and wheels were replaced by a narrower Fordson axle, specially lengthened by 4in., and the vehicle was driven into the Freighter's hold under its own power.

After a 35-minute flight from Shell Mera over dense jungle the Freighter landed the vehicle in a clearing close to the oil-well site at Villano, where it was needed to build a rig and drilling equipment for a new well.

The site was completely inaccessible by any other means than air transport, and the operation provided a striking demonstration of the value of the "Bristol" Freighter in opening up undeveloped areas.



This working model railway, staged by British Railways, was displayed at the Annual Exhibition of the Model Railway Club, held recently at the Central Hall, Westminster.

Model CO_2 Engines

Carbon Dioxide Engines Have, After a Lapse of Many Years, Reappeared on the Market. The History of Their Development and Their Principles and a Review of a Modern Product are Here Given

By F. J. CAMM

TWISTED elastic as a propellant for model aircraft was first used by the Frenchman Penaud in 1871 in connection with the beautifully made models which he flew before the French Academy. In those days elastic provided the maximum amount of power for a given weight, and although spring-operated clockwork motors and compressed-air engines had been used by Laurence Hargreaves, the Australian, in his successful model ornithopters, elastic became the accepted form of motive power for model aeroplanes for over 50 years, save for a few engines produced by isolated experimenters such as H. H. Groves, Mayer, Fieux, Peterin du Motel, and the present writer.

These early engines were operated either by compressed air, flash steam or carbon dioxide, and only one or two by petrol. The early petrol engine weighed as much as 2lb. or more and called for the building of an unwieldy model, and therefore it did not become popular.

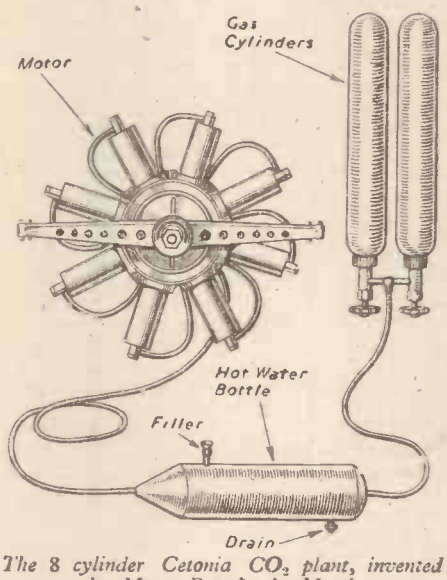
On the other hand, compressed air, steam and carbon dioxide would operate a tiny engine developing anything up to 1/16 h.p. which could be installed into a model having a reasonable wing span.

Flash steam was not entirely satisfactory because of the heat generated and the difficulty of keeping the blowlamp alight during flight. Carbon dioxide engines had a very short life because of the expense and of the difficulty of maintaining a reasonable temperature; whilst compressed air was popular for a number of years, since all that was necessary to operate the engine was a suitable cylinder made from copper or brass foil and a pump with which to inflate it. Working pressures up to 100lb. per sq. in., however, were necessary, and pumping proved to be a somewhat exhausting business. Compressed air as well as CO_2 engines suffer the usual disadvantage associated with the elastic motor, in that the power steadily commences to fall from the moment the model is released.

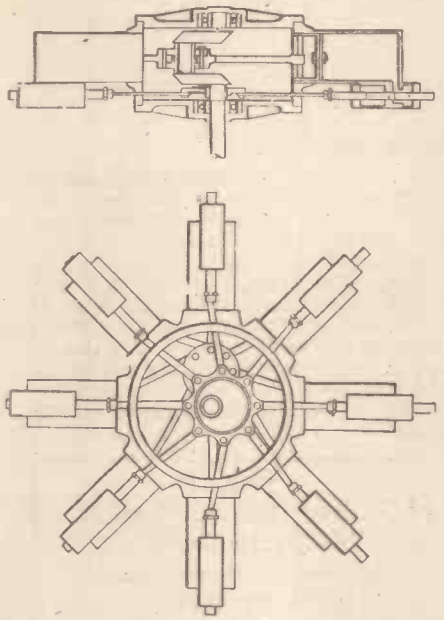
I can fairly claim to have produced the first miniature petrol engines in this country, but they, too, did not prove popular. Many years later I endeavoured to popularise CO_2 and compressed air as a form of power because a supply of CO_2 was readily available in the form of the Prana sparklet bulb used in soda syphons, and compressed did not need any special equipment.

Also an engine which will run on CO_2 will also run on compressed air and steam, and thus the modeller had available three sources of power for one engine. Older aero modellers will remember the series of designs for such engines which I published in *Aeronautics*, of which journal I was the technical editor (not to be confused with the present *Aeronautics* published by the proprietors of this journal); the most successful of which, using my rotary mitre D valve, is still in use. In fact, blueprints are available for it and also for my flash steam plant which makes use of the same valve arrangement.

Now I notice a recrudescence of interest in CO_2 and one or two British firms are marketing such engines operated, as they were over 40 years ago, by the Prana sparklet bulb. Readers interested in this form of motive power may like to have the results of my experiments and the data I accumulated on the subject.



The 8 cylinder Cetonia CO_2 plant, invented by Mons. Peterin du Motel.



Plan and rear views of the Cetonia engine, showing crank and valve arrangement.

Carbon Dioxide

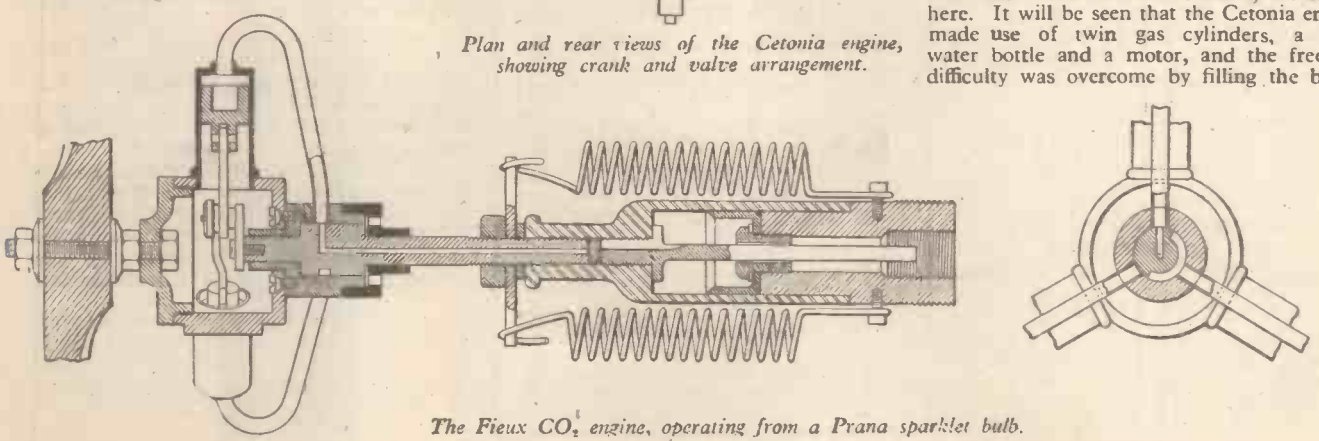
Carbon dioxide is made from carbonic acid gas, which at a pressure of from 35 to 37 atmospheres (approximately 500lb. to the sq. in.) liquefies, or it can be liquefied at ordinary atmospheric pressure at a temperature of – 78 deg. C. The liquid can be purchased in steel cylinders, and on permitting this compressed and liquefied gas to escape in the air, and especially through a fine nozzle, a portion of the liquid immediately evaporates and becomes a gas, the heat dissipation being so great that what is left has no longer the required heat, to keep it in a liquid state. It freezes at once and produces what is known as "carbonic acid snow," which evaporates comparatively slowly.

This provides one of the difficulties to be overcome, because it stops any further production of the gas. Liquefied CO_2 has one advantage over compressed air in that for the same quantity of the gas the pressure in the reservoir is much less. This makes for a greater factor of safety and for a saving in weight.

A peculiarity of the liquefied form of the gas is that under the application of heat the liquid form expands more than the gaseous, providing an exception to the rule that liquids expand less by heat than gases.

The Cetonia

Two of the most popular CO_2 plants were the Fieux and the Cetonia, illustrated here. It will be seen that the Cetonia engine made use of twin gas cylinders, a hot-water bottle and a motor, and the freezing difficulty was overcome by filling the bottle



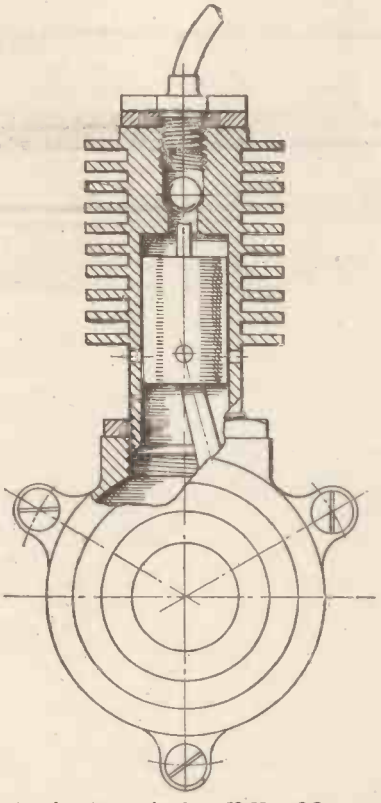
The Fieux CO_2 engine, operating from a Prana sparklet bulb.

with hot water at a temperature of 90 deg. C. Through this bottle runs a network of tubing somewhat similar to the flash boiler, into which the Liquid CO_2 is passed direct. Liquid CO_2 cannot remain liquefied at a temperature above 31 deg. C. however great the pressure, but immediately turns itself into a gas, thus preventing freezing. Hot water is ideal for the purpose because of its high specific heat.

For example, assuming the specific heat of water to be 1, that of air is 0.25, therefore a pound of water in losing 1 degree of temperature would warm 4lb. of air 1 degree. But water is about 770 times heavier than air; therefore, comparing equal volumes, a cu. ft. of water in losing 1 degree of temperature would raise 770 × 4 = 3,080 cu. ft. of air 1 deg. C.

The liquid CO_2 it will be observed, is carried in small steel cylinders, each containing about 1 kilogram.

The engine is started or stopped by turning a tap. It will be seen that the engine



Sectional view of the K.K. CO_2 engine, showing ball valve and push rod fixed to top of piston.

is of the eight-cylinder radial type, having a bore of 19 millimetres and a stroke of 28 millimetres. The overall diameter of the engine is 185 millimetres and the total weight 780 grammes. The cylinders are of steel set at an angle, of course, of 45 degrees. The crankshaft is mounted on ball bearings and the connecting rods are hinged to the large end of the master connecting rod in the usual way. On the crankshaft is an eccentric operating the inlet valves of the piston type. The balance of the engine, of course, is perfect, and in the rotary type provides a self-contained flywheel.

This motor, when tested at the Conservatoire des Arts et Metiers, gave 1.03 h.p. at 710 r.p.m. for 1 min. The weight of the complete plant is 4 kilograms, and installed into a machine weighing 17½ kilograms it flew a distance of 1,178 metres. The model was 3 metres long, 2 metres span, and the propeller was 0.85 metre dia. In addition to winning the Gordon Bennett Cup for models, this model secured many other awards, including a Gold Medal in the Concours Lepine at Paris in May, 1911, and it was adopted for experimental research work by the military Aeronautical Establishment of Chalais Meudon.

The Fieux Plant

The diagram at the foot of page 267 shows the general layout. It was supplied with either two, three or five cylinders; the crankcase was of aluminium into which the cylinders were screwed. The cylinders were of bronze 1½ millimetres thick, which easily withstood an internal pressure of 40lb. per sq. centimetre. The bore was 10 millimetres and the stroke 25 millimetres. The weight of the three-cylinder type was 2 oz. and the five-cylinder 2½ oz. The construction was somewhat similar to that of the Gnome. In fact, the arrangement of the connecting rods is identical. These engines, of course, work on the two-stroke principle.

The generating plant consists of a steel cylinder or sparklet, a distributing cylinder, and a reducing valve for regulating the pressure between the gas cylinder and the motor. Carbon dioxide is stored in the cylinder or sparklet at a pressure of nine atmospheres, or approximately 140 lb. per sq. in. When the sparklet cylinder is screwed into the ends of the distribution cylinder gas is liberated by the valve of the gas cylinder which is thereby opened by a pin. The model illustrated was claimed to give 1/12th of one h.p. at 1,225 r.p.m. It won the Gordon Bennett Cup for models less than 1½ metres in length with a flight of over 250 metres.

It is well known in the case of compressed-air motors, of which the CO_2 is only a type, that the best and most efficient method of using air or gas is by heating in its passage to the motor cylinders and by admitting it under full pressure without the use of any reducing valve.

The K.K. CO_2 Engine

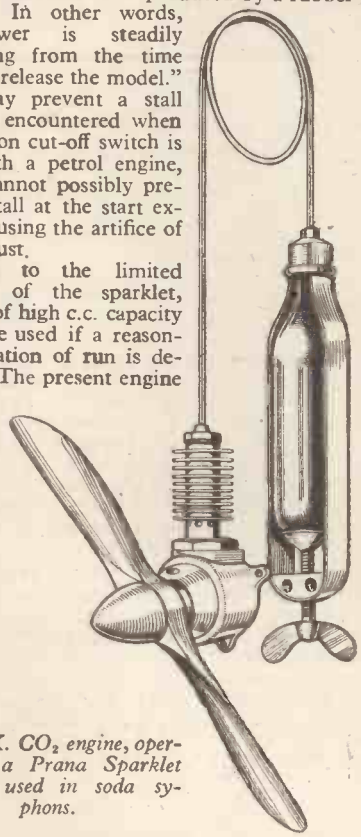
The diagrams on this page show the K.K. CO_2 engine marketed under the name of the Slicker Mite. It is ¼in. bore and 5/16in. stroke and weighs 3 oz. Like diesels and glow-plug engines it will run equally well in either direction. The cylinder is thin to absorb heat from the air and not to dissipate it. It will be noted that ice forms on the sparklet bulb as the engine is running. Air should, therefore, be allowed to circulate around the engine and the sparklet bulb to prevent losing heat. The engine should not be entirely enclosed.

The engine itself weighs 2 oz., and the sparklet 1 oz. charged, ¾ oz. empty.

The sparklet bulbs cost 4d. each, and so such engines can be costly if they are to be frequently used. This particular engine will drive an airscrew 7in. in diameter by 4in. pitch. Sparklet bulbs are obtainable at any chemist at 3s. for a carton of six, with an allowance of 2d. on each carton of empty bulbs. This K.K. engine has an ingenious valve mechanism. Whilst it makes use of an ordinary ball to close the orifice the method of opening the valve so that the gas may enter the cylinder is as far as I have been able to trace quite new. It will be seen that instead of the usual cam, push-rod and spring, a small push-rod is attached to the piston head so that at the top of the stroke the ball is lifted off the seat, thus admitting the gas. Directly the engine has passed top-dead centre the ball is forced under pressure on to its seating, thus shutting off the supply. The engine, as usual, is a two-stroke.

The disadvantage, of course, is that the valve commences to open slightly before top-dead centre instead of just after, and that when open the piston is working against the full pressure from the sparklet. I do not support the claims of the manufacturers who, in their literature, say, "One of the major advantages of the CO_2 engine is that the thrust is similar to that produced by a rubber motor. In other words, the power is steadily decreasing from the time that you release the model." This may prevent a stall so often encountered when an ignition cut-off switch is used with a petrol engine, but it cannot possibly prevent a stall at the start except by using the artifice of downthrust.

Owing to the limited capacity of the sparklet, engines of high c.c. capacity cannot be used if a reasonable duration of run is desired. The present engine



The K.K. CO_2 engine, operated by a Prana Sparklet bulb, as used in soda syphons.

ran for 1 min. with effective thrust. It is equally suitable for model boats. It can only be installed in very light model aeroplanes of small wing-span.

If this form of motive power can be made cheaper from the point of view of operating costs and larger gas cylinders supplied, it will become a further competitor of the simple elastic motor. This latter, in any case, is declining in popularity in this mechanical age.

It is very true that there is nothing new under the sun, and I hope that this article will dispel in the minds of some new aero modellers and others the idea that carbon dioxide motors are new because they have not heard of them before.

Stained and Painted Glass Windows

Leading Up, Soldering and Cementing

By E. W. TWINING

(*Concluded from page 246, May issue*)

AT this stage the reader is warned against taking any risks with a part of a window which may have had many hours spent upon it in painting; for all glasses do not take stain to the same depth of colour in the same time and degree of temperature. Some glasses are soft, require a weak stain and low degree of heat, whilst others are hard, will take strong stain and can be fired at the same time as, and alongside of, painted work.

Always put through the kiln a trial bit of the same glass having on it the same strength of stain as that to be used in the next firing of stain. Note the period of firing the sample, the situation of it on the kiln tray and either the gas pressure or the position of the main gas-cock. A small glass-painter's kiln is shown in Fig. 7, and in the photograph both the pressure gauge and the main gas-cock are visible.

Leading Up

Everything being now completed as regards paint and stain, lay the cutline on the bench and commence leading up. Two straight laths of deal will be wanted: one the length of the light (or portion, section or panel of the light) and the other an inch or so longer than the width. They can be about an inch and a half wide by half an inch thick. These are placed on the cutline in such a way that one edge of each is parallel with and a quarter of an inch away from the outside black lines of the cutline; that is to say, parallel with the long side line and the bottom line. Be sure to get them exactly right and square one with the other. The quarter-inch referred to is one-half the width of the outside lead, so upon the accuracy of the setting of the laths much depends. Then nail them, through the edge of the cutline, to the bench.

First place the bottom and side, both half-inch, leads next to the laths and commence to put into these the border glasses. If the bottom of the light is to the right on the bench the work of leading will commence and be built up from the left-hand bottom corner, but some workers prefer the cutline the other way round: the bottom of the light to the left, and if this way is adopted leading will proceed from the right-hand bottom corner. In either case the longer lath will be nearest the working edge of the bench.

Cutting the Leads

Between the border glasses, and crossing them, the leads in a light under 24 inches in width should be not less than a quarter of an inch wide. Between 24-inch and, say, 30-inch, they should be five-sixteenths or three-eighths of an inch. All leads should be of the half-round pattern, except the edging lead, which can be flat.

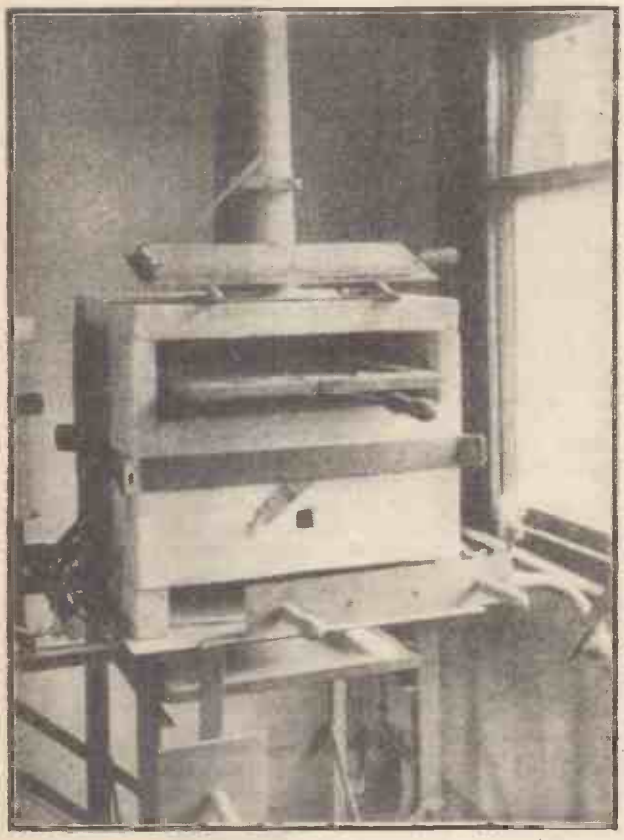


Fig. 7.—A glass-painter's kiln.

The cutting of the leads is done with a vertical stroke downwards, through the lead, on to the bench or side lath, the cut being made with a glazier's knife—a tool something like a paper-hanger's wall scraper but with a blade only about an inch and a quarter wide. The end of the blade, the cutting edge, should be very keen.

The next leads to put in will be those on the inside of the border, surrounding the main subject of the window. If the border cross-leads are quarter-inch, those around the subject should be three-eighths inch. They will be long and straight, excepting only where any part of the subject overlaps the border, as it does in the case of the foot armour of St. George (Figs. 1 and 8).

Then proceed to place in position the other glasses of the foreground and background; working upwards, all with quarter-inch leads, until the figure is reached; around this, in order to strengthen the cutline, a three-eighths inch lead should be run, but for all the parts of the figure inside of the cutline quarter-inch should again be used.

Fig. 8.—A finished window by the writer, at Wolverton.

Glazing Nails

Whilst leading up is proceeding it will be found necessary to hold the glasses in their exact positions on the cutline and, after a lead has been run along its farther edge, that lead as well. This holding is done by means of glaziers' nails, lightly knocked into the bench. Panel pins, inch and a half long, from a hardware shop, can be used as a substitute. Small slips of wood, or short bits of lead, should be inserted between the glass and the nail. As leading up proceeds the nails are, of course, pulled out and re-used farther up.

Soldering

When leading is completed the junction of every piece of lead with another must be soldered. Rub each joint with the end of a composite candle or a touch of tallow and, with a soldering iron in one hand and a stick of solder (the more slender the stick the better) in the other, go over every joint, taking care to miss none. The quantity for each joint should be just sufficient to form, with a correctly heated iron, a smooth, bright and flattened dome of solder.

The best form of "iron" for this work is, unquestionably, one having a short copper bar set crosswise in an iron holder with a small, continuous, Bunsen gas jet playing upon the middle of it. Of course, a flexible pipe is required to a gas supply.

Having completed the soldering of one side of the light remove the laths, draw the light forward to nearly half-way beyond the edge of the bench, supporting it with the left hand. Now lift the opposite side, tilting it until it is held edgeways in the left hand; let it rest upon a pair of wood blocks or books or some such objects, still keeping it edgeways. Walk around to the other side of it and lift it again on to the bench, with the

soldered side downwards, go over all the joints on this, now the upper, side and the light is ready for cementing.

Cementing

The usual way in which cementing is done is, with the light flat on the bench, to pour over it a fairly stiff prepared paint, composed of sifted whiting, plaster, litharge and a dark colouring of umber brown and black, the whole being mixed with boiled linseed oil. This is worked well into the spaces under all the leads with a small, flat, stiff-haired brush, of the scrubbing-brush type. The superfluous cement is wiped off, the light turned over, and the other side done in the same way.

Both sides are then freely dusted with dry whiting and the light left for a few hours. Finally, with a dry flat brush, clean off and polish with soft cloths, taking care to leave no cement sticking to the glass, especially the painted side, where it is rather liable to remain unnoticed.

Blackleading and polishing the leads makes a very nice finish to a window.

The Wires

The last operation is the soldering on of copper wires by means of which the light is secured to the saddlebars.

There should be four or five wires to each bar, according to the width of the light, and the thickness of the wires should be No. 16 S.W.G. If the saddlebars are half an inch in diameter, each wire should be four inches long soldered to the lead at its centre.

As the fixing of a window is somewhat beyond the scope of these articles, for it is masons' work, and as the individual artist will not possess the requisite equipment for carrying it out, it is recommended that a reliable firm of builders be asked to undertake the job; one which has been used to church work for preference.

The subject of Fig. 1 was for one of four war memorial windows, fixed and dedicated last year, in the Catholic Church at Wolverton, Bucks, and as a sequel to the illustrations already given there is reproduced in Fig. 8 a photograph of this same window after completion in the writer's studio.

Impending Changes in Patent Law

By W. J. WESTON

IN the course of this year there will be added to the Statute Book an Act that will be called the Patents Act, 1949. A companion Act will embody the law concerning designs.

For the most part the Patents Act will gather together the law now scattered over half a dozen Acts, and will put that law into more easily accessible and more logical form. The patent will remain what it is now—in theory a privilege voluntarily granted by the Crown, in practice an exclusive right claimable by any applicant who fulfils the prescribed conditions, and the law relating to it will be substantially the same.

The consolidating Act does not enlarge the scope of the subject-matter of a patent. Rather, it seeks to make clear that an idea, a principle, a device, can be patented *only* when embodied in a piece of apparatus, or where the principle is coupled with a method of application. Thus, there is the specific statement that the Comptroller will refuse an application claiming: "As an invention a substance capable of being used as food or medicine which is a mixture of known ingredients." And the life of the patent and the fees payable to ensure its continued existence are unaltered.

The changes and additions, however, are by no means negligible. The section designed to ensure that the fruit of the inventor's ingenuity shall really augment the well-being of his community is a valuable one.

Patent Rights

It has too often happened that a patentee, constrained maybe by his inability to find capital to exploit his patent, has sold his rights to a manufacturer anxious not to exploit the invention but to prevent it from being exploited. Patent rights, by giving the inventor a temporary monopoly, were intended not only to encourage invention but also to help towards industrial expansion; they have at times become means of restriction. The wish of a manufacturer to stifle an invention is perhaps understandable, for its exploitation would render obsolete much of his plant. Such stifling must, however, be against the public interest. The patentee may have a handsome money compensation for the suppression. He loses the intense satisfaction that must come to an able inventor from the thought that his ingenuity is really making the burden of people lighter.

Under existing law "Any person interested may at any time after the expiration of three years from the date of sealing a patent apply to the Comptroller alleging that there has been an abuse of the monopoly rights." In particular the applicant may show that "the patented invention (being one capable of being worked in the United Kingdom) is not being worked on a commercial scale, and that no satisfactory reason can be given for such non-working." The Comptroller, being satisfied of the abuse, can have the patent endorsed with the words "licences of right." Thereby any person can obtain, either by agreement with the patentee or on terms settled by the Comptroller, a licence to use the patent.

The proposed law makes stronger the safeguards against abuses. The three years' limit is removed, the grounds are made more far-reaching, and, a curious innovation, any Government department can make an application to the Comptroller against abuse. Thus for the passages quoted above, we have this ground, "that the patented invention, being capable of being commercially worked in the United Kingdom, is not being commercially worked therein, or is not being so worked to the fullest possible extent." You note that "fullest possible extent" is a newcomer, and that the possibility of a satisfactory reason is excluded.

Inventions Made by Employees

A useful innovation in the coming Act is the provision for a speedy and cheap settlement of disputes about inventions made by employees. The very tedious, very expensive, recourse to litigation may be avoided in the search for answers to the two questions. Is the employee or the employer the "true and first inventor"? And, assuming that an idea and its realisation are both those of the employee, is the employer for all that entitled to the benefit of the invention?

The general rule is clear enough. The difficulty arises in applying the rule. In one case the question was put in this way: "Was the employee simply carrying out the employer's instructions, putting that employer's ideas into the tangible object that became the subject of the patent? Then, even though he exercised great technical skill and ingenuity, the employee cannot be the inventor. If, however, the idea and its realisation are both those of the employee, he alone is the true and first inventor."

This does not conclude the matter. For the employer may yet be entitled to the benefit of the invention. When the invention emerges from work in the course of employment and from information and opportunities given by the employment it is the employer that is entitled to the benefit; such reward as he gives the employee is of grace, not of right. When, too, the invention comes from experimental work for which the employee is paid, then the employer is entitled to the benefit. In *British Reinforced Engineering Co., Ltd.* v. *Lind* (1917, L.T.), for instance, an engineer set to solve a particular engineering problem in relation to work in hand hit upon a new method of carrying out reinforced concrete work. The court held that the benefit of that invention and of the patent procured belonged to the employer, and not to the employee.

Assignation of Rights

To be sure, an employee is not, apart from a stipulation in his contract of employment, obliged to apply for a patent. And no one, except the personal representative of a dead inventor, can apply on his behalf; though an interesting new provision proposed is that an application can be made by any person to whom the inventor has assigned his right. By maintaining a stalemate through his declining to apply he may on occasion obtain some recompense for his inventive ingenuity. When he does apply (whether on his own initiative or in return for a money payment), in such cases as those noted, he holds the patent as trustee for the employer.

There can be no doubt, however, that instances occur where it is the employee that is not only the first and true inventor but is also entitled to all the benefit derivable from his invention and from the resulting patent, and there are many more instances where the employee thinks that he should be entitled to all the benefits.

The new provision makes it possible for either employer or employee to apply to the Comptroller for a determination of any matter in dispute regarding the patent. And there is this very desirable provision, that the Comptroller may direct for a sharing in some measure or other of the benefit. If either party claims to be entitled to the whole benefit of the patent the Comptroller may "by order provide for the apportionment between them of the benefit of the invention, and of any patent granted or to be granted in respect thereof."

The Elements of Mechanics and Mechanisms—20

Pumps : Water Wheels : Turbines

By F. J. CAMM

THE discharge can be greater than the theoretical amount, due to the fact that sometimes the liquid pressure rises above the delivery pressure and causes a discharge before the end of the suction stroke is reached. This is caused by the water in the pump barrel overtaking the outward-moving plunger so that a localised increase of pressure is set up. Double-acting pumps will, of course, deliver twice the quantity in a given time. Force or pressure pumps are hydraulic devices for energising liquids. They are power operated, the rotation of a crank causing the plunger to oscillate within its cylinder.

During the outward or suction stroke of the piston a partial vacuum is created within the cylinder so that water is induced up the suction pipe, forces open the suction valve and thus enters the cylinder. But on the return stroke of the piston the pressure which is placed on the liquid in the cylinder causes the suction valve to close and the delivery valve to open. Therefore, the liquid is forced up or along the delivery pipe to the required height or distance.

Centrifugal Pump

A centrifugal pump is in reality a reversed turbine, the turbine blades impelling the water instead of the water impelling the blades. Such a pump must be full of water when it is started. It must not be allowed to drain, otherwise it must be primed. Water enters the pump along a suction pipe, communicating with the axial centre of the pump, the vanes of which are rotated at high speed by a suitable motor.

A centrifugal head is given to the water in the pump to an extent that the water makes its exit at high velocity and pressure. This pressure causes a partial vacuum to be set up at the centre of the pump, as a result of which water enters the pump through the suction pipe.

Multi-stage Pumps

The multi-stage centrifugal pump consists of a battery of centrifugal pumps, several impeller wheels acting in series so that the discharge from the first impeller chamber enters the second chamber and thence to the third, and so on until the desired pressure or head is reached.

All the impellers are keyed to the same shaft thus ensuring that they all revolve at exactly the same speed. The working efficiency of a pump represents the number of foot lbs. of work derived by the pump for every 1,000,000 British thermal units supplied by the boiler, in the case of a steam-engine-driven pump. In the case of an electrically driven one the efficiency is based on 1,000,000 British thermal units delivered to the motor.

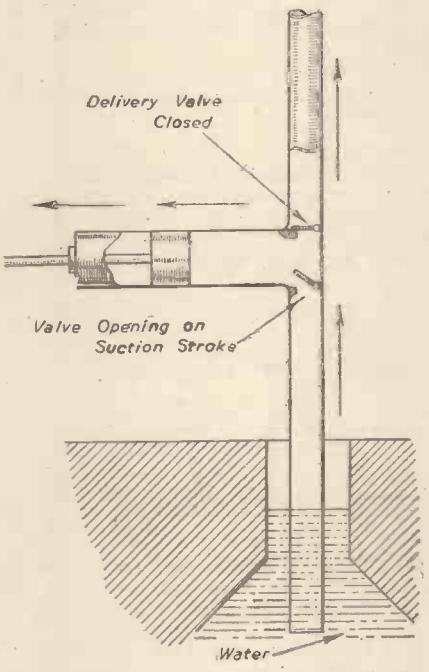


Diagram showing the principle of the common force pump.

If a pump delivers X lbs. of water per second against a pressure or head of Y feet, then:

Work performed by pump = XY foot lbs. per second.

The number of British thermal units supplied to the engine per second is equal to the weight of steam used per second × total heat of 1lb. of steam supplied, and the duty of the pump will be represented by:

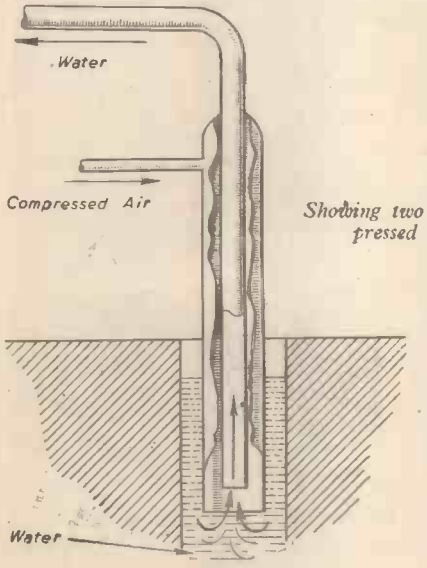
$$\frac{XY \times 1{,}000{,}000}{\text{Wt. of steam used per sec.} \times \text{total heat of 1lb. steam.}}$$

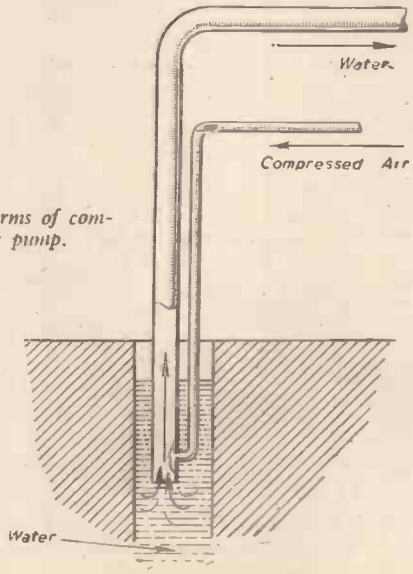
Compressed Air Pumps

Compressed air pumps provide an effective means of raising water from very deep wells. The delivery tube of the pump is made with an air jacket surrounding it, and into this air is pumped by means of a compressor. The air is forced down to the bottom of the well and rises in the delivery pipe of the pump carrying with it a considerable quantity of water.

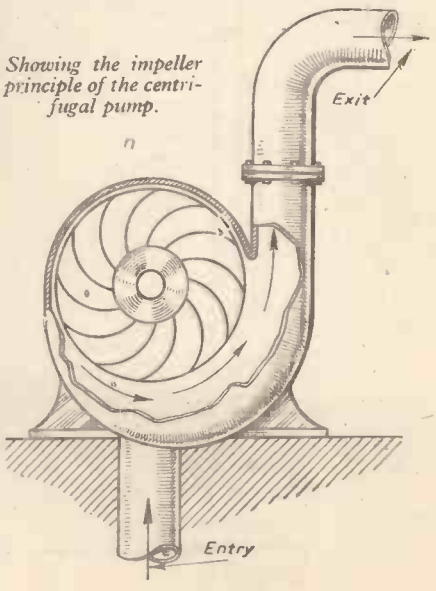
In another form of construction a separate air pipe is taken down externally to the delivery pipe of the pump, the air pipe entering the delivery pipe at its lowest point.

The compressed air forms a mechanical combination with the water and forces it upwards, the air acting as a sort of continuous piston and forcing the water upwards in front of it. The efficiency of compressed air pumps is not high and seldom exceeds 50 per cent. They are only useful for really deep wells, because in order to obtain maximum efficiency it is important that the lower end of the delivery tube is situated at a greater distance below the water surface than the height above the water surface to which the water has to be lifted.

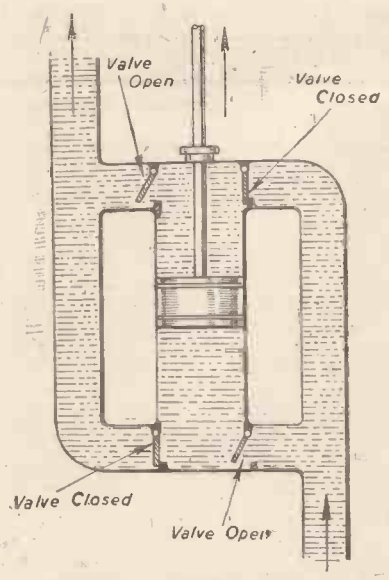




Showing two forms of compressed air pump.



Showing the impeller principle of the centrifugal pump.



Showing the principle of the double-acting pump which delivers water at each stroke of the piston.

Internal Combustion Pumps

In this type of pump the force necessary to raise the water is developed by exploding a combustible gas mixture in a vessel above the water surface, the explosive mixture being in contact with the water surface and forcing it along a supply pipe. This style of pump entirely dispenses with all reciprocating, revolving, or mechanically moving parts or components except for the admission and exhaust gear.

Water Wheels

When a moving liquid impinges upon a movable plate or blade the result is that such plate or blade has imparted to it some of the movement or energy of the liquid. This in brief is the principle of the water wheel. It is one of the world's oldest power producers.

Water wheels can be divided into two classes: impulse wheels by means of which the water acts by impulse or impact so that the kinetic energy of the water is made to actuate the wheel, and wheels which are operated mainly by the weight of the water.

The only practicable type of impulse wheel is that known as the *undershot*, which requires no special fall in the water other than that necessary to give rapid motion to the stream. The weight of the water is of little importance. A typical example is the mill-wheel. It can either have flat or curved blades, but in every case the wheel dips into the water, the water flowing on the underside of the wheel. It is the cheapest of all forms of water wheel.

The flat-bladed undershot wheel has the great advantage that it will run with equal efficiency in either direction.

Poucelet Wheel

Named after its inventor this is the chief of the curved blade undershot wheels. It has a working efficiency of from 55 per cent. to 65 per cent.

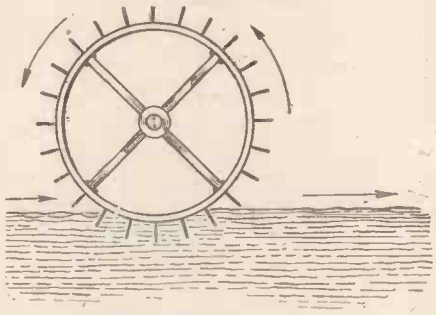
Overshot Wheels

With the overshot wheel the water is allowed to make contact with the wheel at its upper side, the water actually falling on to the wheel. Thus it is actuated not so much by the motional energy of the water but by its actual weight. It produces more power than one of the undershot type, and it requires much less expenditure of water to actuate it. It requires a minimum fall of water, slightly greater than its own diameter, in fact.

Overshot wheels are equipped with buckets, disposed equally around the circumference of the wheel.

Breast Wheels

The breast wheel is of an obsolescent type. The water instead of entering the wheel as with the undershot and the overshot types enters it at breast height or approximately halfway, just below the level of the wheel's axis. It is not so efficient as the overshot wheels.

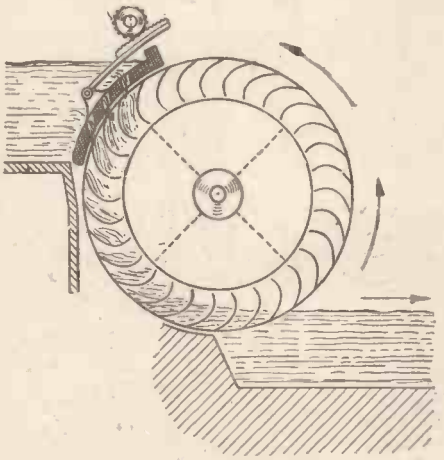


The Undershot water wheel in principle.

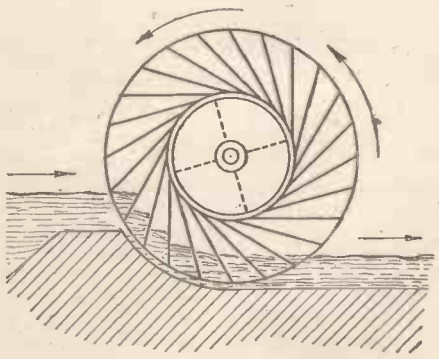
The Sagebien wheel is another type of breast wheel not now much in use. It has straight vanes or blades, each inclined to the radius of the wheel at an angle of from 30° to 45°.

Tail Water

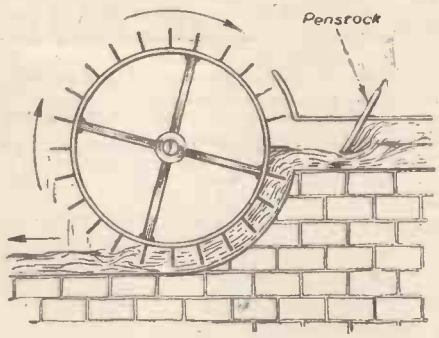
It is essential that adequate arrangements be made for the rapid escape of the tail water or the exit water, for if it is not allowed freely to escape eddy currents and back pressure will be set up, and these will seriously interfere with the efficiency of the wheel.



The Fairbairn Breast wheel, utilising curved vanes which retain the water for a maximum period.



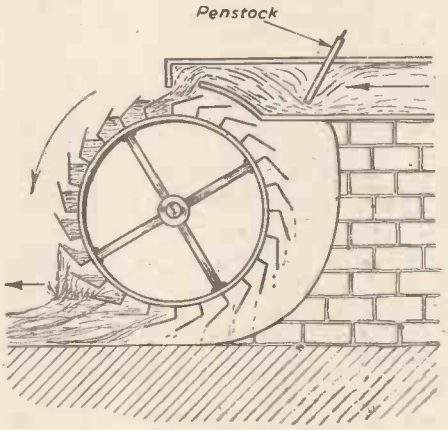
The Sagebien water wheel. It is equipped with straight vanes inclined to the radius of the wheel at an angle of from 30 to 45 degrees.



The Breast wheel.

Water Turbine

The water turbine is the logical development of the water wheel. It has the advantage of being under greater control and it can be made to operate efficiently at low as well as high speeds. It can operate on any head of water from 1ft. up to 500ft. or more. Turbines are of two types—impulse and reaction.



The Overshot wheel.

Pressure Turbines

In the pressure or reaction turbine water enters the wheel under pressure. It flows through the vane system and during its passage the pressure head of the water is converted into velocity head or otherwise into energy of motion. The water leaves the turbine freely and at atmospheric pressure. Reaction or pressure turbines are of several distinct types.

In the outward flow type the water enters at the centre and, after passing through its blades, is discharged at the outer edge. This process is reversed in the inward flow turbine water entering at the periphery and leaving at the centre.

(To be continued.)

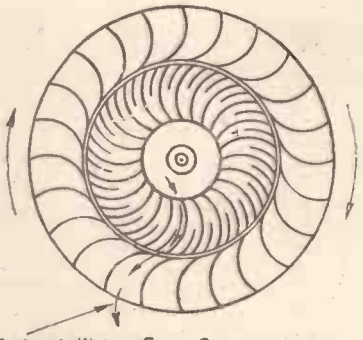


Diagram showing the principle of the water turbine. (Outflow type.)

A Simple Blowlamp Conversion

Changing Over a Petrol Blowlamp to Paraffin Working

By J. F. STIRLING

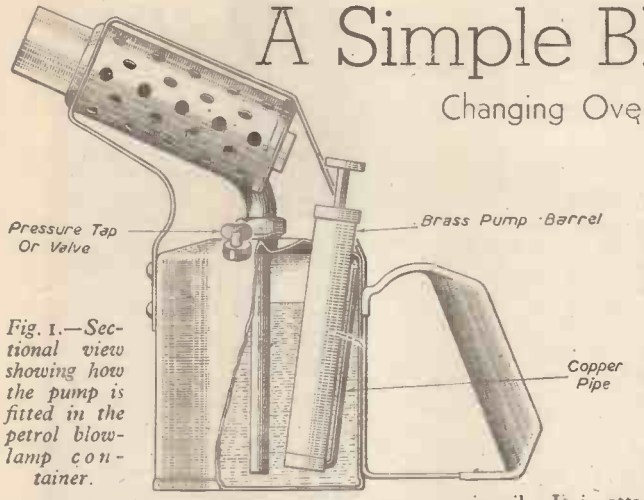


Fig. 1.—Sectional view showing how the pump is fitted in the petrol blowlamp container.

THE majority of owners of petrol blowlamps nowadays come up against the difficulty of obtaining sufficient petrol for the operation of their lamps. Petrol is a strictly rationed commodity; paraffin is not, so that, of the two types of lamp, the paraffin-operated variety is by far the more popular and useful.

The difference between the two types of blowlamps is very simple. Petrol is a readily vaporisable liquid and, once started, a petrol blowlamp will feed itself from its reservoir of fuel. Not so a paraffin lamp, however. The vapour-pressure of paraffin oil at ordinary temperatures is much lower than that of petrol. Consequently the paraffin fuel must be fed continuously to the jet of the burner under pressure.

The necessary pressure to do this is normally very little. Yet, to make the lamp work effectively *some* pressure must be there. Hence the reason for the small barrel hand-pump which is fitted into paraffin blowlamps. By means of this a slight air-pressure is generated above the surface of the paraffin fuel in the reservoir. This pressure continually forces the liquid downwards and, of course, upwards through the main feed-pipe to the jet of the burner.

Now, any owner of a petrol lamp, given the necessary mechanical ability, can very easily convert his petrol lamp to pressurised paraffin working by fitting a small hand-pump within the reservoir. True it is that with this hand-pump in position, the reservoir will not hold as much fuel as it did without the pump and, in consequence, the lamp will not burn as long at one charge as it did under petrol running. But if one is faced with the necessity of running the lamp for a shorter time on paraffin or not running it at all, this particular disadvantage of reduced capacity hardly counts.

To make the necessary conversion, we must construct a small metal pump similar to the one shown in Fig. 2. Use good brass tubing for the pump barrel, which should be about 1in. diameter, the actual length of the tubing depending on the depth of the lamp reservoir.

The Ball Valve

A thick circular disc of brass is now required, the disc being the same diameter as the barrel of the pump. Drill a conical opening into the side of the brass disc and, also, a hole at right angles to it and meeting the conical hole at its farthest end.

The conical hole should be trued up with a little emery and oil-grinding paste, and it may be found advisable to line the hole with very thin leather secured by means of a cold glue or other oil-resisting adhesive.

A small steel ball (an ordinary bearing ball of suitable size) is placed in the hole. To the external orifice of this conical hole is secured (either by means of soldering or by a screw union attachment) a short length of narrow-bore copper pipe sufficient to reach to the top of the lamp reservoir when the pump is placed in position.

The lower disc of the pump, thus drilled and prepared, is then brazed accurately on to the end of the pump barrel (Fig. 2).

The plunger of the pump consists of a disc of leather which has been well soaked in oil. It is attached to the end of a brass plunger-rod by means of a small nut. A screwed cap is made to fit on to the upper end of the pump barrel.

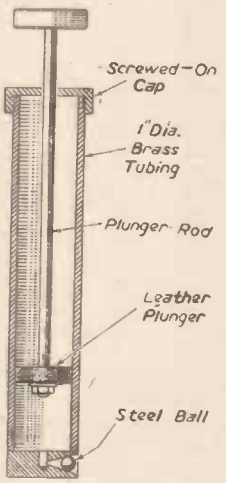


Fig. 2.—Section through the plunger pump.

Finally, the pump is inserted into the blowlamp container or reservoir through a conveniently-positioned hole drilled into the upper side of the reservoir. The pump may be either brazed or screwed in position. Brazing is the better method, since the internal pressure within the container may cause the paraffin to leak upwards through the screw threads unless the lamp is maintained in a perpetually upright position.

Pressure Tap

It is also advisable to insert a small brass cock or tap into the blowlamp container on its upper side so that the air pressure may be relieved after the lamp has been used. Some workers, indeed, have gone so far as to insert a spring-loaded safety valve of the model-boiler type, but this refinement is hardly necessary, although, naturally enough, it makes for added safety.

Operation

The operation of the blowlamp is as follows: When the pump plunger is forced downwards the back-pressure which is exerted on the lower end of the leather plug or piston causes it to expand slightly, thus resulting in its fitting the barrel accurately. The air is forced through the lower ball-valve and out of the pump via the copper tubing to the upper part of the blowlamp reservoir or container. When the pump piston is drawn upwards, the steel ball closes the conical hole and blocks it completely, not permitting air to return from the blowlamp container into the pump barrel. The efficiency with which the ball valve functions depends, of course, on the accuracy of its final grinding. This is a matter which should be tested for before the pump is finally assembled.

As the pump plunger is drawn upwards, air passes downwards into the barrel past the sides of the leather plunger.

Fuel Level

The blowlamp container must not be completely filled with paraffin when charging up with fuel. Leave at least a small amount of space in which to develop the necessary air-pressure for starting the lamp.

The lamp itself is started in precisely the same manner as the ordinary petrol lamp, and, once running, it requires merely a few strokes of the pump given at intervals to keep up the necessary upper air pressure in the container, and to prevent it falling too much in consequence of the steadily lowering level of the paraffin as the latter becomes used up.

An Emergency Conversion

For emergency use, it is possible to make a pressurised paraffin blowlamp merely by screwing a cycle or motor-cycle tyre valve into the upper *vertical* side of the petrol lamp container, and as near the top of the container as possible (Fig. 3). The tyre valve *must* be positioned as far from the burner as possible so that it can be maintained at a maximum degree of coolness. With this simple and rather rough construction, pressure can be got up by means of an ordinary tyre pump. The construction, of course, is not suitable for regular use, but, in an emergency and when a quick conversion to paraffin working becomes necessary, the above system of pressurising a blowlamp will operate quite satisfactorily.

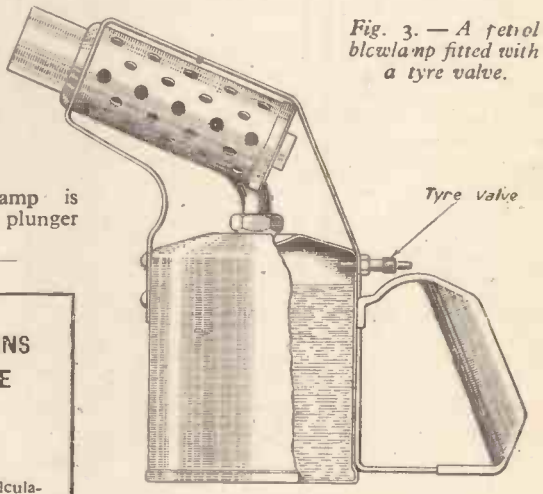


Fig. 3.—A petrol blowlamp fitted with a tyre valve.

The Factories of South Wales

A Short Tour of New Factories

By THE MARQUIS OF DONEGALL

IT was with pleasure and some surprise that I recently received an invitation from the Ministry of Supply "to study recent industrial and engineering developments" in South Wales.

It appeared that many firms had provided alternative work to supplement the coal and tinplate employment, normally the backbone of the South Wales population.

Perhaps one of the few reasonably good legacies of the war is the mindedness of Ministries to facilitate members of the Press to have a look at what goes on.

The work of the Ministry of Supply in South Wales covers engineering, aircraft components, iron and steel, tinplate, refractories, radio, mining machinery, power station equipment—to name a few.

There are also Government surplus stores, labour supply for the Ministry's factories, etc.

Let me put on record that our British Railways 8.55 a.m. from Paddington got to Newport on the dot—allowing for eight minutes' stop at Reading, an average of about 50 m.p.h.

Girlings, Ltd.

We de-trained and em-bussed (shades of Dr. Johnson!), at Newport, and, after a short switchback ride by Jehu, arrived at Girlings, Ltd., Cwmbran.

The firm makes vehicle brakes—hydraulic and mechanical. We were received with great hospitality by Mr. W. E. Gowers, the general manager, and went round the factory after an excellent luncheon.

The practice of this firm is to make hydraulic brakes for the front wheels, and mechanical brakes for the rear wheels of a vehicle. They employ some 3,000 persons of both sexes. About one-third is female labour.

In the general machine shop where small parts are made, they have some 40 automatics of British manufacture, and have managed to cut out tools of German or U.S. manufacture. They also have British hydromatic millers (Cincinnati) with a radius duplex fixture, with lifting arbor. Cincinnati (British) vertical twin rams and surface broachers.

This factory is largely on piecework basis. (Until two years ago this firm manufactured only mechanical brakes. But the increase of independent springing has forced the hydraulic principle.)

Automatic Machines

Of the machines that impressed me in this factory, first came a mammoth affair that performs seven operations on brake-backing plates and shoes.

In this machine the parts are successively hot-caustic soda-washed, swilled, rust-proofed, swilled, dried, enamel dipped and stoved in an oven.

Next, a controlled cycle centreless grinder that grinds, magazine fed, four diameters simultaneously. (Shribner of Birmingham.)

In a checking bay where charts of output and orders in hand are integrated, seven clocks indicate the exact wastage of time, due to shortages or other causes on each of seven conveyors.

Shortages at this factory are not acute. They occur chiefly in small steel wire which we used to import from Belgium.

It would be invidious to give a list of the makes of cars that Girlings supply with brakes and shock-absorbers. They include most well-known makes. They sell brakes of 336 types to 121 customers and shock absorbers including linkages of 300 types to 40 customers. The output is about 32,000 brakes and 20,000 shock absorbers per week.

This factory was taken over from Lucas in 1945. It has factory floor space of half-a-million square feet on a 21 acre site.

Altogether, the happy atmosphere of the place, to which no doubt the model kitchens and attractive canteen-theatre contribute, was reflected in the smiling faces; so different from some of the hard-pressed wartime factories I visited.

British Nylon Spinners

On our way from Cwmbran to Cooper's at Abergavenny, we passed, near Pontypool, the new factory of British Nylon Spinners, Ltd.

The face of our only woman reporter fell somewhat when the 'bus failed to stop. Tension eased, however, when it was learned that the factory which began operating last summer, does *not* make stockings. It is to employ 1,700 workers, and is certainly impressive architecturally, reminding one slightly of the Memorial Theatre at Stratford-on-Avon.

Cooper's Mechanical Joints

So to Monmouthshire and Cooper's Mechanical Joints, Ltd., which started on gaskets in 1908. It now does gaskets and filters of 731 different types and employs 350 persons of whom two-thirds are women and girls. Some of the products have as many as 30 components, and some as few as four.

The Monmouth works were taken over from a manufacturer of fountain pens, the parent factory being at Slough, and it turns out about half the Slough factory's output of exhaust manifolds, gaskets and steel-asbestos boiler washers.

Apart from supplying many car manufacturers with filters and gaskets—they claim to be the second largest gasket makers in the world — Cooper's started making aircraft filters in a shoe factory in Northampton whence they arrived in the beautiful surroundings of Abergavenny in 1946. They now supply de Havillands and Bristol.

Impressive, and quite a different kind of filter, are the immense precautions taken to see that none of the used water from the factory can pollute the River Usk on its return to the river. I counted about eight tanks, each the size of a small swimming pool, the water passing through process after process before rejoining the river.

By this time we were all getting rather tired, so we sat down to our fifth meal of the day; high-tea in the executive's dining-room.

Tinplate Food Cans

We were in the 'bus early next morning on our way to the largest factory of the tour: the Metal Box Company, Ltd., at Neath.

This vast place is one of the company's 23 production plants in Great Britain. It is a modern factory employing some 2,000 workers. It is proud of its labour relations and highly developed joint consultation. The proportion of men to women is 1,760 to 900 (approximately).

The factory was built in 1937, extended in 1940 and development is still going on which will double the floor-space and personnel.

Food cans and components of cans are the chief output of this establishment, the raw material being, of course, tinplate.

Highly integrated mass-production is the keystone. The lacquering department deals with 2,500,000 sheets of tinplate per week, and the printing department accounts for a quarter of a million sheets per week.

Fifty million tops and bottoms of cans per week and 4,000,000 fish and paste cans. The shortage of tinplate was something terrible, I was told!

Can-making Robot

There are enough ingenious machines in this factory to please anybody. I liked particularly the robot that cuts, folds and sticks the body of the can. Another machine stamps the lids and stacks them into units of 200.

Eventually, the conveyors, which are mostly overhead, like those things that fetch your change in some department stores, end up opposite closed railway trucks, each of which holds 35,000 cans ready for filling by the Whitland Creamery, United Dairies and other customers.

Apart from the factories in this country, this great concern has factories in South Africa and Malaya and a "re-forming" factory in India.

Before leaving the Metal Box Company I must mention the thoroughly up-to-date physiotherapy department. This is one of the few of its kind in factories of the United Kingdom. It is much appreciated by the personnel, of whom about 1,000 healthy and debilitated pass through it every month.

Our last call before taking a train from Cardiff to London was a factory of quite a different kind to any of the others we visited.

The "Remploy" Factory

This was the "Remploy" factory at Bridgend in Glamorgan. It is situated on a colossal trading estate, the site of a wartime Ministry of Supply filling factory, which accounts for the scattered location and smallness of the buildings.

The "Remploy" factory is one of a number established by the Disabled Persons Employment Corporation, Ltd. Only those with 60 per cent. disability are employed, and many with 100 per cent. disability do suitable work in their homes.

Although the Services are given priority, I talked to many workers there whose disability came from other causes. Several had been blown up in accidents when the estate was a filling factory. There were ex-miners with advanced silicosis, a youth who had been run over by a train, and others who had been cripples from birth. All seemed cheerful and talkative.

Perhaps the most novel activity is the making of violins. For the purpose of teaching this art, Mr. Schliep, a displaced Estonian, was imported, accompanied by his son, from Germany.

At present there are about 160 disabled persons at this "Remploy," not counting the 61 home workers, who mostly make rugs. Other activities include making toys, leather goods, industrial gloves, and there is a sawmill.

The eventual Wales target is to employ the whole 2,000 severely disabled, and 10 "Remploy" factories will be operating in Wales shortly. "Remploy" is Government financed and non-profit making.

So our tour ended. The move westward has certainly put these workers into attractive surroundings for factory work and there is plenty of room for development, further to the west, in South Wales.

Some Early Cycling Novelties

Interesting Inventions of Bygone Days

By R. L. JEFFERSON

THE showing of two alloy welded cycle frames at Earl's Court brings to mind some other materials and methods of jointing used over 50 years ago.

Pure aluminium tubes were experimented with by Humber in 1896, tested during 1897 and adopted in 1898. Patent Nos. 24,564, 25,025, 29,715, all of 1896, which were for the method of securing the tubes to the lugs. A large liner was inserted between the mitred tube and the lug and the complete joint was secured by substantial cotters. The weight of the complete roadster with 28in. x 1½in. wheels was 29lb., which compares with present-day lightweights.

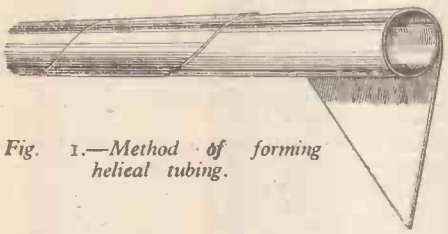


Fig. 1.—Method of forming helical tubing.

Bamboo Frames

Bamboo is a material with properties which have been known for a long time. The Bamboo Cycle Co. made a number of machines with this material for the frame-work, using aluminium lugs over split collars. They proved quite satisfactory in service and quite light; public suspicion had as much to do with the demise of this company as anything else. The machines came out in the latter half of 1895.

In addition there were a number of firms manufacturing machines the frames of which were cast all in one piece of aluminium. The "Luminum" was perhaps the most successful, and the firm lasted the longest.

Helical Tubing

In 1893 the "Premier" Cycle Co. brought out the patent helical tube, and in 1894 they sold over twenty thousand machines with frames made up of helical tubing. The weights of their 1894 cycles were: path racers 22lb., road racers 24½lb., roadsters 33lb., tricycles 45lb.; not excessive for the period.

The tubing is illustrated in Fig. 1, and its method of manufacture is not without interest. The tube is formed by wrapping, or rolling helically a thin sheet of metal, varying from .008in. to .017in., and firmly brazing it together. Strips of the required length are cut off by guillotine shears, the cuts being made diagonally so as to end square when the tube is finished. The strips were then rolled round a mandrel of special design, consisting of a set of three rolls mounted horizontally, one being removable to admit of the mandrel being placed in position. Upon rotating these rolls the mandrel will also revolve, and as the strip and mandrel are in contact with the rolls the strip will be drawn in and so wrapped or wound round the mandrel to form a tube. This winding is performed at such an angle that whilst there will be a double thickness of sheet at all parts at those points where the lap occurs there will be a treble thickness of the sheet at other parts. A clamp is then placed on one end of the coiled strip to prevent it unwinding, it is then removed from the rolls, the mandrel is withdrawn, a stout collar is driven on the extremity of the tube and a plug forced into its bore so as to hold the strip firmly in place until the strip is united firmly by brazing. This operation is performed by running hard solder into the tube and so applying it to the exterior of the tube that a portion will adhere to those parts where the coils or convolutions overlap. This solder is then melted and run into the joints between the strips in a gas furnace, and the tube is shaken and turned to facilitate and expedite the passage of the solder into the joints. After cooling the tube in powdered lime the collar can be knocked off and the ends of the tube cut off square to exact length. The tubes are then hung up and struck with a light hammer, and those which do not have a clear ring are rejected.

Test of Strength

The strength of these tubes was much greater than cold drawn steel tubes, the latter being made from very mild steel, the former of a very light carbon steel just below the air hardening point. A test carried out by Mr. J. M. Reilly was rather revealing. A frame made up of helical tubing and weighing 5lb. 5¾oz., when subjected to a condensed lateral strain, as in the case of a collision, was found to have an ultimate strength of 448lb. A frame constructed of weldless tube and weighing 5lb. 13¾oz. gave an ultimate strength of 264lb. The manufacture of this form of tubing was of necessity slow and very costly, which is the only reason it ceased to be manufactured.

Pneumatic Brake

An idea of another sort was the pneumatic brake brought out at the end of the last century. This consisted of a hollow rubber bulb attached to the handlebars by a clip, a hollow distensible rubber pad or shoe being joined to the bulb by a rubber tube. The illustration, Fig. 2, shows the appliance clearly. The bulb is fitted with an air-inlet valve and a non-return or discharge valve leading to the brake shoe. The bulb can thus be used as a pump to force air into the pad to any desired pressure. To release the air and the brake the push piece on the neck of the bulb was pressed.

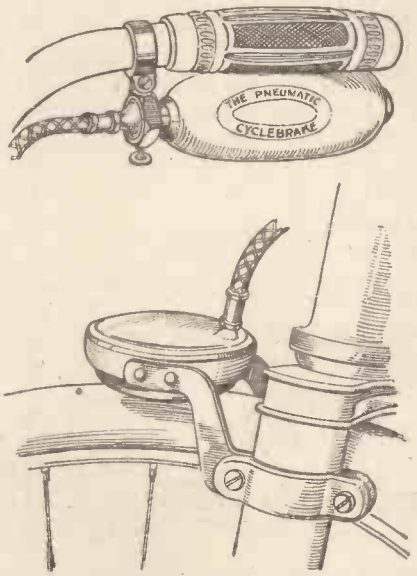


Fig. 2.—A pneumatic brake operated by a bulb attached to the handlebars.

The biggest drawback to this brake was the time lag between the pressing of the bulb and the application of the shoe, and this led to enough accidents to cause its demise.

"Something for Nothing"

There have, I suppose, always been some people who want something for nothing. Inventors often fall under this heading, and many of them, in the boneshaker days, advocated the fitting of an immensely strong spring to be wound up when the rider was descending a hill, and released for the ascent. They appeared to ignore the cardinal fact that you can't get any more out of a cycle than the amount put into it.

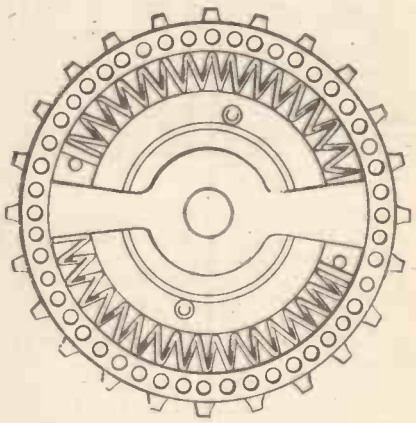


Fig. 3.—A spring chain wheel.

Spring Chain Wheel

A similar object was aimed at in a provisional application, No. 8,347 of 1892, for a spring chain wheel (Fig. 3). The claim for this was that it helped the rider over the dead-centre point; the springs, compressed on the downward stroke, were supposed to uncoil themselves on the weaker upward stroke, the weight factor was ignored. Like most ideas of this kind it died a natural death.

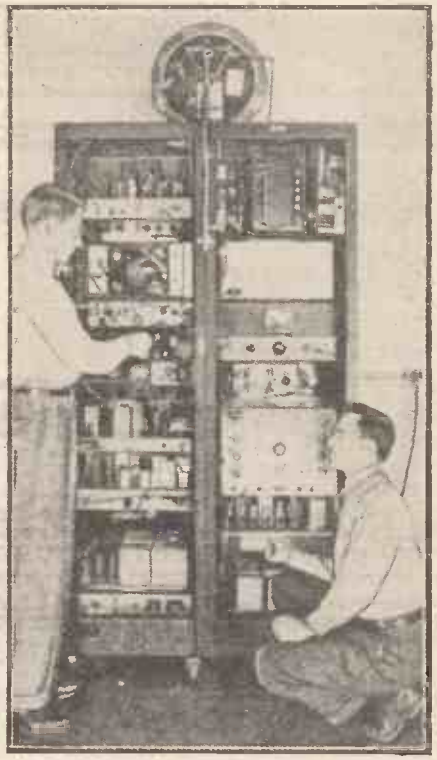
I think a search of the Patent Office files would save present day inventors a lot of very hard work. Not long ago I had an idea submitted to me by a man who had been working on it for nearly three years. He showed me the drawings of his invention, and I thereupon showed him an illustration of the 1895 "Boudard" gear which was exactly the same thing; he had never heard of it and was quite surprised to learn the idea had died.

What I do think would be a good thing is for inventors to concentrate on cleaning up some of the minor points in cycle construction, such as brakes. There should be more of the built-in type, without the festoons of cables one sees to-day. Also, freewheels of the screw-on type could easily be replaced by a neat splined type; repairers especially would welcome this. Let the inventor concentrate on refining what has now become a standard product and leave perpetual motion and dead-centres severely alone.

The Atomic Clock

A New Instrument for the Accurate Measurement of Time

By L. ESSEN, Ph.D., D.Sc.



A rear view of the atomic time-control unit.

THE atomic clock is a new instrument which should enable us to measure time more accurately in the future than we can now. Everyone is familiar with the use of ordinary clocks and with the time signals by which we can set them; but before we can understand the part that the atomic clock may play we must examine a little more closely the present standard of time and how it is used to regulate the time signals.

The standard is the time taken by the earth to rotate about its axis. The instant at which the earth occupies a particular position relative to its axis is recorded by careful astronomical observations and the time interval between two such instants corresponds to one day. This interval is far too long to regulate our modern activities, and it is divided by means of pendulum clocks adjusted to make exactly 86,400 swings in a day, that is, 1 per second. Such clocks adjusted to keep correct time in relation to the earth are the working standards used to generate time signals.

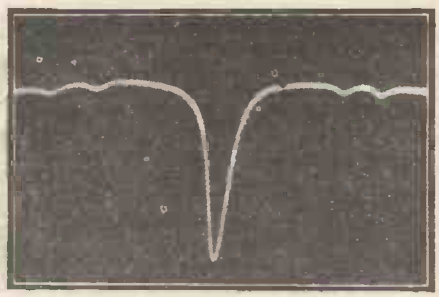
A further development in time-keeping followed the advent of radio. One of the problems of the radio engineer is the measurement of the time of vibration of electrical waves, a time which may be as short of one ten-millionth of a second, or, as he would express it, their frequency is ten million per second. For this purpose he needs a still smaller unit, which is now provided by the quartz clock.

THE ATOMIC CLOCK

The present standard of time is based on the rotation of the earth about its axis, and this is divided into small units by pendulum and quartz clocks. The atomic clock is based on vibrations within the molecule, and when the technical difficulties have been overcome may provide a standard more independent of and more constant than the rotation of the earth.

The Quartz Clock

This consists of a piece of quartz crystal adjusted to make 100,000 vibrations a second and maintained in oscillation by means of a radio valve. It is fairly easy to measure frequencies of other vibrations such as those of a transmitter in terms of this standard frequency without making any actual time measurements at all, but the frequency of the quartz crystal itself must be measured by reference to the time signals. For this purpose it is divided by valve circuits from 100,000 to 50 cycles per second, and this frequency is used to drive a motor with a clock dial just as the 50-cycle mains supply drives the domestic electric clock. Sharp impulses at 1 per second are obtained from the motor and compared with the time signals. If the frequency is exactly 100,000 the clock keeps correct time. The frequency standard can thus be used as a clock, and, in fact, quartz clocks have proved to be better time-keepers than pendulum clocks and have replaced them at many observatories, where they are adjusted to keep in step with the earth's rotation.



A typical absorption

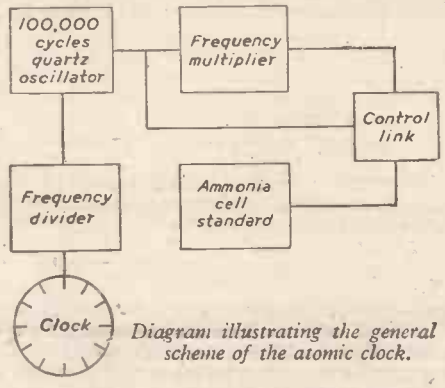
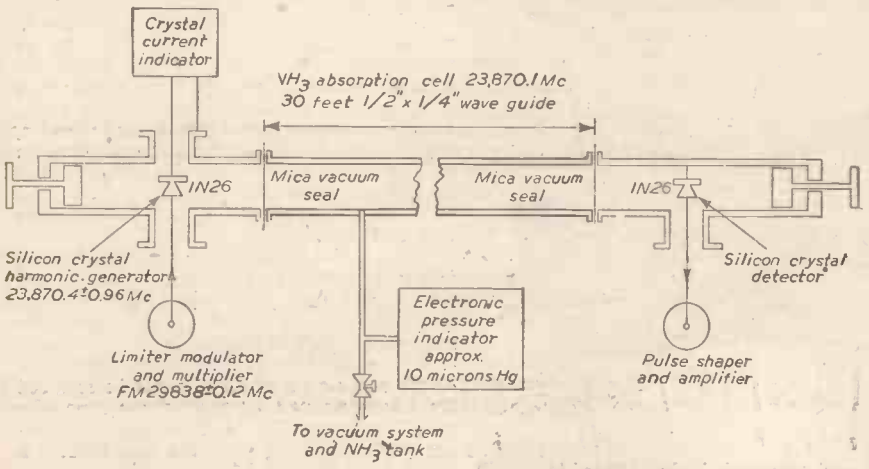


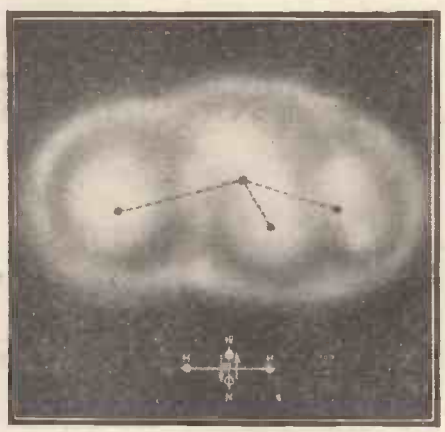
Diagram illustrating the general scheme of the atomic clock.

Why Greater Accuracies are Needed

The earth's rotation together with the quartz clock enable a time interval of one day to be measured with an accuracy of about one-thousandth of a second (i.e. 1 part in 10^8) and it might well be thought that this is precise enough for all requirements. But at standardising laboratories such as the National Physical Laboratory it is the aim to define the standards of measurement with a precision at least ten times as great as that required in practice. It is a kind of safety factor to allow for rapid developments in any particular branch of science that might require a higher precision. Now, in the case of frequency measurements—although this is already one of the most precise of all physical measurements—certain applications require almost the full accuracy that can be given. Some systems of navigation, for



Cross-section of an absorption cell. The cell is a piece of waveguide coiled round the clock's dial.



R.f. alters nitrogen atom's position.

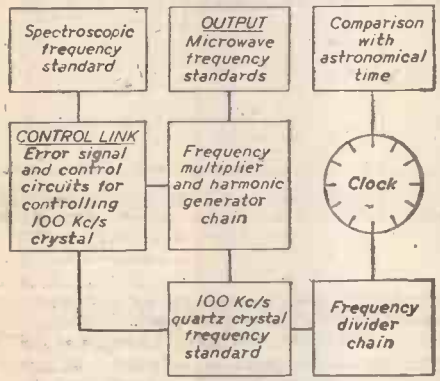
example, use radio transmitters having an extreme constancy of frequency.

There are several reasons why it is difficult to improve time and frequency measurements using the present standards.

1.—Quartz clocks usually gain or lose slightly and need periodic adjustment to keep correct time with the earth.

2.—The time of the earth's rotation cannot be observed very accurately. The highest precision is about one-hundredth of a second. This is a constant error, so that the percentage error decreases if we extend the measurement over a longer period.

3.—The period of rotation of the earth



Simplified block diagram of N.B.S. atomic clock.

is known to vary slightly in the course of time.

It is because of these difficulties that the atomic clock made at the National Bureau of Standards, Washington, is of interest to both the astronomer and the radio engineer.

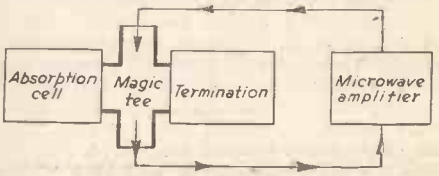
Analogy with the Measurement of Length

It will help us to understand the atomic clock if we consider the progress that has been made in recent years in the measurement of length. The standard of length in this country is a metal bar known as the Imperial Standard Yard preserved at the Board of Trade. All precision length measurements such as those of accurate gauges must be referred ultimately to the standard bar. It would clearly be more convenient to use some standard length occurring widely in nature, such as the length of a wave of light, if that were possible.

Recent advances in the technique of interferometry have now made it possible to measure the length of, say, a one-inch gauge directly in terms of the wave-length of light, and this is being increasingly used as a standard. It has the advantages of accessibility—it is only necessary to obtain a suitable lamp—and permanence.

The Atomic Clock

The radiation from an atom or molecule possesses not only a constant wave-length but also a constant frequency, and it has long been recognised that it would constitute a valuable standard of frequency if it could be used. Until recently, however, there has been no technique for comparing the frequency of these molecular or atomic vibrations with that of a man-made oscillator, such as a transmitting station or a quartz clock. The development of radio valves that will operate at wave-lengths of the order of 1 cm. (frequency 3×10^{10} cycles per second) makes this comparison possible, because some molecular radiations have wave-length and frequencies in this region. The intensity of these radiations is too feeble for them to be observed directly; but if the molecules are illuminated with radio waves of the right frequency some of the energy of the wave is absorbed. If the energy that passes through the molecules is measured and the frequency is altered slowly there will be a sharp decrease in the measured energy when the frequency corresponds to the absorption frequency of the molecules. This effect was observed some years ago at Oxford University. In America they have now solved the problem of how to use this effect to control a clock. The molecules used in the atomic clock are those of ammonia gas, which gives the strongest absorption so far observed. The gas is contained in a 30ft. length of copper pipe which is coiled round the face of the clock dial. The illuminating waves are obtained by the selection of a very high harmonic of a quartz oscillator vibrating at 100,000 cycles per second. The harmonic itself would not give quite the right frequency and another small frequency must be added to it, but this is a technical detail of no great significance. The waves are passed into the cell through a thin mica window and the energy leaving the far end of the cell through a similar window is measured by a detector rather like the cat's whisker used in the old crystal receiving sets. The detector gives a voltage proportional to the energy it receives. This is a minimum when the frequency of the waves is exactly the same as the absorption frequency of the molecules. If the frequency moves away the voltage rapidly increases to its normal value, but for small frequency differences the voltage will be intermediate between the minimum and the normal values. It thus serves as a measure of the frequency difference; and it can be used to alter the frequency of the quartz oscillator so as to reduce the frequency difference to a very small value. The frequency of the oscillator is thus controlled by the natural absorption frequency of the gas. It is made to drive a clock dial in exactly the same way as already described for the quartz clock. The readings of the clock are thus governed by the frequency of the quartz oscillator, which is itself controlled by the gas.



Magic tee and atom oscillator circuit.

The Accuracy of the New Clock

The accuracy claimed for the clock is one part in 10^7, that is one-hundredth of a second a day. It is thus less accurate than the standards already in use, but it is not unusual for the first model of a new type of instrument to be inferior to the refined versions of previous types. It may be that the present form of atomic clock will never be as good as, for example, the quartz clock, for there are certain fundamental difficulties which will not be easy to overcome. Scientists are, however, already investigating other means of controlling standard oscillators by means of molecular and atomic vibrations, and from theoretical grounds at least some of these promise to be at least 10 times more accurate than any existing time-keeper.

The atomic clock and its inventor, Dr. Harold Lyons.

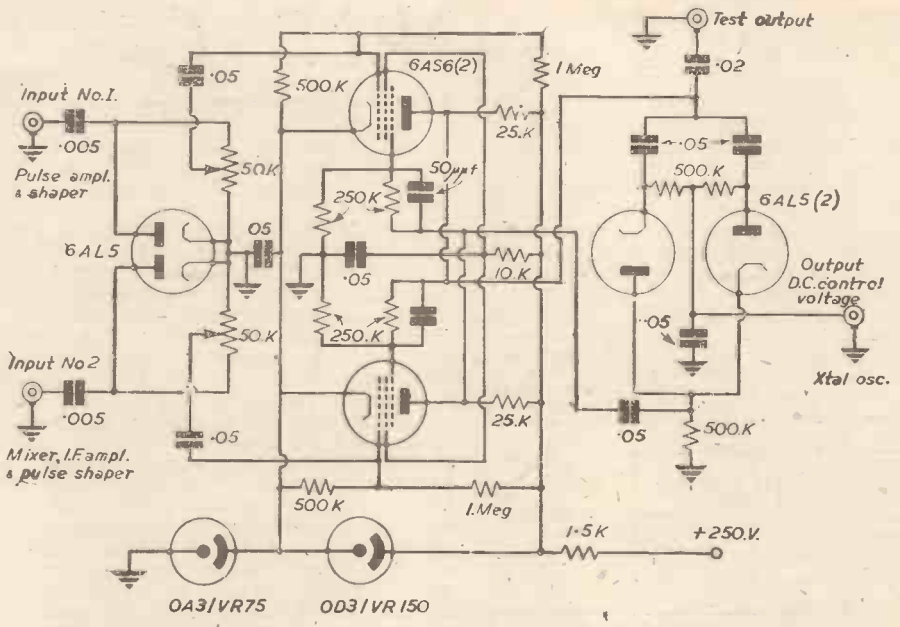
The Future Rôle of the Atomic Clock

One major difference between the atomic clock and previous clocks should be pointed out. It has been explained how in the previous standards the rotations of the earth, the swings of a pendulum or the vibrations of a piece of quartz are actually counted and recorded. This is not the case in any form of atomic clock yet envisaged, but an auxiliary oscillator is set so that its frequency is as nearly as possible equal to that of the atomic vibration. It should perhaps be regarded therefore as a standard of frequency rather than a standard of time. This is particularly so, as one of the essential features of a clock is that it should not stop. The

link between the atomic vibrations and the controlled oscillator is very elaborate and includes a large number of radio valves and other components, each of which is a source of potential breakdown. It is not therefore likely to give the long, unbroken periods of operation required of a clock, at least not until the techniques involved are vastly improved.

It is necessary to remember also one very important advantage of the earth's rotation as a standard. If, owing to unfavourable circumstances, such as a long period of bad weather, some faulty readings are taken, these errors are not perpetuated. The clock is still running properly, although it is not being read very accurately, and when better conditions return more accurate readings can be taken. On the other hand, if an atomic clock goes out of control momentarily its time recording is lost for ever.

Although it is a very risky proceeding to forecast the line of development of a new branch of a subject such as this, it does seem that in time-keeping the atomic clock, the quartz clock and the earth's rotation will all play their part in the measurement of frequency and time. It will be possible to set the quartz clocks with great precision in terms of the atomic clock. The quartz clocks controlled in this way will not only serve as standards of frequency in radio engineering but will enable the astronomer to investigate the small vagaries in the earth's rotation. On the other hand, the latter will still be used for the measurement of time over long intervals.



The square-wave generator and discriminator circuit which supplies the a.f.c. voltage.

[*We are indebted to Radio Electronics for several of the illustrations appearing in this article.*—ED.]

Photocell Strip Control Equipment

WHEN strip material such as paper, fabric, plastic, etc., has to pass through a machine during a manufacturing process there is often a tendency for the web to move from side to side, with the result that the roll of material does not layer properly and the overhanging edges become damaged. Lateral wandering also makes it difficult to run the material over rollers for printing.

The difficulty, however, has been overcome by the Electrical Equipment Co. (Leicester) Limited, of 106, London Road, Leicester, with the aid of photocell equipment supplied by The General Electric Co., Ltd.

Fig. 1.—Equipment in use to prevent lateral wandering of corrugated paper. The web can be seen moving through the lamp and photocell unit.

The equipment consists of a slotted lamp and cell unit (see Fig. 1) with the lamp in the top half and two photocells in the bottom, the cells being masked so that light can fall on one, both or neither according to the lateral position of the web passing through the control head.

When the web is too far in one direction, both cells are covered; when it is correctly positioned one cell is covered, and if it moves too far towards the opposite side neither cell is covered.

These three conditions are used to control, via relays, two solenoids which move an idler roller sideways under the web and gradually edge it, if necessary, in the desired direction. In the "neutral" position, when only one cell is uncovered, neither solenoid is energised and the idler roller revolves with the web. Fig. 2 shows the interior of the control boxes used with the equipment.

Accuracy of Control

Accuracy of control to within a few thousandths of an inch can be obtained in operation and correction starts immediately there is any deviation from normal position. The maximum standard correction is two inches of lateral movement, but for special cases up to twelve inches can be arranged.

The solenoids used for correction are D.C. operated and have a constant rating, with a linear pull throughout the stroke. Speed of operation is controlled by an adjustable hydraulic damper of the self-filling reservoir type.

A further adaptation of this principle is guiding the web from a coloured line. When printing paper, etc., it is often desirable to work from a printed line as opposed to the edge of the web.

This is controlled by the varying degree of light reflection on the photocells, i.e., when light is reflected from white paper on one cell and from a coloured line on the other a similar position is arrived at as in the first case.

Moving Light Head

In conjunction with this adaptation the equipment is so designed that, instead of the roller moving the fabric from a fixed light head, the light head moves in a lateral direction on free bearing and follows the datum line. The equipment is designed according to the application. In the case of trimming, cutters are affixed to the light head and trim the edge of the web at any desired position; secondly, a guider can be fixed to the head to ensure that plastic material in a semi liquid state is guided back from the edge of the web to obviate the spillage on to the roller and wastage.

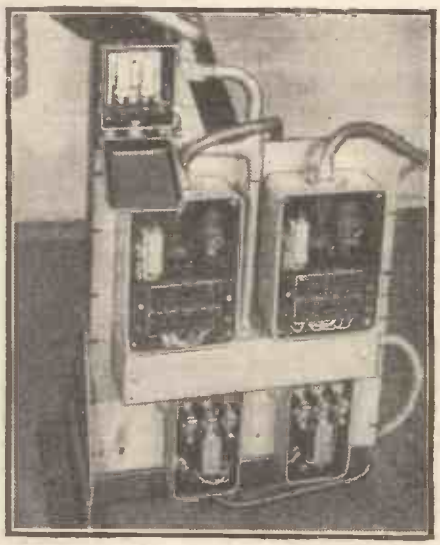


Fig. 2.—Interior of the control equipment, showing its relative simplicity. Each photocell only needs one valve, one relay and one contactor.

THE WORLD OF MODELS

Model and Handicraft Exhibition in Bombay : Model Steam Turbine Unit : Scale Model "Victory" Ship

By "MOTILUS"

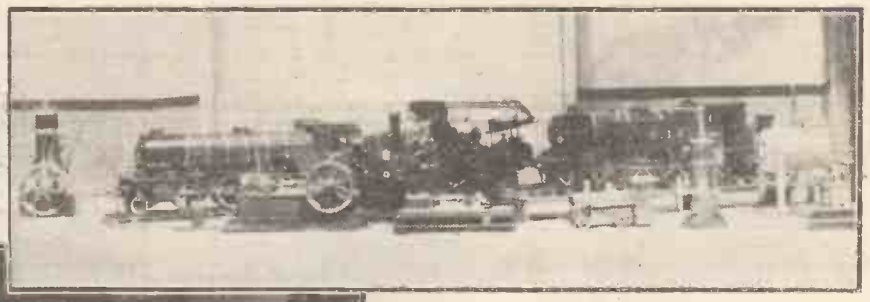


Fig. 1.—Group of mechanical models at the Model and Handicraft Exhibition, at Parel, Bombay. From left to right can be seen a marine engine, 2½in. L.N.E.R. "Green Arrow" express locomotive, a road roller and a 4-6-4 2½in. gauge tank locomotive.

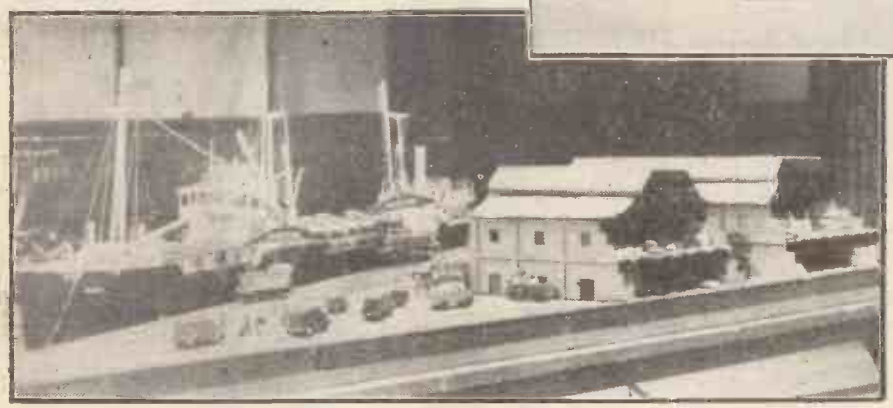


Fig. 2.—A model dockyard displayed at the Parel Model and Handicraft Exhibition. A cargo steamer is alongside the quay and readers will also notice the sectional model warehouse, the dockyard personnel and vehicles.

THE widespread interest in PRACTICAL MECHANICS takes this periodical to all parts of the world. In India, where the magazine has a considerable circulation, many of the readers are interested in modelmaking. The Editor recently sent on to me a report he received on a Model and Handicraft Exhibition held in the Railway Institute Hall at Parel, Bombay, in March last. This was the third annual exhibition to be organised by the Great Indian Peninsular Railway Technicians' Association, Bombay, and it was opened on 3rd March by Lt.-Col. R. C. Paranjoti, chief mechanical engineer of this railway.

The exhibition was divided into six different sections: carpentry, fretwork, handicraft, electrical, ship models and mechanical models. The most interesting models were to be found in the mechanical section (Fig. 1) where first honours went to Mr. J. A. Cox, an assistant mechanical engineer of the railway, for his tank locomotive of the 4-6-4 type, 2½in. gauge. This model also won the prize as the best exhibit in the whole of the hall. Mr. Cox displayed a number of other working models in the mechanical section, the excellent detail work on his 2½in. gauge 2-6-2 type engine with tender, L.N.E.R. "Green Arrow," attracting considerable attention. Mr. Cox's model road roller, worked by compressed air, was also much admired. There was a variety of other models in this section, including marine engines, horizontal steam engines, oscillating steam engines, vertical boilers, etc., all worked on compressed air.

Mr. A. Gonsalves won an award for the best model in the ship and yacht section, with his model 16th century galleon, the hull of which had been carved from a solid piece of Burma teak. Mr. A. E. Tarwalla won two awards: one in the carpentry section for a wooden table lamp with beautiful veneer work, and the second in the fretwork section for inlaid woodwork depicting various scenes (Fig. 3). Other prizes went to Mr. M. E. Barucha for a model of a modern swimming bath, in the handicrafts section, and to Mr. A. P. Mittal, a young technician on the railway, for an ingenious wireless table lamp entered in the electrical section.

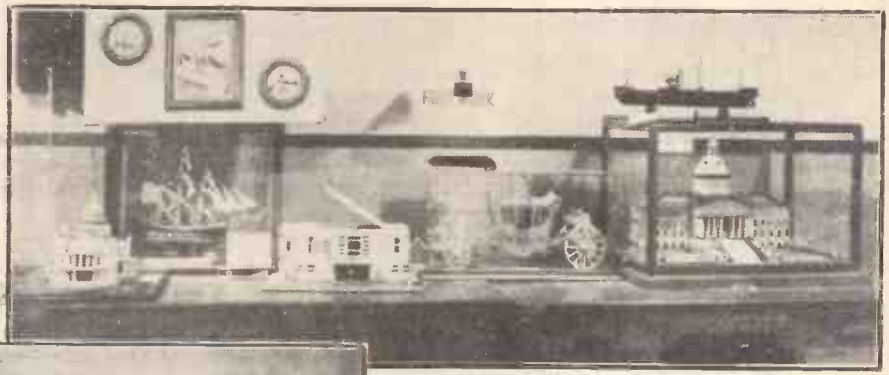


Fig. 3.—A selection of the varied glass-case models on show at the Parel Model and Handicraft Exhibition, including ship models, architectural models and a ceremonial coach model. All examples of finely-detailed modelling.

Several loan models appeared among the hundred and fifty exhibits. The G.I.P. Railway had designed and built a complete model dockyard including a docked cargo ship, warehouses and tracks and showing locomotives in the process of unloading (Fig. 2). They also loaned models of post-war designs for railway coaches. The Bombay Baroda and Central India Railway loaned a working model of a railway station yard, with signal and interlocking devices and complete track

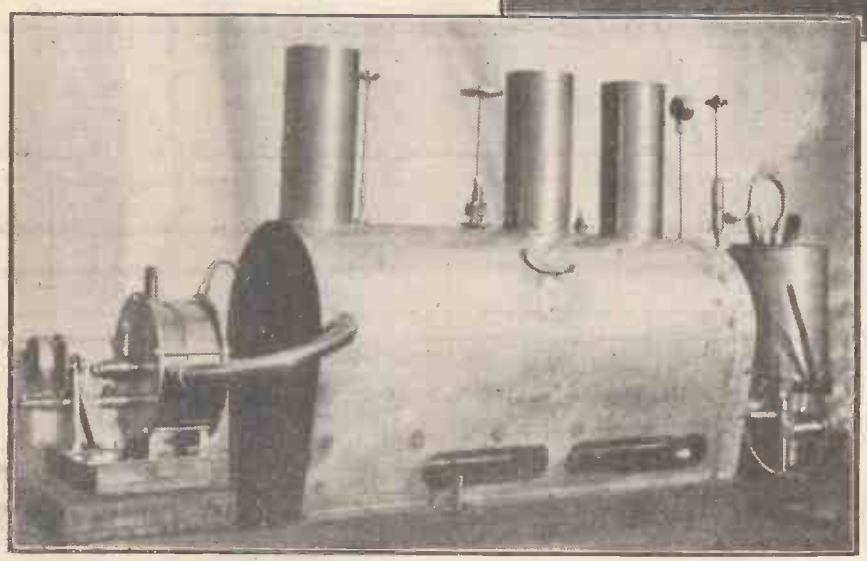
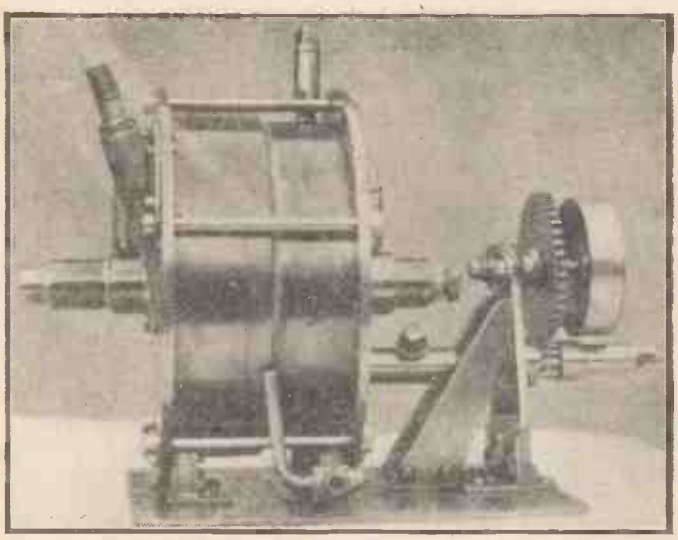
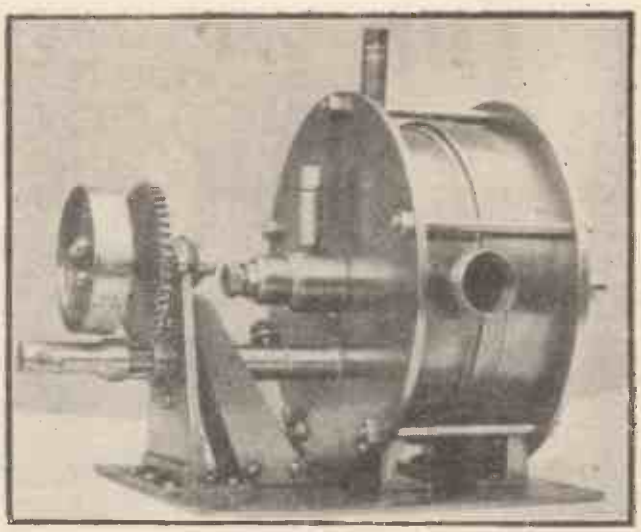


Fig. 4.—The complete model steam turbine unit designed and built by Mr. J. Oliver Crombie and suitable for use in a model steam boat.





Figs. 5 and 6.—Two close-up views of the working model steam turbine made by Mr. J. Oliver Crombie.

circuit, which served as a source of enlightenment on railroad safety precautions for many visitors to the exhibition. An unusual exhibit was a plastic scale model of a Bristol Mark 171 freighter aeroplane, loaned by Messrs. Greaves Cotton & Co., who also exhibited a sectional 22 h.p. Ruston oil engine.

Messrs. Veniza & Co. displayed a number of model aircraft, imported from U.S.A. and Great Britain. On the last day of the exhibition they gave demonstration flights with these models, much to the delight of an enormous crowd of visitors.

I regret that the photographs received from India are rather small, and do not show to best advantage the excellent detail work and craftsmanship of these enthusiastic Bombay modelmakers.

Model Steam Turbine Plant

From time to time both amateur and professional modelmakers attempt to make a working model steam turbine complete plant, either for propelling model ships or for some other purpose. It is rare, however, for these attempts to meet with any degree of reasonable success, so I was interested to hear recently of a unique model steam turbine unit (Fig. 4) made by Mr. J. Oliver Crombie, of Ferring, near Worthing. Mr. Crombie made the entire unit himself, with the exception of the pressure gauge, which he purchased, and as the model has some practical working value he has been good enough to let me have some details about it, which I am glad to be able to pass on to readers.

I usually like to indicate briefly the "modelmaking background" of model engineers about whose work I write, as we are always interested in fellow craftsmen, as well as their miniature creations. Mr. Crombie served his apprenticeship in the locomotive works of the well-known firm of Messrs. Robert Stephenson and Sons, Ltd., at Newcastle-on-Tyne, from 1897 to 1900. So, as Mr. Crombie says in a letter to me, "I am really a 'loco' man."

No doubt readers are aware of the attempts that have been made to place on the commercial market a satisfactory and efficient model steam turbine, quite apart, of course, from the "toy" ones that are good as working models to watch, but which have no power behind them for practical work. Mr. Crombie started his model partly out of a curious interest in turbine propulsion and partly because he hoped the finished model would be used in a model steam boat belonging to a friend, although this idea had to be abandoned later.

Those who have tried their hand at building a model turbine plant will be only too well aware of the pitfalls and difficulties that are encountered. Mr. Crombie took about seven months to construct the actual turbine (Figs. 5 and 6) including time taken on tests to discover the most economical throat area for the nozzle: three nozzles had to be made before deciding the best size. Then there was the boiler to be made and experiments had to be carried out with lamps, Mr. Crombie eventually deciding that the vapour type proved most successful. Most difficult job of all was the "letting in" of the small gear wheel into the rotor shaft and, secondly, the cutting of the teeth in the two larger wheels of phosphor bronze, for which operation Mr. Crombie made and hardened a special tool: the setting of the radial blades was another difficult task.

The problem which he feels is the chief drawback to a model steam turbine is that it is unwise to run the turbine for more than twelve to fifteen minutes without lubricating internally, which is tiresome. This drawback might be overcome, but Mr. Crombie has no solution to offer so far!

The model unit is a foot high and overall length is 2ft. 3½in., with a total weight, in working order, of 20lb. The turbine has a rotor of 2⅞in. diameter, with 48 blades rotating at 8,000 revs. per minute at a pressure of 70lb. The reduction gear is 25.5 to 1, the speed of the "final" shaft being about 310 revs. per minute. There are adjustable, case-hardened pivot bearings. The tubular, horizontal boiler, of 4in. diameter, is 11½in. long, having flues, and with a heating surface of 250 sq. in. There is a superheater in the smokebox. Heating is by a methylated spirit vapour lamp with needle valve control, consuming more than a quart of spirit per hour.

Regarding the working power of this turbine model the following notes from Mr. Crombie may be of use to fellow modelmakers who are experimenting on similar work:

"When a leather band is held and pressed round the drum on the final shaft (constituting a brake-horse-power test), the velocity of the turbine is only slightly reduced. When the circular casing of the turbine is removed and distance pieces put over the five hold-together bolts the turbine works almost (but not quite) as well. The rotor and internal gear wheels can then be seen revolving, and though doing about 130 revs. per second the rotor does not appear to be moving at all. The exhaust pipe is, of course, then eliminated.

"The turbine never reaches maximum angular velocity until some of the internal lubricant has been carried away by the exhaust steam, which happens after about a minute. The best lubricant for the pivots, one which will mix and remain with the condensed steam, has had to be discovered by patient experiment. After roughly three-quarters of a million revolutions of the rotor the pivot bearings and gear wheels show no sign of wear.

"With a large boiler the 8,000 revs. per minute are maintained continuously with a pressure of only 45 to 50lb. But with the unit boiler, as shown in the illustration (Fig. 4), 65lb. pressure is necessary, suggesting a 'volume-weight' being a great advantage behind the issuing steam."

Mr. Crombie says he received one or two valuable hints regarding methylated vapour

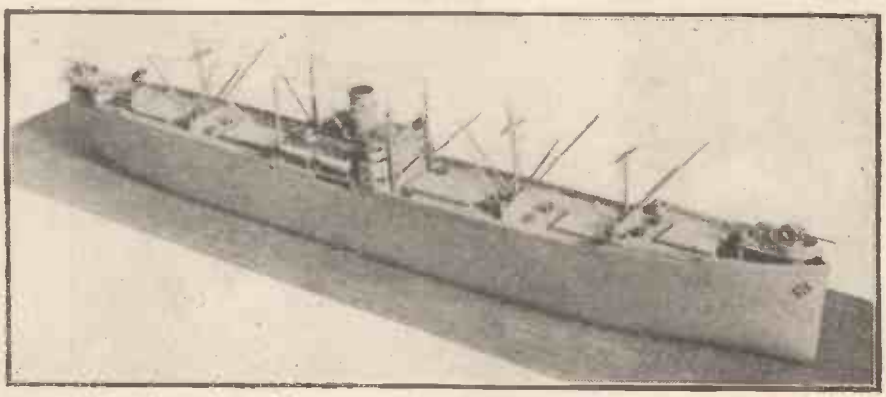


Fig. 7.—The full-hull model "Victory" ship made for the new Maritime Museum in Lucerne. Scale: 35ft. to 1in.

lamps from Mr. R. Relph, of East Cliff, Cornwall. Mr. Relph is a civil engineer, and also a very clever model engineer. Following his own experiences in his usual modelling activities, Mr. Crombie is keenly interested in this problem of the practical working model steam turbine plant. Readers interested in this form of propulsion may like to write to Mr. Crombie, through the Editor, and I feel sure he will be only too pleased to give them any help he can through the benefit of his own experiments. Mr. Crombie would also be glad to know of anyone in this country who has been successful with any similar model.

Modern warfare, with its tendencies to accelerate research in the worlds of science and manufacturing, frequently gives rise to the making and breaking of records in many spheres. During the last war the number of warships built after the design of Kaiser's American "Victory" or "Liberty" ship (over 2,000 of them) must surely have broken a record: partly pre-fabricated, these ships were built in shipyards in many different parts of the world, the main output coming from U.S.A. and Great Britain. They were well-built cargo ships, designed to be constructed quickly and to do an efficient war job.

The model "Victory" ship, illustrated in Fig. 7, is one made to the order of Mr. Philip Keller, of Lucerne, Switzerland. Mr. Keller has a private collection of ship models, representing ships of numerous types from all over the world. I believe it must be one of the finest private collections in existence. When, a short while ago, it was decided to open a Maritime Museum in Lucerne, Mr. Keller generously gave a large number of ship models to the Swiss authorities for exhibition in the new museum. The "Victory" ship model, made to a scale of 35ft. to 1in., was ordered specially for inclusion with the models for the Lucerne Maritime Museum; the model is finished in the standard grey colour of the war-time ships and shows as much detail as is possible in this small scale.

Trade Notes

B.E.N. Spray Gun

B.E.N. PATENTS, LTD., have recently brought back into production the popular B.E.N. Model "S" Spray Gun, which is invaluable for the spray painting of small objects and for a wide range of decorative effects. This precision gun is of

The B.E.N. Spray Gun.

light weight, is easily operated, and is specially designed to produce a wide range of effects from a dot or fine line to a full broad spray. It is invaluable for pottery decoration, showcard and poster work, decorators' shading and blending effects, furniture shading, fabric decoration, and lampshade, toy, artificial flower and antique novelty work. Attractively finished in polished duralumin with nickel-plated fittings and heavily plated copper gravity cup, the Model "S" is machined throughout to precision limits and all parts are interchangeable. The material needle is of stainless steel. Designed for round spray only the Model "S" is supplied with two spray head combinations designed respectively for fine and medium effects. With the No. 1 spray head, intended for fine work where water colours, dyes and other light liquids are to be applied, perfect atomisation is obtained from 1 cu. ft. of air at 25 to 30lb. pressure. For heavier work involving lacquers, oil colours, bronzes and materials of medium consistency the No. 2 spray head is necessary. A 1-oz. gravity cup is supplied as standard (4-oz. cup extra) and a ¼in. knurled hose connector for 3/16in. hose is fitted. Further particulars are obtainable from B.E.N. Patents, Ltd., High Wycombe, Bucks.

Is This a Record?

IT is sometimes stated that electronic equipment is unsuitable for industrial use owing to the alleged short life of valves and other apparatus.

A case, however, has recently come to light which refutes this. In 1937 an Osram valve and photocell, taken at random from stock, were installed in smoke-detecting equipment at Mount Royal Hotel, Marble Arch, London, and remained in daily use without interruption until replaced in December, 1948, a total of some 100,000 hours. Throughout this period the valve and photocell were subjected to an ambient temperature of 90-100 deg. Fahr.

The "Rawlclip"

AMONG the latest developments in fixing devices is the Rawlplug girder clip, a patented device which clips on to girders instantly, and will take brackets at any angle for carrying pipes, cables, conduits, etc. There are two types, one for "H" girders and the other for angle girders. The Rawlclip is made in three parts: One carrier with one sliding self-locking clip at each end. The clips are made of the best quality spring steel, and the sliding clips and carrier have interlocking indentations which engage when the parts are assembled on the girder. The carrier is provided with a slot in which the nuts and the screws holding the saddle are inserted and the nuts tightened up. The Rawlclip forms a firm fixture with the girder, and will not work loose with vibration. No special tools are required for fixing it. An illustrated folder giving further particulars and prices is obtainable from The Rawlplug Co., Ltd., Rawlplug House, Cromwell Road, London, S.W.7.

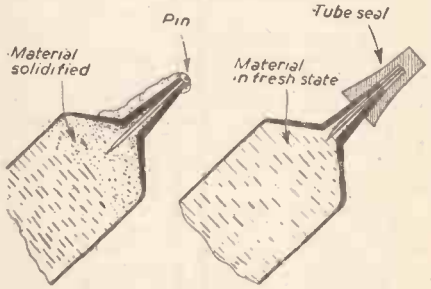
Spoke-making Machine

DANIEL SMITH, LTD., Castle Ironworks, Wolverhampton, have recently produced a spoke-making machine which should be of advantage to the cycle industry.

The machine is the result of considerable investigation by the firm's engineers abroad, and it is stated that it has been made and designed at the request of the Ministry of Supply as a dollar saver. The reason why it will save dollars is that originally the British cycle industry used to purchase most of its spokes from hard currency markets. The new machine only requires one operator and will produce finished spokes of any length between 7½in. and 13in.

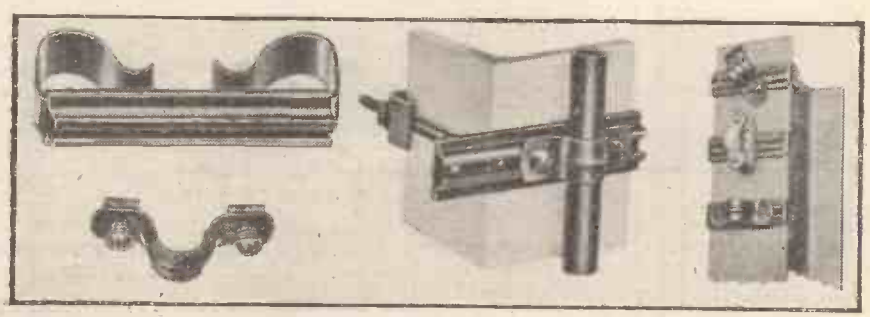
New Tube Seal

A SIMPLE device for reducing the evaporation through the nozzle of a collapsible tube of adhesive or paint has been placed on the market by the Tube Seal Co., 33, Tennyson Road, Stoke, Coventry. When an ordinary pin is used for perforating the nipple of a tube not provided with a screw cap, the contents in the neck of the tube quickly solidify due to evaporation around the pin.



The advantage of using the new tube seal is clearly shown in these diagrams.

A tube seal overcomes this objection by means of a sleeve which seals the nozzle, and a pin which, after piercing it, prevents the contents of the tube escaping. Further information can be obtained from the Tube Seal Co. at the address given above.



The "Rawlclip," which is suitable for holding conduits, water pipes, steam pipes, etc., at various angles on girders.

Letters from Readers

Glycerine Litharge Cement

SIR,—It may be interesting to your reader, M. Stewart, to know that this cement is extensively used in the refrigeration industry, but we usually obtain yellow litharge and make a stiff paste by adding glycerine carefully. Any refrigeration engineer will demonstrate this. Screwed flanges on ammonia pipes, etc., need not be sweated or expanded if this cement is used, and such joints are reopened usually by heating with a blowlamp and tapping with a hammer to break the cement.—J. PARTINGTON (Bolton).

Methanol as a Fuel

SIR,—Reading a recent issue of PRACTICAL MECHANICS, I was interested in the query from G. Rothwell, of Manchester, regarding the disadvantages and problems of running his motor-cycle on methanol.

Some time ago I had the task of adapting a two-stroke motor-cycle engine to run on this fuel, and perhaps the following information might be of use to the reader in question:

(A) Primarily, assuming that the engine is lubricated by "petroil" system, it is known that methanol will not mix with any *mineral* oil. It will, however, mix with *vegetable* oil and, for the purpose required in this instance, the only way out of the problem is to use commercial (or pure) castor oil, using the same measure as for petroil mixture, i.e., 16 to 1 parts. The aroma, incidentally, is a nostalgic one—reminiscent of T.T. races and early aeroplane engines when castor oil was in vogue.

(B) Methanol is very bad for paint and cellulose, burning the tank enamel almost at once, and great care must be taken not to spill any when filling up.

(C) Water is formed during combustion, as stated in PRACTICAL MECHANICS, and will be noticed dribbling from the tail pipes while the engine is running. It does not corrode anything either internally or externally, and the engine can be left over a period of weeks without any harm resulting.

(D) Jet size (the mixture has to be very rich indeed) requires from 2½ to 3 times normal petrol size, and air correspondingly smaller. In my case the mixture control needle had to be tapered and shortened to get any running at all, and the final results were attained by much trial and error. As stated above, the mixture is very rich. Hence the consumption in m.p.g. is high; Mr. Rothwell can expect from his machine only 20-35 m.p.g. which, as the price of castor oil and methanol is also high, makes the proposition a dubious one.

(E) Starting is at times difficult with a cold engine. Before I managed to get my carburation correct the engine would not start on methanol at all. This trouble was overcome by flooding the carburettor with methanol-castor oil mixture, removing the sparking plug and squirting a small quantity of neat petrol through the plug-hole, and replacing the sparking plug after ascertaining that the plug was free from condensation. With the throttle opened a little and the mixture set for "rich" the engine was kicked over vigorously; the neat petrol fired at once and the engine "revved" hard sufficiently long enough for the methanol mixture to be induced to take on the running.

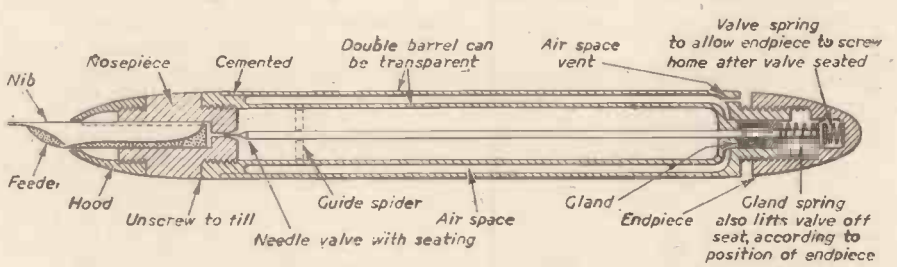
Finally, I would like to add, for performance methanol is wonderful stuff; the bike goes like a bomb with surprisingly cool running at sustained speed. However, at low revs. power is low, and engine-stalling is frequent unless revs. are kept up. While stationary the engine must be "blipped" to keep it going; a hot engine can be restarted without resort to priming, but unless accurately carburated is difficult when cold. Two-strokes seem to like methanol, and, when I converted mine, no one was able to give me any tips, so it proved a problem for some appreciable time. I run on petrol now, and honestly do not regard methanol as a satisfactory substitute.—S. ASHER (Gorleston-on-Sea).

"Practical Mechanics'" Fountain Pen Competition

SIR,—May I comment on the published designs in connection with the above competition?

Mr. Munro's is far ahead of the others and appeals to me. I hope to see these pens on the market soon.

Loss of capacity due to rubber bags and gadgets to self-fill them means frequent refilling. If the whole barrel can be used for ink, with longer periods between filling, why not dispense with all self-filling gear and pour the ink into the barrel. Petrol lighters are not self-filling and who minds?



Mr. E. W. Baigent's idea for a large capacity non-leaking fountain pen.

The most awkward problem is blobbing due to air expansion. By using plastic materials the barrel could be made double like a vacuum flask, with much less heat transfer from the hand.

The other designs published all seem to provide against leakage in the pocket (most pens seal pretty well when the cap is on), but they don't provide for hand-warmth leakage while writing.

A needle-valve would control flow to suit various nibs, and an index on barrel and end-piece would indicate the user's preference.

Seating on the needle-valve would seal pen for carrying.

While in pocket the nib is uppermost, so that if the user opens the valve immediately on removal from pocket, still holding nib up, any pressure due to warming up from body would escape through the nib.

I have tried many pens, one is a ——, and gives no trouble except capacity, but it costs seven times as much as another for the same number of parts. I was disappointed in finding I had not more for my money. And for the price of the new ——, one would expect the last word in pens, yet I'll wager it still has a rubber bag. A friend owning one complains that he cannot see enough of the nib to know which way to hold it for writing.—E. W. BAIGENT (High Wycombe).

Perspex for the Amateur

SIR,—May I draw your attention to the compressed air tank in the "Perspex for the Amateur" article in the February issue of PRACTICAL MECHANICS?

In my opinion the tank, in its present state, will be in danger of bursting and probably injuring the operator.

Firstly, if a petrol tank is used, all traces of petrol should be removed by swilling out with hot water and allowing to stand for 48 hours out in the open air; this will lessen the risk of explosion when soldering or brazing.

Secondly, the pressure of 30lb. per sq. in. seems much too high for a tank of that type. A safer pressure would be about 3lb. per sq. in. Aircraft petrol tanks, some of corrugated 22 S.W.G.M.S., are tested at 1½lb. per sq. in. I have seen a flat aluminium tank assume a spherical shape with a pressure of 6lb. per sq. in.

Thirdly, the tank should have a pressure gauge and a relief valve; either of these should be quite easy to acquire with all these ex-R.A.F. components available. The stop-tap should be of a type which screws down on to a seat (oxygen cocks, etc.). Most of the other types leak with air.—P. MILLS (Woking).

SIR,—In my article in the February issue I obviously made a rather rash statement that the pressure inside a petrol tank should be taken up to 30lb. per sq. in. The safe pressure obviously depends on the shape and material used for the construction of the tank.

Some time ago I made a paint-spraying plant in which I used a petrol tank out of an old Vauxhall car. The tank in this case was cylindrical in shape and it withstood all the pressure I could exert with a foot pump, which must have been well over 30lb. per sq. in.

In my own blowing apparatus for "Perspex" I used some Government surplus pressure tanks. The reason I did not quote these in the article is that they are not readily obtainable.

With regard to the possibility of danger to the operator in the event of the tank bursting, I think that if such a mishap did occur the tank would give at a joint, and that as the method of inflation is slow and the pressure comparatively low there would be very little possibility of the operator being hurt.

Although I did not mention it in the article, a pressure of 5lb. per sq. in. is all that is required to blow quite thick "Perspex." Thus a pressure in the tank of 10lb. per sq. in. would be quite adequate.

With regard to other points mentioned by your correspondent, precautions are obviously necessary in preparing the tank for brazing, but these should be self-evident.

The introduction of a pressure gauge and a relief valve would obviously be an advantage, but they would complicate the apparatus.

The type of valve mentioned would be the best to use, but I did not experience any trouble with an ordinary turncock.—J. C. REUSSNER (Thornton-le-Dale).

Brazing Butt-jointed Cylinders: Conic Forms

SIR,—As a craftsman whose work brings him much in touch with the subject, may I bring to the notice of your readers a method of silver-soldering or brazing of butt-jointed cylinders which I assume to be most unorthodox but find to be extremely effective. In all the literature on the subject the method appears to be that one binds the cylinder with soft iron wire to prevent opening of the joint and applies the borax flux in the form of a paste by combining it with water. Obviously, the snags in binding are: (a) That, due to varying co-efficients of expansion, the iron wire may mark the softened metal: (b) that, due to the same cause, the joint may slip and overlap; and (c) that there is a possibility of the solder adhering to the wire. These possibilities are real. I used to have to put up with them, but not for some considerable time now.

The cause of the opening joint is expansion taking place in the wrong place first, since it is natural to apply heat to the joint *inside* the cylinder. Result: the inside expands more rapidly than the outside and the metal will tend to straighten. By the time expansion of the outside catches up with that inside the metal has become very malleable, and closing of the gap is not possible unless a binding medium is used.

The cure is, of course, to heat the outside first to a dull red heat opposite the joint, and the joint remains closed, and if not tight will close right up.

This brings me to the application of borax. This salt contains water of crystallisation, which is always driven off on heating, causing some turmoil and movement of the borax, which often leaves the joint for some other position where its presence is neither desired nor required. Mixing the borax to a paste with water does not prevent this, and the reason for making a paste, i.e., to get the borax right on the job, is defeated. Hence, the method used by me and my students, always with success.

As the outside of the job is being brought to a dull red heat, I hold a wire with flattened end in the flame and dip it in the borax on reaching red heat, then back to the flame, rolling it to prevent loss of borax until a bead sufficient to cover the joint is formed. Then both flame and boraxed wire (or spatula) are applied to the joint, and the wire is lightly trailed up and down until borax covers the full length. More borax can be applied by the wire if necessary.

I can imagine the critics saying that the joint surfaces will now be oxided. What of it? Borax is a solvent of most metallic oxides and will remove them and, of course, by its screen action, will prevent further formation. Should the job be a small one the solder or spelter may be transferred to the job by the wire, melting it on to the wire first, or by placing small pieces along the joint and reheating to flow point. For larger jobs some support must be given, and I suggest iron angles of suitable flange width laid under the job, flanges up and running the full length. Don't let the flanges be too far from the joint.

While I am on this topic might I give another tip regarding the development of conic forms. So many people calculate the circumference of the cone base and then laboriously and inaccurately step this distance around the circle of development with dividers. I never bother to develop the job on paper. It is marked straight on to the metal and ensures perfect accuracy. The method lies in the relation between the slant height of the cone, which is the radius of the circle of development, and the diameter of the base of the cone. π × twice the rad. of circle of dev. (slant height of cone) gives an angle of development of 360 deg. From this we calculate the angle required for the job. So, as π x twice slant height is to 360 deg., so π x diam. of base of cone is to angle of development.

$$\pi \times 2\,SH : 360^\circ :: \pi \times d : x^\circ$$

giving $$2\,SH \times x^\circ = 360^\circ \times d$$

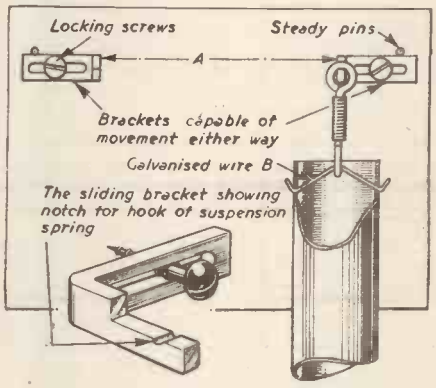
$$x^\circ = \frac{360^\circ \times d}{2\,SH}$$

So then, we might say, multiply diameter of base by 360 deg. and divide by twice slant height.

One word of warning. When metal is bent the inside is contracted and the outside expands; therefore all calculations must be based on the mean diameter. If a cylinder is to fit over a disc at either end, one thickness of the metal must be added to the diameter of disc. If the cylinder end is to fit into a flanged disc, one thickness of the metal must be subtracted. The same rule will apply, of course, to conic forms.—E. T. BAILEY (Bognor Regis).

Electric Door Chime Improvement

SIR,—With reference to the article by E. S. Brown, "An Electric Door Chime," appearing in the issue of May, 1948,



Adjustable brackets for suspending chime tubes.—E. R. Putman (Wallington).

I should like to point out a few modifications which I have made in the chime I have constructed and which may be useful to other readers.

For the coil former I used the barrel of an old fountain pen which was of the correct size and provided a much firmer basis than paper or card on which to wind the coil.

I visualised trouble in adjusting the tubes from the suspension hooks, as shown in the article, especially as there is so little distance between the tubes and the striker rod. Instead of the hooks I made adjustable brackets of sheet brass slotted to allow of movement either right or left (see "A" on accompanying sketch).

For the suspension of the tubes I discarded the split pins and used instead small lengths of galvanised wire which were placed through the holes in the tubes and drawn up from inside the tubes to the shape shown at "B," the short ends of the wire being turned up as shown. This obviates the chance of the tubes jumping the groove in the split pin should the tube be knocked accidentally.

The chime works well on three cycle-lamp batteries and has given no trouble.—E. R. PUTMAN (Wallington).

Screwdriver Theory

SIR,—In a recent issue of PRACTICAL MECHANICS, Prof. Low again mentions what must be one of his favourite theories, viz., that the greater torque obtained from a long screwdriver is a result of holding it out of line with the screw. I don't agree for two reasons:

Firstly, the driver does not have to be far out of line before it will turn out of and damage the screw slot.

Secondly, merely holding the screwdriver out of line will not result in greater torque. The end of the driver would have to inscribe an arc at the moment of turning, otherwise the torque would surely be the same as when it is held normally.

My own theory is that a longer screwdriver gives greater purchase because the user is able to "spread himself out" and take a better grip. Also, the larger the handle diameter the greater the leverage applied.

This could easily be proved right or wrong by connecting a train of gears with stop pawl to a powerful spring balance, a slot being cut in the spindle of the first gear. The merits of various sizes of drivers could then be found.—B. TOON (Stamford).

Club Notes

Harrow and Wembley Society of Model Engineers

THE above society has arranged a programme of events for the current month, as follows:

June 8.—Talk by Mr. Rogers on "Lathe Topics."

June 18.—Visit to Romney, Hythe and Dymchurch Railway. Members of other clubs are welcome to join us. The hon. secretary should be notified as soon as possible of the numbers likely to be coming.

June 22.—Marine talk arranged by Mr. R. Emery.

A visit to Longmoor Transportation Centre, Liphook, has been arranged for August 28. The number in the party is limited and early application is advisable.

J. H. Summers, Hon. Secretary, 34, Hillside Gardens, Northwood, Middx.

Radio Controlled Models Society

THE Radio Controlled Models Society, London group, has started a series of monthly lectures, designed primarily for beginners to radio and electrics, commencing with fundamental electrical principles, and working up over the year to cover the whole field of radio control. Notes and references will be provided to assist members in their private reading. Visitors will be welcome at the lectures, the first one of which took place at the St. Ermin's Hotel, Caxton Street, S.W.1, on Sunday, May 8th, when Mr. J. C. Hogg, general secretary of the R.C.M.S., gave the first of two talks on "Fundamentals." Details of further meetings, and of membership and the society's activities, may be obtained from:

The Hon. Group Secretary, Lieut. (L) G. C. Chapman, R.N., Pine Corner, Firwood Rise, Heathfield, Sussex.

The Manchester Society of Model and Experimental Engineers

THIS society, which is over forty years old, is at last in sight of its goal. Plans are nearing completion for 660ft. passenger-hauling locomotive track in one of the Manchester parks. Provision will be made for 2½in., 3½in., and 5in. gauge, and the club members are also building a 5in. gauge locomotive. Other interests are catered for, and a 70ft. circular car track will be laid down. The society expresses a cordial invitation to model engineers of all interests to join, and visitors are welcome at our weekly meetings at the Girls' Institute, Mill Street, Ancoats, Manchester, on Fridays at 8 p.m.

Hon. Secretary, George Garvin, 13, Vernon Road, Droylsden.

QUERIES and ENQUIRIES

A stamped addressed envelope, three penny stamps, and the query coupon from the current issue, which appears on page 72 (THE CYCLIST), must be enclosed with every letter containing a query. Every query and drawing which is sent must bear the name and address of the reader. Send your queries to the Editor, PRACTICAL MECHANICS, Geo. Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

Cholesterol and Oxycholesterol

WOULD you please answer the following questions :

(a) What is cholesterol ?

(b) What is oxycholesterol ?

Where can they be obtained ?—H. A. Hopkins (Grimsby).

(a) CHOLESTEROL, when pure, is a colourless substance crystallising in fine needles, which melt sharply at 145 deg. C. Chemically, it is one of the higher alcohols, and has the formula $C_{27}H_{45}OH$. It is found in various places, such as the brain, in bile, in wool fat, in egg yolk, in gallstones, and even in cancerous and tubercular deposits. It can also be made artificially.

Cholesterol has been given some renown as a hair tonic or stimulant, but since there is some evidence that its absorption into the body under certain conditions may be associated with the development of cancer, it is hardly advisable to use it for cosmetic purposes.

It can be obtained from any firm of laboratory suppliers, such as Messrs. Reynolds and Branson, Leeds, or Messrs. Vicsons Ltd., 148, Pinner Road, Harrow, Middlesex. Its price is in the region of 6s. 6d. per ounce.

(b) So far as we can trace, oxycholesterol is not commercially obtainable. It is a crystalline product formed by the mild oxidation of cholesterol. It is a constituent of many animal cells, and it has been used in the synthesis of certain cancer-producing substances, such as methylcholanthrene. It has not, however, the chemical importance of cholesterol, its parent substance.

Petrol-proof Varnish

I AM experiencing great difficulty in making hard-drying black enamel on a motor-cycle tank proof against petrol. Can you supply me with a formula for making a colourless lacquer which will solve my problem, or what marketed brand of varnish would be suitable ?

I have tried all local colourmen without success and have experimented with clear dope and transfer varnish, all to no avail.

Would a "waterproof" varnish do the job ?—S. Dunn (London, N.).

TO a large extent, two coats of an ordinary shellac varnish will stand up well against petrol. Alternatively, you can use a clear lacquer made by dissolving scrap celluloid in equal parts of acetone and amyl acetate, or, better still, the following varnish :

Clear celluloid	15 grams.
Ethyl acetate	17 c.cs.
Amyl acetate	25 ,,
Xylene	60 ,,
Benzene	40 ,,
Boiled linseed oil	8 ,,
Tricreylphosphate	3 ,,
Ethyl alcohol	26 ,,

Again, you can use a solution of Perspex in trichlorethylene, or, if you wish, inquire of Bakelite, Ltd., 18, Grosvenor Gardens, London, S.W.1, for one of their synthetic resin varnishes which are proof against petrol and benzene.

You will, we think, be able to buy a clear-cellulose varnish ready made from Messrs. Nobles and Hoare, Ltd., 3, Cromwell Road, London, S.E.1, or Messrs. Vicsons Ltd., 148, Pinner Road, Harrow, Middlesex.

Sizing Cement Walls ; Books on Painting and Graining

WOULD you please supply me with the following information : What is the solution that is put on cement walls before painting them ? Also, is there any book dealing with painting and graining, etc. ?—R. R. Kendrick (Ferns).

CEMENT walls which are to be painted are usually brushed over with size to fill up the pores and to prevent the wall absorbing too much of the paint. You can make up a convenient size solution for this purpose by dissolving 10 parts of glue-size (by weight) in 90 parts of hot water. Brush the solution on HOT and do not attempt the painting until the wall has thoroughly dried out again. Two applications of the size solution are better than one.

The following books dealing with painting and graining will interest you. They can be obtained (possibly secondhand) from either Messrs. W. & G. Foyle, Ltd., Charing Cross Road, London, W.C.2, or from Messrs. Wm. Bryce, Ltd., 54, Lothian Street, Edinburgh. In each case we have noted the publisher's net retail price (pre-war.)

E. A. Davidson : House Painting, Graining, Marbling and Sign Writing (7s. 6d.).
P. N. Hasluck : Practical Graining and Marbling (3s.).
W. J. Pearce : Painting and Decorating (12s. 6d.).
M. Vince : Practical House Decorating (3s. 6d.).
A. H. Sabin : House Painting (9s.).
J. E. Butterworth : Practical Painting and Decorating (5s.).

Base Exchange Material for Water Softener

I HAVE constructed the water softener as described in the January issue of "Practical Mechanics," and shall be glad if you will enlighten me as to what base exchange material I must use, and where I can obtain it.—E. Harris (Honiton).

THE base exchange material you require for your water-softener is Zeolite crystals, which may be obtained at approximately 6s. per lb. from the undermentioned suppliers :

Messrs. The Universal Water Softeners, Ltd., Clock Parade, London Road, Enfield, Middlesex.

Messrs. Hall & Hamblen, Water Treatment Engineers, 13, Amy Street, Leicester.

Nickel Plating

I AM interested in nickel plating and have been wondering if a suitable current might be obtained by the use of a transformer and rectifier from the house supply (230 A.C.). I notice these components are advertised in "Practical Mechanics" and would appreciate your advice regarding the right types to purchase.—R. W. Wright (Darlington).

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.

NICKEL plating could be carried out by means of a step-down transformer and a metal rectifier from the 230-volt A.C. supply. We would suggest an equipment capable of giving about 4 volts across the terminals of the bath and a current of 12 to 20 amps. per square inch of plated surface. The vat voltage could be controlled by means of a resistance in the primary circuit of the transformer, but a more efficient arrangement would be to use a transformer having a tapped secondary winding.

Bleaching Fluid : Glass Bottle Manufacturers

CAN you please tell me what ingredients are used in the manufacture of a good bleaching and cleansing fluid for use in the ordinary household, such as is commonly sold in most shops. Also, where can I obtain the necessary materials and bottles ?—J. R. Smith (Askam-in-Furness).

THE ordinary bleaching fluid which is sold in shop for household use is a stabilised solution of sodium or calcium hypochlorite. It is produced by the large-scale electrolysis of brine, and can be obtained in quantities for re-sale through your regional office of I.C.I., Ltd., which is situated at King Street House, Manchester.

You cannot possibly make such a solution yourself, for it requires not only much chemical skill and knowledge but also extensive and costly chemical and electrolytical plant.

You can, however, make a simpler type of hypochlorite solution for yourself by grinding up 1 part of bleaching powder (chloride of lime) with 10 parts of cold water. Add about ¼ part of common salt to the solution. Then filter it. In this condition, the liquor will be an effective bleacher, but it will only keep for about a fortnight, after which it will tend to become acid and to lose its bleaching power.

There is, unfortunately, no other method of making a bleaching liquor on the home scale.

Bleaching powder can be obtained from I.C.I., Ltd., address above mentioned, or from any chemical merchant as, for example, Messrs. James Beard, Ltd., 16, Great Ancoats Street, Manchester ; Messrs. J. W. Towers & Co., Ltd., 44, Chapel Street, Salford 3, Lancs.

You should also be able to obtain it locally in small amounts for experimental work from any of your local druggists.

Glass bottles may be obtained from any of the following firms : Messrs. J. Arthur Battie, Ltd., Doncaster ; Messrs. Gregg & Co., Ltd., Hope Glass Bottle Works, Knottingley, Yorks ; Messrs. Jackson Bros. (of Knottingley), Ltd., Headland Glass Works, Knottingley, Yorks ; or United Kingdom Glass Co., Ltd., Hayes, Middlesex.

Preventing Cement Floors from Dusting

COULD you please inform me how to make a solution for preventing a cement floor from dusting ? The floor was laid last autumn, has not had a lot of use, and was made of washed sand and slightly coloured pink.—H. J. Cooper (Chelmsford).

CEMENT floors very commonly give rise to dusting troubles, particularly when the cement content is on the low side. However, even the best of cement floors will give rise to this trouble under constant traffic.

There is no solution which you can make for the purpose of stopping the dusting. Various solutions of sodium silicate (waterglass) have been recommended from time to time, but they are of little use.

A better preparation is an emulsified wax solution, such as "Glocoat" (Messrs. Johnson and Sons, Hendon, London, N.W.4) or "Sposs" (Simmonds Products, Ltd., Trading Estate, Slough). Such preparations are applied to the floor. They deposit a film of hard wax thereon which binds the loose floor particles together. Regular application is necessary to keep the dusting trouble completely in abeyance.

Alternatively, you can use a preparation of ethyl silicate which, when applied to the floor, deposits hard silica thereon. Such a preparation is "Kexacrete," which is manufactured by Kaurex Products, Ltd., Elstree, Herts.

It would not be possible for you to prepare either of the above classes of solutions yourself.

Transparent Adhesive

COULD you please give me a formula for making an adhesive, similar to that used on transparent tape which can be bought in narrow widths at stationers ?

I wish to coat pieces of transparent paper about a foot square with a preparation so that they will remain slightly "tacky" for a long period. M. Leonard Clifton (Shepperton).

SELF-SEALING adhesives are not easy to make. The simplest of them all consists of a mixture of about equal quantities of rubber latex and mica powder. Since, however, this does not give a perfectly transparent film, you may not find it suitable.

The following is a relatively simple formula for a transparent adhesive of this type :

Gun cotton	5 parts (by weight)
Ethyl acetate	4 ,,
Toluene	2 ,,

To the above add the following ;

Ester gum	4.5 parts
Castor oil	3 ,,
Butyl phthalate	3 ,,
Ethyl acetate	2 ,,
Toluene	2 ,,

The resulting liquid should be stored in wide-necked bottles provided with screw lids.

Writing Pad with Celluloid Front

I INTEND to construct a scribbling pad of the type which consists of a cellophane front which is pressed on a wax block by a pointed stick and then the image removed when required by separating the two.

Could you please give me the composition of the block and any suggestions for the construction of the pad ?—G. G. Doig (Glasgow).

NO details have ever been published respecting the construction of the writing pads which you mention, but possibly you might be able to ascertain details from looking up old patent records in the Mitchell Library at Glasgow.

In any case, the transparent front of the pad is usually of celluloid, not cellophane. This is arranged to make contact with a tablet or pad which is composed of a very soft rubber in which has been incorporated a quantity of black pigment—usually a mixture of slate and lampblack. The pad is readily compressible. When compressed by the writing stylus, it remains in that condition until the pressure is relieved by sliding the celluloid front over the pad. Eventually, however, the pad loses its flexibility, and also the celluloid sheet becomes permanently indented, so that the pad as a whole becomes useless.

For purpose of construction you require a very soft black rubber sheeting material. We do not know where you can get this these days. We believe that this material is no longer manufactured. However, you might try Messrs. F. Reddaway and Co. Ltd., Pendleton, Salford, 6, Lancs, or, alternatively, you could contact the Research Association of British Rubber Manufacturers, 105-7, Lansdowne Road, Croydon, Surrey, which organisation might possibly be able to put you on the track of this material if it should happen to be still available.

Prevention of Rust in Storage Tank

DURING repairs to my hot-water system I have found that rusty growths have formed inside the hot-water storage tank, which is galvanised.

Is there any method of arresting this corrosion and preventing it recurring ?

Could the tank be painted internally with a heat-resisting paint not harmful to health should the water be used for drinking purposes, and, if so, what paint would you recommend ? Is aluminium paint suitable ?—F. Benham (Dulwich).

THERE is no paint with which your water tank could be coated internally without setting up some danger in the case of the water being used for drinking purposes.

Your best plan is to scrape the offending growths away by hand and afterwards to treat the water at regular intervals with a small quantity of sodium metaphosphate to prevent the recurrence of the growths.

Under the name of "Micromet," sodium metaphosphate is prepared in slowly soluble form by Messrs. Albright and Wilson, Ltd., Water Treatment Department, 49, Park Lane, London, W.1. This firm issues a booklet on the subject which we feel sure would interest you.

If the water was not to be drunk, aluminium paint would be effective after scraping away the tank growths, but there is always a danger of tiny flakes or particles of the metallic aluminium coming away and being carried off in the water. To drink such flakes would at once introduce a hazard to health.

Thermal Efficiency of Engines

WILL you please state the approximate efficiency percentage values of any modern internal combustion engine and any modern steam locomotive ?—B. W. New (Bounds Green).

WE presume you refer to what is called the "thermal efficiency" of an engine, which is the ratio of the indicated horse-power of the engine (expressed as heat units) to the heat energy of the fuel used per minute.

It can be proved mathematically that even with a perfect or ideal internal combustion engine the thermal efficiency could never exceed 87 per cent. In practice, however, even with the best engine designs the thermal efficiency of such engines is very much lower. With an ordinary petrol engine the thermal efficiency varies between 20 and 28 per cent., being usually nearer the former figure than the latter. The thermal efficiency of a diesel engine may reach 40 per cent.

The thermal efficiency of a steam locomotive is still lower, often being no more than 8-10 per cent. and sometimes considerably lower.

Drying Box for Hypersensitised Plates

I WAS interested in the method you gave in a recent issue for hypersensitising plates, but I find difficulty in drying them in the dark as I have no dark room. Could this deficiency be overcome by putting the plates in a light tight box with a substance which would absorb the moisture ? If so, what substance would you suggest, and where could it be obtained ? Would phosphorus pentoxide or "amadou" be of any use ?—R. S. Maddever (Launceston).

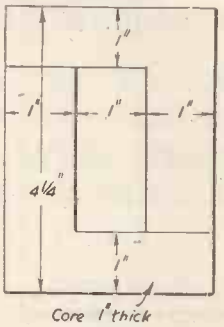
PHOSPHORUS pentoxide is messy and expensive stuff to use, and we doubt whether it would be very effective for your purpose. Ordinary quicklime would be much better. But why not construct a drying box in the two opposite sides of which a series of air holes are drilled ? These holes could then be shrouded with downwards-slanting wooden strips on the outer sides of the box so that the light would be trapped effectively and prevented from entering the box. Such a box containing the plates would, when placed in an open door or other position of draught, dry the plates with maximum speed.

We feel, however, that if you are going in for specialised photographic experimentation such as the hypersensitisation of plates you will find a dark room of sorts an absolute necessity.

Step-up Transformer Details

I HAVE a number of stampings totalling 1in. in thickness, the other dimensions being as indicated in the accompanying diagram.

I would like to make up a transformer to step-up from 100 v. to 250 v. 50 cycles, with the highest output possible. Would you give me the data on the gauge of wire required, and quantity ? —C. Laws (London, S.W.).



Stampings for a small step-up transformer (C. Laws).

WE consider that about 50 volt-amps. would be the most that you could expect from your core. We suggest the primary be wound with 750 turns of 24 s.w.g. enamelled wire, and the secondary with 2,000 turns of 29 s.w.g. enamelled wire. A layer of thin paper should be wound between the layers of wire, with a layer of leatheroid about 0.015in. thick between the primary and secondary windings. About ¼lb. of 24 s.w.g. and 1lb. of 29 s.w.g. should suffice. Adjacent layers of stampings should be reversed when the core is assembled, so that the joints in one layer are covered by the next layer.

Chemical Barometer

COULD you please advise me what are the chemical constituents used to make up the active part of the visual barometers which change colour on the advent of wet or dry weather ?

Can the constituents be so compounded that a certain degree of humidity is indicated ?—R. M. Croshaw (Guildford).

TO make the chemical barometer which you mention, prepare the following solution :—

Cobalt chloride ..	1 part.
Common salt ..	1 part.
Water	3 parts.

Saturate white blotting paper or other absorbent paper with this solution and then hang the paper up to dry. Any solution left over can be used again. It will keep quite indefinitely.

The colour indications of the paper roughly represent the amount of moisture in the atmosphere. Such indications are :—

Rose Red	RAIN.
Pale Red ..	VERY MOIST.
Bluish Red ..	MOIST.
Lavender Blue ..	DRIER.
Blue	DRY.

You will see, therefore, that the device is not, strictly speaking, a barometer. It is, rather, a simple type of hygrometer, or atmospheric moisture measurer. The device, therefore, gives a direct indication of humidity changes, but, of course, you must not expect too much from it.

Telescope Mirror

I AM interested in your articles on making a reflecting telescope, but understand that silver on glass speculum does not last long, although the greatest care is taken.

Is it feasible to make speculum of cast iron (or other metal) chromium plated, and would it be as good as a silver-on-glass type ? Or would a stainless steel mirror be more suitable ?—T. H. Williams (Prestatyn).

IT is not feasible to make a successful telescope mirror on a basis of cast iron or, indeed, on any metal, even stainless steel. Glass must be used, since this material can be ground with such an amazing degree of accuracy and it can be so readily silvered. What is more, when the degree of silvering has become ineffective, it can be cleaned off with nitric acid and new silvering applied.

There are, unfortunately, at the present day very few suitable textbooks on the practical side of telescope and mirror construction for amateurs. You might be able to get a copy of a second-hand, out-of-print work on this subject by inquiring of Messrs. Broadhurst, Clarkson & Co., Ltd., Farringdon Road, London, E.C.4.

You can, of course, obtain optical blanks for mirror silvering, and these could be ground to your own requirements, so that you would only have to do the silvering. It is possible that Messrs. Broadhurst, Clarkson & Co., Ltd., address as above, might be able to supply some second-hand material of this type. An inquiry, also, to Messrs. Sir Howard Grubb, Parsons & Co., Ltd., Optical and Telescope Works, Walker Gate, Newcastle-on-Tyne, would also bring you useful information.

Leaking Petrol Tank

I HAVE had some trouble with a small petrol tank in which a slight seepage occurs at the seams.

The loss is very slight, being a trifle worse in cold weather, but I am anxious to get rid of the danger of having petrol drips on the floor of the building.

I have tried painting the tank around the seams, and this provides a temporary remedy, but eventually the petrol dissolves the paint and the leakage again occurs.

In view of this, I feel that if I could obtain a petrol-proof paint which could be brushed on, or any other preparation which would not be dissolved or softened by contact with petrol, I could put the matter right.

I should be very grateful, therefore, if you could tell me the name of any such paint or preparation, and the supplier's address.—Geo. Brown (Worcester).

USE thick and semi-dried shellac varnish (shellac, i.e., dissolved in methylated spirit). Stipple this on to the leaky seam in the tank. Then, when it has dried, sandpaper as much of it away as possible. Repeat the process, but this time allow the layer of varnish to remain without sandpapering. On top of this give one or two coats of any cellulose paint or enamel.

Another way would be to treat the leaky seam with a special hardening Bakelite varnish, which is manufactured by Bakelite, Ltd., 18, Grosvenor Gardens, London, S.W.1. This varnish has to be mixed with a certain quantity of acid "accelerator" before applying, after which it hardens and becomes insoluble within about 24 hours. The treatment would be quite effective, but, on the other hand, you would require so little of the varnish that you would find it rather costly to purchase, say, 1lb. of the material just for this small job.

We would advise you to give the simple shellac method, above described, the first trial. Provided that the gap in the tank seam does not widen in any way, the shellac method should give you satisfaction over a very long period. It would be an advantage, here, if you could work a little red or white lead into the semi-dried shellac varnish which you use for the first treatment of the leaky seam.

Jelly Electrolyte

CAN you please tell me the name of a chemical element that will make the sulphuric acid used in accumulators turn to a jelly ?—G. H. Perry (Wigan).

JELLY electrolyte for an accumulator can be made in the following way :

Dilute sulphuric acid. Specific gravity, 1.250	3 parts (by vol.)
Sodium silicate ("Waterglass") Solution. Specific gravity 1.180	1 part (by vol.)

This results in a colourless fluid which should be charged into the accumulator immediately. After 24 hours it sets to a jelly with a pale blue tinge.

The solution strengths of the acid and the silicate solution must be made up *exactly* according to the specific gravities above given.

The use of these electrolyte jellies is not good practice and is seldom to be recommended. It results in a loss of the accumulator's efficiency, ranging from anything between 30 and 50 per cent.

For making an accumulator cell practically unspillable glass wool is a much better method.

Chatterton's Compound

CAN you inform me as to the formula for a substance called "Chatterton's Compound ?" Can paint be applied to this substance ? —F. Sheehy (Cashel).

CHATTERTON'S Compound is a mixture of resin, Stockholm tar and gutta-percha, and can be prepared by melting together approximately equal parts of these substances. It can be made harder or softer as desired by increasing or decreasing the proportion of resin in it. It cannot be painted over satisfactorily because the tar tends to flux with the paint and to soften and discolour the latter, and, also, to prevent it from drying and hardening properly.

Blackening Brass

CAN you tell me the solution used to blacken brass ?—E. J. (Coventry).

MAKE a solution of 1lb. copper carbonate, 1 quart ammonia hydroxide and 3 quarts water. This solution should be heated to 175 deg. F., and the brass, free from grease, immersed for 30 seconds. The result is a beautiful matt black similar to that obtained by instrument manufacturers.

THE Cyclist
Editor: F. J. CAMM

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Comments of the Month

By F. J. C.

The Use of Crossings

THE Minister of Transport recently announced in the House of Commons that he intended to lay before the House amendments to existing regulations for pedestrians and drivers at road crossings.

He explained that the amendments were based on the recommendations of the Committee on Road Safety and would have the effect of removing certain ambiguities. One of them would prescribe that drivers approaching controlled crossings would, when the signals were in their favour, normally have precedence over pedestrians. On uncontrolled crossings the pedestrians' right to free and uninterrupted passage would be maintained.

The Road Research Laboratory has been asked by the Minister to undertake experiments to determine whether a warning line on the carriage way on the approach side of an uncontrolled crossing would be a useful practical measure to warn drivers to give way to pedestrians already on the crossing, and to warn pedestrians that it might not be safe to cross if a vehicle had passed the line.

The Minister expressed his disagreement with the Committee's suggestion, endorsed by a majority of them, that pedestrians should be encouraged to signal their intention to step on to a crossing.

The Committee's findings have recently been issued and the Minister agrees with most of the recommendations. The report recommends that a pedestrian phase should be introduced in traffic light signals where practicable and advantageous. Where this is not done and pedestrians can readily see the lights, it is suggested that an additional signal face should be provided. The Committee calls for a revision in the regulations and an increase in the penalty for a breach to £5. At present it is £2.

The Committee wants pedestrians encouraged to signal their intention to step on to a crossing. Crossings should be retained at places where it is reasonable and customary for pedestrians to cross, and where the regulations can give a measure of protection. When this cannot be done the remedy should be to provide a subway or bridge or to shift or abolish the crossings.

We are astonished that the Committee has not drawn attention to the great increase in the number of crossings. Some of them are less than 50 yards apart, and they seriously slow down mechanical transport.

Pedestrians should not be encouraged to believe that they may cross the road wherever they choose, and where crossings are provided their use should be made compulsory. Indeed, their failure to use them amounts to contributory negligence.

Revision of the Highway Code

THE new regulations will mean a revision of the Highway Code. There should also be an early revision of public vehicle stopping places, which should be remote from traffic lights and crossings. The Committee recommend that uncontrolled crossings should not normally be provided on unrestricted roads, but where they are advance warning signs should be provided. The majority of crossings, says the Committee, over side roads at uncontrolled junctions should be abolished, and the system of crossing places should be reviewed in the light of past experience, and those which serve little purpose should be removed. Consideration of the need for control of pedestrian crossings at or near crossing places should be deferred until the department has carried out experiments in relation to the segregation of pedestrians.

Additional paragraphs in the Highway Code are recommended as follows:

To Pedestrians.—On pedestrian crossings where there are no police or traffic signals you have a prior right of way, but do not use it unreasonably. Remember that vehicles cannot pull up suddenly. Give the traffic a chance and cross only when you are satisfied that it is safe to do so.

To Drivers.—Look out for pedestrian crossings. Remember that every pedestrian on a crossing not controlled by police or traffic signals always has the right of way. You must give him free passage. Adjust your speed and course accordingly.

The wanton carelessness of pedestrians is a matter for grave concern. None of the exhortations from the Ministry of Transport, over the radio, and on hoardings, deters them from their carelessness. Quite often they are the cause of accidents in which they themselves are not involved.

For example, in the M.O.T. Road Accidents statistics for February appears the following:—

"The great majority of the 3,100 accidents attributed to the action of pedestrians during the month was caused by carelessness in walking along or crossing the road. Approximately half of these accidents occurred while pedestrians were crossing, and in 673 of these cases the view of the pedestrian was masked by a stationary vehicle. Carelessness in stepping, walking, or running off the footpath or verge into the road accounted for 1,134 accidents."

The statistics show that of a total of 9,126 accidents during the month, no fewer than 8,055 were due to human error. Of 4,013 accidents attributed to drivers, motor cyclists, and pedal cyclists, the biggest single cause was turning right without due care. This was responsible for 247 accidents involving drivers and motor cyclists, and 198 involving pedal cyclists. The next most serious cause was misjudgment of clearance, distance, or speed. This accounted for 389 accidents. Crossing without care at road junctions was the cause of 370 accidents to drivers, motor cyclists and pedal cyclists, skidding accounted for 322, and a further 317 were attributed to overtaking improperly.

Road deaths in Great Britain during February totalled 356 compared with 402 in January (a month of three more days), and 305 in the corresponding month last year. In addition, 10,353 persons were injured, 2,663 seriously, compared with 11,991 and 3,173, respectively in January, and 8,572 and 1,939 in February, 1948. Last year February had 29 days; there was then no standard ration of petrol for motorists.

The new system of road accidents statistics which the Ministry of Transport instituted last January is revealing from month to month the primary causes of road accidents.

World's Road Conference

THE World's Road Conference will meet in August under the aegis of U.N.O. to investigate methods of standardising, in all the countries of its constituent members, road rules and traffic signs. They will consider a system of international road communications so that foreigners, no matter what country they visit, will be able to use the roads under a standard system of signs and signals.

The proposed system will, of course, take into consideration the language difficulty. Cyclists will not welcome a recommendation due for consideration that every bicycle must have a bell and a brake, and that their use be made compulsory under penalty. Nor will they like the recommendation making the use of cycle tracks compulsory.

In certain districts it is suggested that single file should be compulsory, and that riding more than two abreast should be illegal anywhere. Cyclists have successfully opposed in this country previous recommendations of this sort, but they may not be able so successfully to oppose them if a majority of U.N.O. delegates are in favour of them. In fact, we should be bound to adopt such recommendations if we are to avoid the accusations which have been made against Russia.

Record Cycle Sales

RECORD exports by the bicycle and motor cycle industries for March have resulted in a record first quarter for 1949, state the British Cycle and Motor Cycle Manufacturers' and Traders' Union, Ltd., Coventry, in a review issued recently. The total value of machines and components exported during the quarter was £7,841,450, as against £6,087,387 for 1948.

The number of complete bicycles exported in March was 221,710, an increase of 46,192 over February and of 64,367 over March, 1948. Their value was £1,533,910. The number exported during the quarter increased from 418,327 last year to 583,386, mainly to India and Pakistan (173,280 machines as against 24,920 in 1948), Canada (11,876 as against 10,137), Turkey (5,196 as against 2,122) and the Dutch East Indies (36,545 as against 42).

The export of complete motor cycles increased in March to 6,539 as against 5,615 for February and 5,226 for March, 1948. Their value was £598,102. The increase for the quarter was from 17,452 last year to 19,715, mainly to India (from 502 to 1,620), Australia (4,403 to 6,291), Canada (463 to 628), Dutch East Indies (125 to 1,124) and the Argentine (237 to 2,465).

Deerhurst, Glos.

One of the finest examples of Saxon building remaining in England today. The lovely church of St. Mary. A treasure of the interior is the rare decorated stone font, dating from the 9th century. The church lies close by the R. Severn and can be approached by the river from Tewkesbury.

GORDON RANDALL

Paragrams.

A Convert!

A NEWSPAPER advertisement the other day offered a motor-cycling coat in exchange for a cycling cape and leggings. Another willing convert to the fold—or has petrol rationing proved too much for him?

Fashion Note!

A PARISIAN fashion designer, Pierre Balmain, has created what is described as being the latest fashion for lady cyclists. The technical description is "cycling knickers" and they are described as being very full on the hips and tapering above the calves, where they fit tightly. A plain white blouse must be worn with these articles, and the designer suggests that, to be completely up to date, the rider must have a saddle cover and matching saddle-bags in the same material as the cycling knickers. Mrs. Bloomer's invention may not have been quite so gay as Pierre Balmain's idea, but there does not seem much possibility of shorts going out of fashion just yet.

Roads on Shelves

A NEW half-mile stretch of roadway leading to Brooklyn Docks, New York, has been built on three shelves. There is one road for the traffic to and from the docks, and another road for pedestrians only. Should a motorist run over the edge of his shelf and drop on to the road below it is just too bad for all concerned.

Stand Clear of the Gates

THERE were even more bitter curses at level crossings in Grimsby the other day than there usually are, during a gale which swept the town and reached 60 or 70 miles an hour. Many complaints have been made about the gates, which usually flap feebly to and fro when opened or closed—no doubt due to the senility of the mechanism controlling them; but on that day railway workers had to be stationed at each gate in order to close them properly. Even at ordinary times it is not unknown for one of the gates to make a vicious dart at some unwary cyclist just when the other gates have closed.

Streamlined Cycle Motor

THE latest type of motor designed for attachment to an ordinary cycle to be produced in America is a very streamlined affair. The engine is mainly built of aluminium and weighs less than 15lb. It fits over the rear wheel, which it drives through a roller and free-running clutch, and is contained in a streamlined cover. Speeds up to almost 30 miles an hour are claimed and the makers say that tyre wear is kept down to the minimum by the special clutch. There are two controls, consisting of the clutch lever on the frame, and the accelerator lever on the handlebars.

Watch Your Bike

ACCORDING to police statements it appears very probable that gangs of cycle thieves, who may use lorries to take away their plunder, are working in the Midlands, and they take a very keen interest in the latest and more expensive models. They kept the Loughborough (Leics) police busy during 1948, when 178 cycles valued altogether at approximately £1,750 were stolen from the streets of the town. Only 98 machines were recovered and most of these were found abandoned. During the first two months of this year about 25 machines were stolen, valued at over £300. Incidentally, the police are often asked to trace a missing cycle when the owner, who has probably had it for several years, can only give a very sketchy description of it and rarely knows the number.

Enlarged Club Magazine

SO successful was the first duplicated issue of "The Last Mile," the new club magazine of the Falcon Road Club, Loughborough, that the club has now launched out into real print with an 18-page magazine. As time goes on it is hoped that the magazine will be a regular part of the Falcon Club's activities.

Doncaster's New Bridge

WORK is due to start this year on a £200,000 project involving the construction of a new three-span bridge which will replace the Mill Bridge on the North Road through Doncaster. So that traffic is not held up, the first half of the new bridge will be built for use by traffic before the old bridge is demolished, and then the remainder of the bridge will be finished. In connection with this project a general road-widening scheme is planned to give a smoother flow of traffic. During the 1947 floods the water rose to the parapet of the existing bridge and traffic was held up and at one time it was thought possible that the river might do the demolition job itself.

Record Event

THE record Easter weather may have been partly responsible for the considerable success of the ninth annual open 25-mile time trial held by the St. Neots and District Cycling Club during the Easter week-end. At any rate, there were 144 entries and the maximum of 120 riders were accepted. The winner was Dave Keeler, of Letchworth, prominent member of the Vegetarian Cycling and Athletic Club. Starting from scratch, he covered the first half of the course in 30 mins. 50 secs. and finished in 1 hr. 13 secs. He beat the record for the event by 2¼ minutes. Other riders also improved on previous times for this event.

Crumbling Bunyan Relic

THE ancient Moot Hall, at Elstow, Bedfordshire, which was old in the days when the celebrated John Bunyan lived at Elstow, is gradually crumbling, and unless funds can be obtained by public subscription for its repair it is unlikely that it can be saved, as the Ministry of Works are unable to take over the building as an ancient monument. The Moot Hall, which in its day held the same place in village life as the modern village hall, is a fine example of fifteenth-century domestic architecture, but to-day it is used as a store by the Elstow Produce Association. The owner of the building, Major Simon Whitbread, has done some repairs, but it is estimated that to put the roof in order alone will cost about £3,000.

Sports Organiser Dies

THE death has occurred at the age of 80 of Mr. William Henry Tomlinson, of The Park, Woodlands, Doncaster, who was one of the best known organisers of cycling and athletic events in the North of England. For many years he organised sporting events at Brodsworth, where he worked as a miner before he retired, and many well-known cyclists, including Reg. Harris, went to Brodsworth Sports at his invitation.

Contempt of Court!

CAISTOR magistrates could not help a mild chuckle when they heard the story of how the village constable in the North Lincolnshire village of Limber came to lose his bicycle. The constable explained that he pulled up a lorry and told the driver he suspected him of stealing a headlamp from a parked car. He put his cycle in the back of the lorry and was just about to climb into the cab with the driver when away went lorry and bicycle, leaving the policeman stranded. Two days later the constable caught up with the lorry driver at Whitley Bay and finished his little talk—but he didn't walk all the way. This was the constable's last case as he has now retired.

Hard-riding Fenmen

RIDERS from nine Fenland clubs took part in the annual Fenland R.R.A. Longmarkers 25-mile time trial, and there was a large entry. During previous events Fenland Clarion riders have been well to the fore, but this year the Wisbech Wheelers put up a fine show with riders in the first, second, third and fifth places. The winner was W. Carter, with a time of 1 hr. 8 mins. 55 secs. The first of the Fenland Clarion riders to finish the course was Harry Bone, who came fourth with a time of 1 hr. 11 mins. 15 secs.

Ghost?

A LEICESTERSHIRE business man living at Hinckley claims to have seen a weird headless and legless figure, dressed in khaki, going along the road in the Three Pots locality not far from Hinckley. A ghostly coach-and-four is supposed to drive along Watling Street from time to time, and Dick Turpin on Black Bess is also said to have a liking for the district, but this latest figure is a new one on the local inhabitants. It was quite dark at the time, and the figure is said to have resembled two sacks joined together and moving slowly along the road. No explanation of the figure's appearance has been found, beyond the fact that a tramp carrying what looked like his bedding on his back has been seen in the district.

One Jolly Pedestrian

SKEGNESS COUNCIL have decided to have the town's "trademark," the jolly fisherman, stencilled on the pavement at all the pedestrian crossings in the town. It is hoped that the jolly fisherman does not have the opposite effect to the one intended, and make pedestrians look at him and then step off the pavement without looking where they are going.

Collector of Old Bikes

MR. A. C. MUNDY, of Taverners Road Peterborough, a keen member of Peterborough Cycling Club and also the proprietor of a cycle shop in the city, is a keen collector of old cycles. He has, among other models, an ancient tricycle, an American sports cycle between 50 and 60 years old, and a couple of penny-farthings; not forgetting a specimen of that strange-looking machine, the Dursley-Pedersen. Not only does Mr. Mundy collect old machines, but he keeps them in good order and rides them sometimes. Once he did an 80-mile club run on one of his penny-farthings, which he learned to ride with much expenditure of blood, tears and sweat; particularly sweat.

In Remembrance

THE Broad Oak Road Club, Derby, held their annual "remembrance" track meeting on their concrete track at Osmaston Park Road, Derby, on Good Friday, in memory of those members of the club who died while on active service in the last war. Riders from all parts of the country took part, and the meeting was well supported.

Better Than American

RIDERS from Nottingham, Grantham, Lincoln, Oakham and Melton Mowbray gathered at the Colles Hall, Melton Mowbray, in good numbers when a prominent American cyclist, 22-year-old Sidney B. Zwick, gave a description of a lengthy cycle-and-train tour which he made through the Western and South-western portions of the United States. Mr. Zwick, who is now holidaying in England, referred to the development of cycle touring in America, and said that cycling facilities here are much better than in the States; particularly the touring organisation. Cyclists are apt to be ignored in America, where the accent is all on the car. The history and work of the League of American Wheelmen were also described by Mr. Zwick.

Too Much Excitement?

A LEICESTERSHIRE cyclist who went the other day to collect a bantam he had bought was presented by the bantam with an egg while it was on its way home in the cycle bag. Later that same evening two more eggs came to swell the rations.

Just Beginners

WHEN five bicycles were reported missing, Grimsby police started their investigations and soon caught the offenders, an 11-year-old boy and his 8-year-old brother. A constable saw the boys with a bicycle which did not appear to belong to them and after telling various different stories they eventually admitted stealing it and when they appeared at Grimsby Juvenile Court they asked for the theft of four other machines to be taken into consideration. The 11-year-old had previously been before the court on a charge of breaking and entering and had been bound over. The magistrates remanded the boys for three weeks so that further inquiries could be made.

In Support

MEMBERS of Barton Wheelers took part in the antiques section of the North Lincolnshire exhibition held in April and rode an assortment of weird and wonderful machines. A tricycle, of no light weight, seemed to be the most reliable. Then there was one of the original boneshakers, with solid tyres and pedals on the front wheel; a penny-farthing and a smaller edition of the penny-farthing which had a double chain drive from pedals below the front axle to the front wheel. There was more than a little toil and sweat.

Around the Wheelworld

By ICARUS

Learning a Trade

IT is a strange thing that boys are not attracted to the craft of cycle building and repairing as they are to general engineering and other specialised branches of engineering, such as automobile and aircraft. Perhaps that explains why we have so few competent cycle repairers.

The Cycle Engineers Institute, which later became the Institution of Automobile Engineers, did a great deal in the early part of the present century to make cycle engineering a recognised industry. It produced standards for screw threads, cotters, lugs, wheels, spokes, cranks, etc., but it failed, and became absorbed by the rapidly developing motor-car industry.

Everyone to-day prefers to sell goods rather than make them, and that is why I suppose there is a shortage of skilled labour. I therefore applaud the new apprentice scheme introduced by Raleigh Industries Ltd., of Nottingham, the object of which is to train young men in that branch of engineering or other trades for which they show particular aptitude. There are many trades open to boys, ranging from toolmakers to draughtsmen, and under the scheme selected candidates will be trained during a period of from four to five years in a selected trade.

The company has appointed a training officer who will supervise the apprentices' syllabus and keep the youths' parents advised of their progress. Candidates will undergo a probationary period of six months, at the end of which, if their reports are satisfactory, they will be interviewed by the apprenticeship selection committee. Those selected will be required to enter into an apprenticeship agreement through their parents, to which they and the company will be party. Premiums will not be required, and apprentices will be paid the day rate of wages, increasing with age, and will work the normal number of hours in accordance with the Factory Act.

S.R.R.A. Jubilee

THE photograph on this page shows the members and guests at the S.R.R.A. Jubilee Dinner at the Windsor Castle Restaurant early this year. In the picture you will see President J. Dudley Daymond, E. Coles-Webb, H. H. England, F. J. Camm, Sandy Holdsworth, Frank and Monty Southall, and many other cycling celebrities. The S.R.R.A. was born when safety cycling was born, and it has carried the torch through with energy and enthusiasm, as it continues to do to-day. Many famous cyclists have been on its membership roll and Daymond himself was one of the earliest secretaries, having been a member for 50 years. Daymond, who is an R.R.A. timekeeper, has done an enormous amount of voluntary work for cycling and was a member of the Bath Road Cycling Club, now defunct as an unlimited club, until, with many others of the older members including the only surviving founder member, W. G. James, he resigned from it owing to the dictatorial attitude of some of the club's officials.

The S.R.R.A. Jubilee dinner at the Windsor Castle Restaurant.

Clock-type Speedometer

I LIKE to keep a record of my two-wheeled journeyings, and for many years I used one of those small and very efficient devices which was secured to the front wheel spindle so that a trigger fitted to the spoke could engage with a star wheel once every revolution. Although these devices were satisfactory, they have certain disadvantages. They cannot easily be read whilst riding the bicycle, in wet weather they become smothered in mud, and they are not in a protected position.

I have now fitted one of the Smith's clock-type speedometers, which you see in the photograph. By means of this instrument the club cyclist will be able to measure the benefit obtained with different gear ratios and other modifications. This combined speedometer and mileage recorder has a 2½in. dial with chromium plated rim, the case and fittings being finished in hard-wearing black enamel. Various driving gears are available for different front wheel sizes. The normal drive is taken from the right-hand side of the wheel, but accessories for left-hand side drive can be supplied for cases where brake-drum, hub dynamo, etc., are already fitted on the right.

"Two-on-a-tandem"

I AM anxious to obtain a copy of "Two-on-a-tandem," by Charles James, which was published by Chapman and Hall in the 1890s. The same author wrote a full-length novel entitled "At the Sign of the Ostrich," laying his plot around the old Ostrich at Colnbrook, which dates from 1106. If any reader has a copy of "Two-on-a-Tandem" for sale I shall be glad if he will communicate with me.

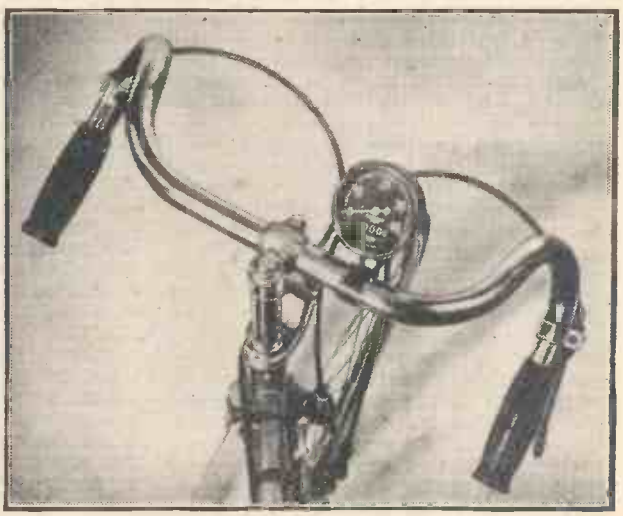
A Cycling Library

I THINK I must have as complete a library of cycling books as anyone in the country, if not in the world. It was a colleague of mine, R. L. Jefferson, who first started me off in the hobby of collecting cycling books. There is hardly a well-known cycling book dating from 1860 which I do not possess. I have many of the bound volumes of early cycling journals, and every volume from No. 1 to date of "Bicycling News," which, when it existed as a separate journal, was the oldest cycling periodical in the world, being founded in 1876. It was on that journal that the late Lord Northcliffe served his apprenticeship to journalism. It had several famous editors, and contributors included Lacy Hillier, F. T. Bidlake, and A. J. Wilson, founder of the R.R.A.

I have volumes of the "Rambler," "Wheeling," "Wheel World," the bound volumes of "English Mechanics" for the early years of the 19th century, wherein was dealt with the early hobby horses and MacMillans and Dalziell's rear-driven wooden-rim iron-tyred bicycles. I have old maps and road books including Ogilvies, interesting old catalogues, old prints.

I have the Badminton books on cycling, Griffin's famous works on the history of the bicycle, H. O. Duncan's curious heterogeny entitled "The World on Wheels," old club handbooks and early photographs.

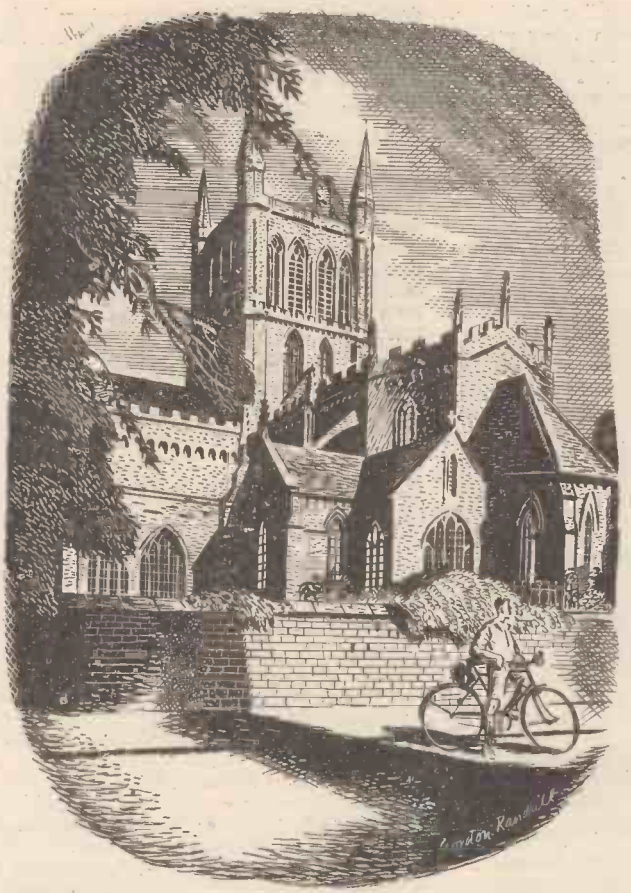
Such a collection is a never-ending source of interest and pleasure, and I recommend my readers when on tour to visit second-hand bookshops with the object of starting such a collection.



Smith's Clock-type speedometer.

Wayside Thoughts

By F. J. URRY



Pershore, Worcestershire. The beautiful Abbey Church with its fourteenth-century tower.

Putting It Over

I HAVE recently been told by a corresponding friend to whom I sent a specification for a bicycle that my opinions too closely follow the line of the racing man. But what is a lightweight touring machine but an adaptation of racing practice put into comfortable cycling service? The differences are tyre sizes, saddles, bars and, the most important of all to me, angles. In the latter matter I'm sure we have become too upright in frame design for use at modest speeds, with the result that such machines are uneasy to steer and therefore tiring. Personally, I like 68 deg. with a good fork rake too, and then the bicycle steers itself and is as comfortable at the end as at the beginning of the day. But 70 deg. both head and seat tubes is not too difficult, provided the fork rake is right, and since you cannot always get a lightweight fitting to suit 68 deg. angles, I recommend that design when the other is not obtainable for the use of fellows like me who want to ride as easily as possible since they can no longer ride fast. With 1⅜ x 26 open-sided tyres on light rims, decently wide guards, a roomy saddle and a slightly dropped bar, the whole outfit does not even look racy in these days, although it may have done five and twenty years ago. Certainly no one would look at one of my machines as in any degree connected with the swift sport; and yet they are all adaptations of the best practice in the racing world with the single exception of the gear ratios, which are on the very low side compared with the popular notion. But, as I said before, I can no longer ride fast because it hurts, so I use my smaller gears to ride with ease and comfort and, I hope, a certain amount of grace. It is difficult to break away from the roadster tradition that only the type of bicycle to which that name applies is the right choice for the elderly.

I Think So

YES, the old idea dies hard, and I'm not quite sure the industry want it to die because the upright bar is easy to make and hang thereon brake fittings. But of this I am sure, it makes for bad cycling because in nine cases out of ten a correct riding position cannot be obtained. Notice the people on the road and you will realise how true this is. They either sit bolt upright, and thereby waste effort, or with arms akimbo roll their bodies from side to side in climbing a slope, and invariably grasp the bar on the flats *because that is a lower position than the grips.* Which suggests the power behind my reasoning that to be comfortable one must be seated correctly and in a position to give a share of the work to every muscle in the body without overburdening any. We differ in make and shape, but the good general rule for easy riding is an equal division of the weight between saddle, bar and pedals. And that is not generally possible to obtain with the upright bar, wherefore a flat one, or one slightly dropped, is one of the necessities of comfortable cycling. It is a pity, in my view, that so many juvenile machines are produced with the upright bar, for it is a bad beginning to positional cycling. The reason is probably because parents are ignorant of the pastime and do not want their kiddies bending over the bar. They will bend all right whatever bar is fitted, but the difference between doing the job gracefully or otherwise will certainly depend on this fitment. By this I do not advocate deeply dropped bars, far from it, buf I do believe in giving the youngsters the opportunity of becoming efficient and practised cyclists early in life. The knowledge thus gained is valuable, for although they may go to what we older folk may call extremes later on when speed attracts them, they will at least have learned the proper application of power to pedal by that unconscious process of early correct positioning. And most important of all, when an individual rides well and easily the process of cycling becomes more of a game than a mere method of travel, and the player becomes an expert. The chance, therefore, of a gay life awheel is enhanced for such, and because I have found it so good and healthy for sixty years I just want other people to join in and accept the delightful grace of the game.

The Old Cry

WHAT makes me intensely annoyed is to hear people whose cycling experience has been confined to a few suburban miles middle-footing it on a machine completely unsuitable to them, denouncing the pastime as hard work. Their ignorance is colossal, their cheek immense. It is like me denouncing motoring after an uncomfortable ride on a bus. Yet many of these critics are believed because some folk want to believe them as a kind of cloak for their own lack of activity. The excuses for non-cycling start with that phrase "hard work" and go right through the whole gamut of "Why should I?" up to the point of sheer ostentation: "It isn't done, you know, in our positions." The annoying thing is that so few such folk realise what they are missing, the individual freedom and glory of possession by way of the self-contained travel unit. In my opinion it is better to ride than drive, to be alive than dormant, to keep what you may of youth than allow it to languish in idleness, and to slide silently through the delight of the countryside than to urge a speed that severely limits observation. You can teach the novice how to ride with ease and grace, you can take him to the hills, the moors and the sea, to the wide-flung visions and the glory of the sky, but beyond the muscular tuition, the mental one will, in the main, be one of his own making. You can show him, but you cannot make him love these things, these abstracts of beauty which are half this joy of cycling; but at least you can give him opportunity and guidance. And that is well worth while, for its results often defeat the critic and the cynic, as well as renewing your own faith in a world where values are too often counted materialistically. And at the end of it all there is health, a supple body growing older but still elastic enough at seventy to rise above the years and make a glorious day of it. These, then, are among the things that make me keen for the youngster to start right, for the racing boy to develop into a comfortable cyclist, and so enlighten his middle-age with the glory of loveliness, and his elder years with the quiet joy of a self-satisfying pastime.

Some Little Things

WHEN you come to the time in life when you cannot read a map without the aid of spectacles you either leave the job to the other fellow and enjoy giving him the critical end of your tongue if he goes wrong, or do as I do, carry a small magnifying glass and refuse to be led astray—or at any rate lead yourself into that condition. I get far too much interest out of my maps to lightly give up the joy of seeing where the road runs before I take to it, and my little spy glass is a decided help.

During the late winter there were few occasions when anything more protective than a light pair of gloves was necessary, and by that I am reminded that I always carry a pair in the bag, even in mid-summer, for I've known days, and particularly the eventime, when the proper use of them was grateful and comforting. I once came over Carter Bar from the north on a July day and got rather warm climbing the long slope to the summit. Then followed the run down Redesdale, and in half an hour I was chilled stiff and would have given a fancy price for gloves. That lesson was duly learned.

I now possess a pair of the new Dunlop alloy rims in 1¾in. size, and am waiting to have a bicycle fitted to them. They look to me very good and seem harder than most of the alloys, for there is a resilience about them usually foreign to this type of fellow. Anyhow, we shall see in due course.

At long last I understand that battery lamp users are going to be given the opportunity of buying a really first-class job—and about time, too. I have seen the new article which is light in weight, rubber mounted, and by its design spreads the glow.

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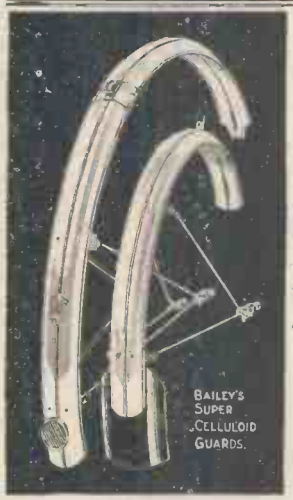

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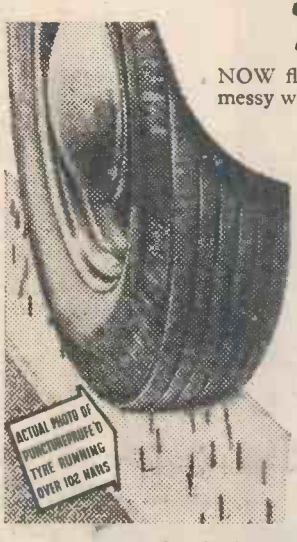

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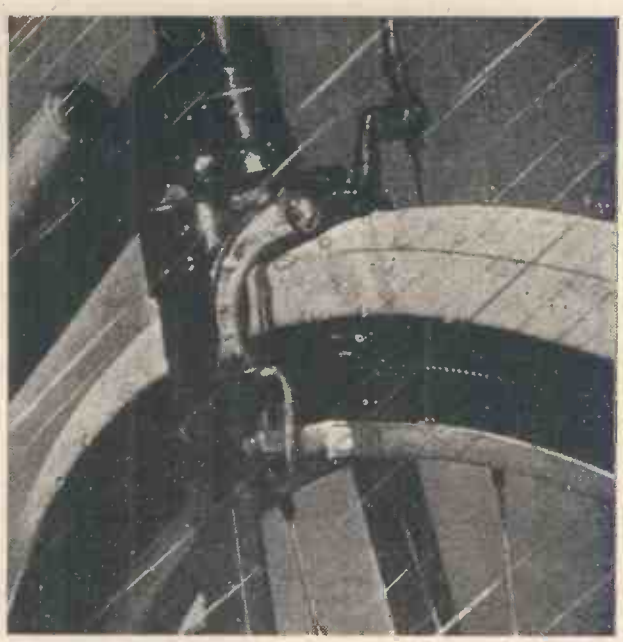

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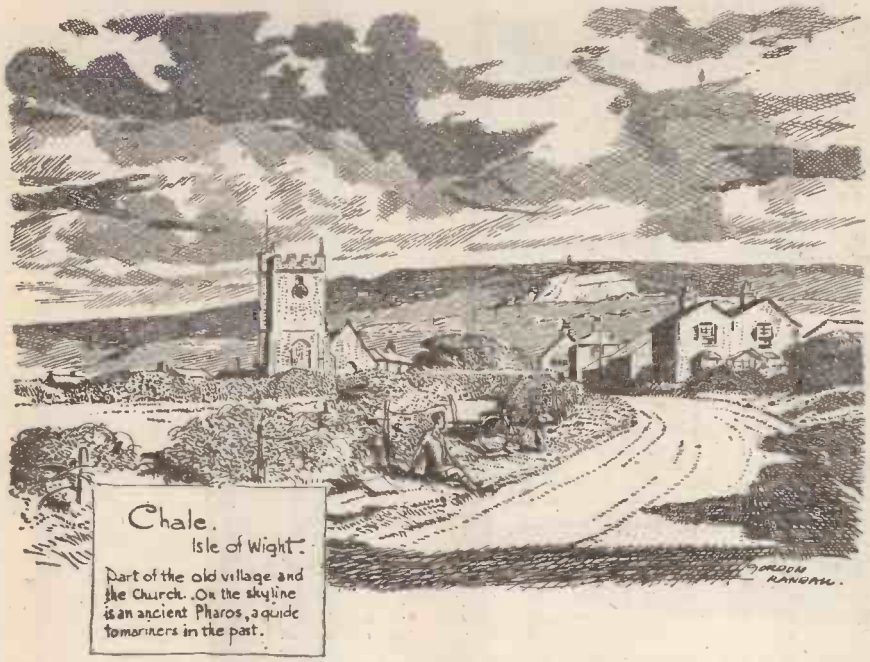
CYCLORAMA

By H. W. ELEY



Chale. Isle of Wight.
Part of the old village and the Church. On the skyline is an ancient Pharos, a guide to mariners in the past.

The Foot and the Pedal

TAKE a good look at average cyclists on the road—the "potterers"—and you will be amazed at the large number who have evidently never grasped the importance of using the pedals correctly! With many, there is no "coaxing" of the pedals, no proper rotary action of the feet . . . and consequently, of course, there is lack of power, lack of drive, and less comfort. There is a right and a wrong way to do almost everything, and this matter of correct use of the feet in connection with the pedals is vital if the best is to be got out of cycling. The feet should very nearly maintain a true circle, the ankle joints enabling the ball of the foot to apply the pressure as far round the circle as possible. Old-timers, skilled in all the arts of cycling, will know what I am getting at . . . that essential "clawing" of the pedals which means so much. To the tyro, I would say . . . get a little instruction from some expert in the game. It is more than worth while.

"Roses Round the Door"

IT is traditional that June is the month of roses, but my own experience as a rosarian has always been that the most perfect blooms come much later in the season. Still, when one rides abroad in lovely June it is possible to see roses embowering cottage doors, and to see fine shows in gardens. The English rose! It is the incomparable flower, and in my tours in the countryside I have talked with many keen rose growers . . . many of them country parsons, who seem particularly keen on rose culture. I suppose they have the necessary time to attend to pruning and all the other cares which roses need. An aged vicar I met in a Surrey village recently showed me, with pride, his Lady Inchiquin bush, his Mabel Morse, his Shot Silk, and many other varieties. And how tenderly he cared for them! Yes, I welcome June if only for her roses. . . .

He's Deserted the Bus and the Tube!

HE was quite an old gentleman, keen-eyed, attired suitably for "the City" . . . and I met him as he dismounted from his cycle outside some business premises not far from High Holborn. I had met him in the long ago and recognised him again . . . and, of course, I at once asked him about the bike! And this good old veteran of the City informed me that, sick and tired of crowded tube trains and of endless waits for buses, he had taken to using the cycle as a means of getting to his office. I admired this wise old gentleman and the clean and shining bike which he rode. A cyclist of over forty years' standing, he had solved a problem which must surely worry thousands of Londoners. That daily struggle for the bus; that uncomfortable, stuffy ride in a tube train . . . *must* they be endured? I sometimes feel, when I have been "decanted" from a tube carriage with all the rough and tumble of a rugger scrum, that there must be a better way of journeying from home to business. And I believe that my old gentleman has found the way! And . . . he told me he felt "tons better" for the exercise!

Beside the Silvery Severn

WORCESTERSHIRE is a good county, as I have always known. Its 716 square miles contain some of the best scenery in England. A fair land of hop gardens, of orchards, of pleasant towns like Tewkesbury and Evesham; of the glories of the Malvern Hills; a county with ancient Roman links at Droitwich . . . for the wise Romans knew its salt, and worked salt-mines there in the dim days when Roman legions marched across our land, and long, straight roads were made by men who had a genius unsurpassed for such work. I write of Worcestershire because I have just received an invitation to cycle there in the summer. Maybe I shall accept. It would be good to see Broadway again, though I deplore the way in which this delectable place has been commercialised . . . and I do not think that gargantuan coaches blend with the historic atmosphere of the place. But the Lygon Arms still stands . . . one of the finest and most stately hostelries in the land. At one time Broadway was a country retreat for the Monks of Pershore. In the Lygon Arms you are shown the "Cromwell Room," where the Great Protector is reputed to have slept on the night preceding the Batile of Worcester, in the year 1651. And if I go to Worcestershire, perhaps I shall visit Evesham, and that rich vale of orchards, where the plums grow in such profusion. But other areas lure me, too, and it is possible that my summer tour will be in quiet Suffolk, in the Constable country by the Stour. . . .

The Club Takes the Road

AS I write, from my window I can see a happy band of club members setting off for their trip into the country. Laughter . . . happy faces . . . gleaming bikes . . . all the old-time enthusiasm for the open road which makes cycling the best of all games Happy wheeling!

Charlcote, Warwickshire. The guest house of Charlcote, built by Sir Thomas Lucy. It was from the grounds of this house that Shakespeare is said to have stolen a deer. This very historic building now belongs to the National Trust, and is open to the public. Of special note is the fine detached Gatehouse, and the old Brewing House. Deer, and a fine breed of Spanish sheep roam the parkland.

My Point of View

By "WAYFARER"

Winchester Cathedral and the Deanery. The Cathedral is the longest in England—526 feet. Dating from 1079, it is built on the site of a Saxon church.

Trailing His Coat

THE author of a new topographical book about Gloucestershire speaks of Lower Slaughter as "absolutely the loveliest village in all England." He is entitled to his opinion, of course, but it were better to express this without quite so much dogmatism and finality. The author's action is a case of trailing his coat (for somebody to tread on) with a vengeance. It suggests, too, that he has seen all the villages in England, which I do not suppose is a fact.

Alien to Fact

THE Minister of Health is reported to have stated that the political party to which he belongs is "like a man on a bicycle: if he stops, he will fall." My comment—made without the slightest political interest—is that such a statement is not of necessity in accordance with facts. The wise cyclist so arranges matters that he can, and does, stop without falling. He puts one foot to the ground—perhaps both feet—and easily maintains an upright position. I have done this thousands of times.

(*But if the political party has both feet planted firmly in the clouds, what then?—Ed.*)

Indispensable

ONE of the more important of our daily newspapers announces that subscribers living in the principal districts of Paris can receive their copies early on the morning of publication, under normal flying conditions. The advertised subscription rate "includes the cost of the special cyclist delivery service." This is yet another instance of the indispensability of the bicycle. A mighty aeroplane carries the newspapers from London to Paris, and then the aid of the little old bicycle—the "humble" bicycle—is invoked to complete the journey! Hurrah for the far-from-humble bike!

Dodoesque

THE bicycle-step has latterly come in for some unexpected—and undeserved—publicity. Having a bad memory for the more important dates in history I cannot say how many years it is since I possessed a bicycle with a step, nor am I able to say what factor it was that started the movement towards stepless bicycles. It may have been the introduction of the gospel instinct in the slogan "as little bicycle as possible," for which I must bear the brunt of the blame (if any). It may have been the introduction of the first (and best) quick release device, consisting of a skewer through the back wheel hub—long since superseded on questions of cost. Alternatively, the rather liberal use of wing-nuts may have given the bicycle-step notice to quit. Whatever the prime factor in this movement of abolition, the step is now almost as extinct as the dodo.

Yet I suppose that the step still has its uses in the case of cyclists even more old-fashioned than myself. With the perched-up saddle which, fortunately, is no longer much in vogue, it is no doubt necessary for the cyclist to have some means of "going aloft" and afterwards returning to Mother Earth, and the step is probably his one and only solution of an unnecessary problem.

The worthy folks who have been discussing this dodoesque question seem to be under the impression that there are only two ways of mounting a bicycle—the step and the pedal. The latter method always appears to me to be brutal, imposing a heavy strain on a vital part of the bicycle—though I am quite prepared to believe that statistics prove my view to be without justification. Anyhow, the third mounting method, and the one I practically always use, is to throw my leg over the saddle and then apply pressure to the right-hand pedal, and there you are. There is a variant of this method which is perhaps worthy of note. I sometimes mount (and dismount) by swinging my leg over the handlebar. This plan is very useful for the front rider of a tandem, for, in the dismounting process, at any rate, it saves him from committing a brutal assault on his partner, if still in the saddle!

Effortless Ease

ALWAYS attracted by the most commonplace—and most romantic—travel unit to be seen on the public highway, I find it interesting to observe the effortless ease with which the experienced cyclist progresses. One knows, of course, that there come occasions when Rude Boreas is brutal to us and when Jupiter Pluvius makes things as uncomfortable as possible. But take any ordinary occasion when the weather is fair, and note how the cyclist appears to glide along. It is always a pleasant sight, even to one who has been cluttering up the roads for over half a century, and who has looked upon hundreds of thousands of brother cyclists. The lone rider makes a provocative picture; so does the tandem pair, pedalling and steering perfectly and going ahead at a fine "bat"; so also does the club group, riding in double file. All these people seem to "glide through the air with the greatest of ease" like the famous young man on the flying trapeze. Noiseless and smooth-running, these cyclists quickly pass beyond one's ken, leaving one to wonder whither they are going—what they will see—what experiences and small adventures will fall to their lot—where they will stop for a meal or put up for the night—and when they will return. Sometimes it is a mouth-watering job to watch one's fellow-riders heading for the countryside—in search of that freedom which the bicycle can be relied upon to provide.

Dispassionate Consideration

LET us consider, quite dispassionately, as it is now possible to do (though at one time much heat—to which I contributed at least my quota!—was engendered) questions relating to the lighting of road vehicles, including cycles. My own position in relation to the rear-lighting of cycles is unaltered. I am still uncompromisingly hostile: I still feel that rear lights are totally unnecessary: I still hold that they are wrong in principle. I assert—and when I say this in the presence of motorists, who profess to think that we cyclists are so much safer now that we have our red rearward ornamentation, I am looked at with amazement—that I carry a rear light only because the law makes it necessary, and that, if there were any latitude in the matter, I would scrap my back lamp to-morrow—or, more probably, to-night! But I am prepared to admit that rear lights on cycles are not the great nuisance we cyclists expected them to be, and I shall now go farther than that and admit, for the sake of argument, that, if rear lights are of real value to road-users as a whole, we must go on wearing them, in that spirit of co-operation without which we inhabitants of this so-called vale of tears would have a very uncomfortable time.

A Point of Law

TO that statement I would add this: that if the value of rear lights is deliberately overrated, and if drivers of motor vehicles relax their vigilance because of this added illumination—in other words, if they do not continue to rely on their own forward lighting and to remember the possibility of encountering pedestrians, straying animals, fallen trees, and other unlighted obstructions—then the rear lighting system can become a positive menace. Personally, I should be quite happy if the rear lighting of all vehicles were abolished. I would then, as now, light my own way and exercise that watchfulness which is so very essential at all times.

Having written the foregoing, let me "put in," as the lawyers say, some brief details of a serious accident which occurred at night a few months ago, and which is still the subject of litigation. With the rights and wrongs of that accident we are not concerned here, but we *are* concerned with the principles of road usage, and that is what I want to discuss. Here are the points brought out in a County Court action: Vehicle "A" was anchored at the roadside, what time the driver dealt with a puncture. The Judge was satisfied that the vehicle was wearing two tail lamps, but did not think they were showing an adequate and proper light; he found that the vehicle was not parallel with the nearside kerb, thus making it more difficult for anyone coming behind to see the tail lights. (Personally, I don't appreciate the relevance of that remark.) As regards Vehicle "B," which crashed into the rear of "A," the Judge thought the speed excessive and the lookout defective, the latter being affected by the driver's failure to drop the blind behind his seat and thus shut out the interior lights of the vehicle. His Honour allocated the blame thus, and I, for one, do not feel disposed to quarrel with the decision: two-thirds to "A" and one-third to "B."

Subject to the observance of certain conditions, this type of accident is avoidable, and it appears to me that the sooner people sit up and take notice, learning the lessons which road casualties teach, then the sooner will the maimings and killings cease. We must act wisely, and must not run risks. We must take obvious precautions to minimise the overrated dangers of night (or day) travel. We must look where we are going. We must play safe. We must travel at a speed which is in keeping with the forward illumination we are providing. We must realise that there are still unlighted obstructions along the road. All these "musts" apply to every type of wheeled road-user. They are not just a counsel of perfection for one class of driver. They are for the man in charge of a loaded lorry and for the man driving his own private car. And—I emphasise this—the "musts" apply to each and every cyclist. We cyclists would be fools if we claimed immunity from a commonsense plan such as the one outlined above. Fortunately, self-interest impels us to "play the game."

Cycling Included

MY recent reference in these columns to the Outward Bound Trust, of Aberdovey, has brought me an appreciative letter from the executive director, who tells me that cycling plays an important part in the Trust's activities at the Sea School, "as the boys do much of their preliminary work in preparation for the big expedition, such as map reading and compass work, on bicycles, which enable them to cover a very much wider area for this purpose than they could possibly do on foot." That, of course, is as it should be.

Hardy Souls

IMMEDIATELY after that snowy Saturday at the beginning of March I heard a girl telling her friend that she had been out rambling, despite the weather conditions. Eighteen had promised to participate in the event, and 16 hardy souls turned up. These folks are apparently as keen as cyclists when it comes to defying unpleasant samples of climate.

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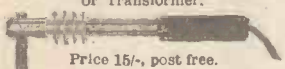

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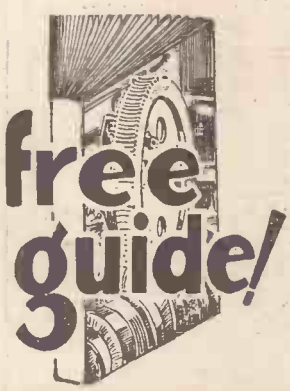

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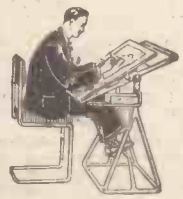

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