PRIZE-WINNING LATHE DESIGN

NEWNES

PRACTICAL MECHANICS

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EDITOR: F. J. CAMM

NOVEMBER 1949

The BRABAZON 1 Takes the Air

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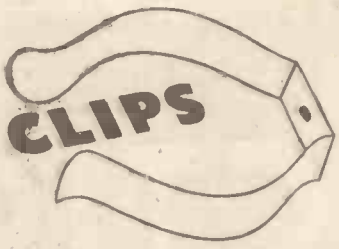
PRINCIPAL CONTENTS

YOU NEED CLIPS



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PRACTICAL MECHANICS

EDITOR F. J. CAMM

NOVEMBER 1949
VOL. XVII. No. 193

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

FAIR COMMENT

By THE EDITOR

Lathe Competition Result

SOME excellent designs were submitted, in connection with our lathe competition, and the winning design, with descriptive notes, is given elsewhere in this issue. Three other designs were of such merit that I have increased the prize list, and the designs submitted by the three runners-up will appear in later issues. The winning design, it will be seen, is not outside the scope of the amateur. Its designer has, of course, departed here and there from orthodox practice to bring the construction within the workshop facilities of the amateur. One or two pieces, perhaps, will have to be placed in skilled hands, especially those parts which need turning.

At Radiolympia

I WAS able to meet very many of my readers during Radiolympia. I enjoy these friendly contacts, for it enables the reader to express his views and make suggestions in a more extended form than is possible by correspondence. As my readers know, I do not lose many opportunities of going amongst them when the opportunity offers. During the year I am called upon to judge competitions, make speeches at annual dinners, present prizes and visit local exhibitions. This involves a great deal of time, but I cheerfully undertake these tasks.

During the recent Battle of Britain week I judged the Model Aircraft Competition at Horley, and I think as a result I have been instrumental in banding together all those lone hands whose individual work collectively made the exhibition. Every exhibitor is a keen reader of this and our associated journals. I hope that the secretaries of the model clubs who are arranging similar events will keep me informed. Where time permits, and providing that the date does not collide with another, I shall be delighted to visit their functions. Where the membership is small it is often useful to combine efforts for the purpose of, say, an exhibition with clubs from surrounding districts. In the early months of this year, when I gave a lecture on watch manufacture to the Stoke-on-Trent Engineering Society they combined with the Coventry and Birmingham Branches of the Institution of Mechanical Engineers. This often saves three visits.

Engineering Data Sheets

EVERY week for at least twenty weeks our companion journal, *Practical Engineering*, is publishing eight engineering data sheets. There will thus be over one hundred and sixty in the complete series, for which a specially embossed and fitted binder has been prepared which is available to all readers at the reduced price of two shillings, including postage. Many readers of this journal will find these tables of great value, for they are hitherto unpublished tables of valuable engineering data and formulæ. *Practical Engineering* is published at fourpence every Friday, but to ensure that you do not miss an issue and thus break the sequence an order for regular delivery should be given to your local newsagents. Remittances for binders should be sent to *Practical Engineering*, George Newnes, Ltd., Post Sales Department, Tower House, Southampton Street, Strand, London, W.C.2.

Salesmanship in America

AN American journal has some unflattering remarks to make about British motor cars and British car salesmanship in America. Here are some extracts:

"Take the case of U.S. sales of British automobiles. From a 1948 peak of more than 2,000 a month and great hopes for the future, English car makers are now selling less than half that many autos in the U.S., and the prospects for the future are dismal.

"Why the sudden slump? Britons themselves blame the over-high price tags they are forced to hang on their cars over here, due to heavy costs and taxes in England, shipping expenses, import duties, and so on.

"No doubt imported British cars are too costly to compete on price alone with our own makes. But high costs aren't entirely responsible. It's obvious that another factor, ignored by our overseas cousins in all published statements, has much to do with the slump. That factor is *just plain bad salesmanship*! . . .

"We believe there is plenty of room in this country for some outside competition in the automobile division. We think that intimate exposure to somebody else's styling notions might help Detroit (and the American public as well) to overcome its unfortunate preoccupation with the upside-down bathtub or cheesebox-on-roller-skate idea of what an automobile should look like. We think the British can give us that kind of healthy competition—and make themselves an honest buck in the bargain. If they really try.

"We don't think the British are ever going to give us a run for our money with their current species of Lydia Languid salesmanship. We'd like to see them start all over again—and do it right this time, by investing a little dough in a really professional campaign to make Americans want to buy British cars."

Storm Location

EVERY day observers in the British Isles "see" thunderstorms a thousand miles or more away. Storms which may be out in the Atlantic or over the Dalmatians are located by direction finders at four stations in the United Kingdom.

Every lightning flash produces radio waves which can be picked up and it is these waves which the stations see on their cathode ray tubes. The direction finder at each station has two receivers, each connected to a loop aerial. One aerial is orientated along the North-South line and the other along the East-West, so that an impulse from a flash is received on the aerials in different strengths, and produces a line on a cathode ray tube accordingly. For instance, if an impulse arrived from a lightning flash at due North from the station, there would be nothing received on the East-West aerial and the line on the tube would be vertical. If it came from due East the line would be horizontal, and so on. The position of the line on the tube is read by eye from a scale round the edge, or it can be photographed on moving film.

The observer at the control station at Dunstable selects a flash on the tube, usually a strong one, and immediately signals to the other three, who are all connected by land line. The flash is still visible on their tubes, because of the afterglow, and the out stations pass in their bearings which are plotted on a chart. Where the bearings intersect is the position of the storm centre.

If the flashes are being photographed a code signal is transmitted from control which lights up a small lamp in each camera and prints a scale on the edge of the film. The film, which carries a record of every flash picked up, is developed, and flashes are selected and identified by means of the scale. Although this takes a little longer it eliminates any possible error and makes certain that bearings are given on an identical flash. The bearings are plotted in the same way on the chart, which is made from a "gnomonic" projection, and on which no correction for the curvature of the earth's surface is necessary.—F.J.C.

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NOTICE TO INTENDING CONTRIBUTORS

THE EDITOR OF PRACTICAL MECHANICS is always pleased to consider manuscripts suitable for publication in the columns of this journal. As a general guide, articles should be about 1,200 words in length, although where the subject warrants it, the article may be extended to 2,000 words. Short articles of 500 to 750 words are also accepted.

To avoid the possibility of overlapping, intending contributors are advised to write in the first instance to the Editor, giving a brief outline of the article they intend to write, and at the same time enclosing details of their qualifications.

MSS. should be typewritten, using one side of the paper only, and double spacing. Preferential consideration will be given to those MSS. which are accompanied by sketches and/or photographs, and these should be properly captioned.

The Editor does not hold himself responsible for the safe custody of manuscripts, but every effort will be made to return unaccepted contributions if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor, PRACTICAL MECHANICS, Tower House, Southampton Street, Strand, W.C.2.

Some Simple Inventions

Including a Few Suggestions for Prospective Inventors

By J. W. TOMLINSON

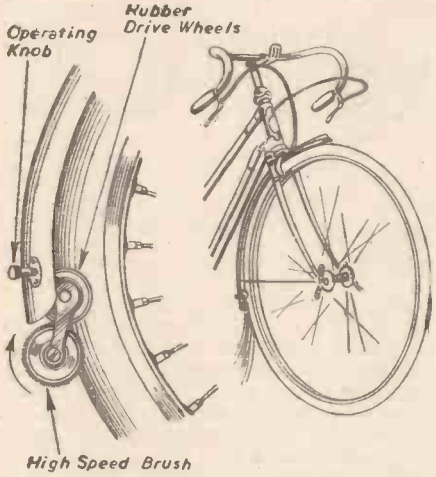

Fig. 1.—Anti-splash device for cycles which might be made to work.

YOU can sometimes hear people say that there is nothing to invent these days, that everything has been invented. Now any wide-awake person knows that this is idle talk; he knows that there are more opportunities for inventors today than ever before. Not only is the field open to the man with academic qualifications, it is open to the ordinary man who thinks of simple ideas, such as new household gadgets and things that are used by everybody every day. It is often these simple ideas that make the money and occasionally turn out to be real fortune makers.

Inventing is more than just thinking, it means action, and this is where many a potential inventor finishes. He thinks out an idea, perhaps on a train journey or maybe when lying in bed, and instead of getting it down on paper he lets it fly out of the window. Getting it down is the first positive step after thinking it out, and the next step is to make a model, either in wood, cardboard, tin, or plaster according to what the idea is.

Provisional Protection

If you think you have something good get it protected right away. The easiest and cheapest way of doing this, although perhaps not the best way, is to go to the nearest G.P.O. and ask for a set of Provisional Patent Forms; these will cost you a pound. Fill them in and send them to the Patent Office. If the idea is accepted it is provisionally covered for twelve months and you can start negotiations with interested parties for the sale of your patent.

Of course, if you are really interested in inventing it will pay you to join the nearest Society of Inventors. And again, if you think your idea is very good, and you have the money, take it to the nearest patent agent, who will draw up a provisional specification costing from about £4 4s., according to the complexity of the idea. This will make it harder for any unscrupulous person to steal your idea. But remember this, the Patent Law in this country as it stands, offers very little protection to the poor inventor. Should any person steal your idea, *you* will have to take action against him, and this may cost thousands of pounds, to protect something which is yours.

This does not affect the large firms so much, who generally carry a large staff of technical experts-supported by a big financial backing. They can fight and protect their ideas, but with the poor inventor, he has to simply watch his invention being stolen. A wise old friend of mine who had spent many years in America, where people are more patent minded, told me one day after I had just taken out a provisional—"The best way with these little ideas is not to bother with a patent at all. Get it on the market, make what you can, then leave it to the sharks."

The small inventor working on his own will mostly be interested in gadgets of a simple nature, leaving the expensive thoughts for the big concerns. Thousands of pounds have been made in the past on these simple things. The man who put the crinkle in hair pins to stop them slipping out made a fortune, also the same is said of the man who invented barbed wire, and we all know of some simple toy that has made a fortune.

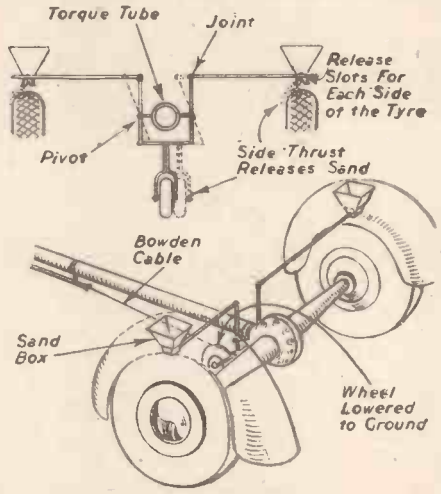

Fig. 2.—Suggested device to stop a skid.

What to Invent

The scope is as wide as civilisation and the inventor can have his pick from any walk of life. Take cycling, for instance; there are several million cyclists in this country, and although the enthusiast does not mind getting wet, there are still millions who would like to remain dry when cycling in the rain. A fortune is waiting for the man who can invent an all-weather cycle, a kind of umbrella cycle, simple and cheap and easy to handle. If the inventor does not want to go this far, a simple idea is needed to prevent trouser legs from getting soiled and splashed from the front wheel. No cyclist objects to putting on a raincoat, but pulling on leggings is a bugbear. Any rider can observe, especially at night time, when the front lamp throws its beam across the spray, that the dirty water is thrown off the front of the wheel and the rider runs into it. If this water which is taken up from the road could be wiped off the tyre the nuisance could be prevented. A suggested idea is shown in Fig 1. The gadget should be made so that it can be instantly thrown in and out of gear, and could be arranged with rubber wheels running on the sides of the tyre which operate a high speed brush or fan. Another annoying thing is a wet saddle, and this can happen in a matter of minutes when the cycle is left in the rain. A concealed roll of plastic fitted to a spring roller, which could be pulled instantly over the saddle and released by just a flick, would be invaluable.

To Prevent Skidding

Hundreds of lives are lost every year through vehicles skidding on greasy and ice bound roads, and there is no satisfactory way of preventing this happening. A line of thought can be taken up from the method employed by the railways, when sand is dropped on the line. In this case it is an easy matter, as the locomotive is on lines and the sand can be dropped with time to spare. With the motorist the vehicle invariably skids sideways, and it all happens in a split second, giving the driver no time to think or press a button. An automatic device which dropped sand only when the wheels went sideways, as in a skid, would be just the thing. This could be operated by a small wheel, which is lowered by bowden cable when travelling over slippery roads. The wheel is attached to a pivoted arm, so that the slightest side thrust caused by the vehicle skidding, operates the trip mechanism which releases the sand. The release could be arranged so that the sand was dropped on the skid side of the wheel, as shown in Fig. 2.

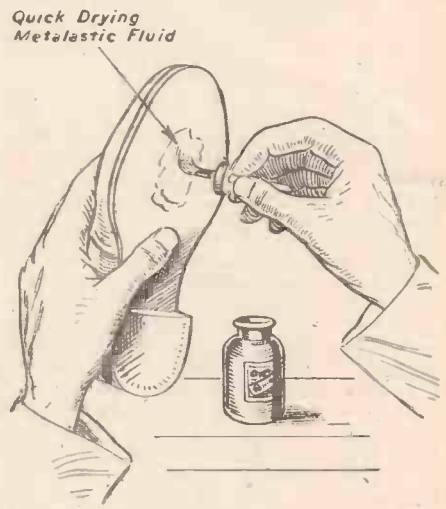

Fig. 3.—Why not an overnight method for making shoes last longer?

Shoe Repairs

Shoes are used by everybody and they are always wearing out. Often when shoes are sent for repair more leather is pulled off by the repairer than is worn off by the user. If

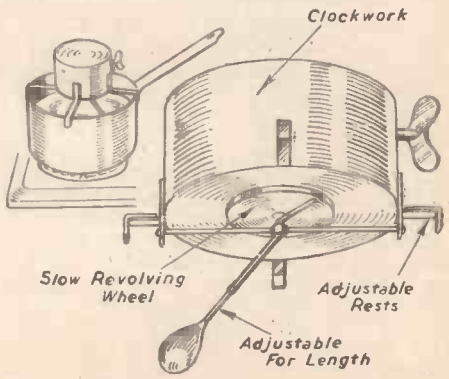

Fig. 4.—Automatic device for stirring jam, etc.

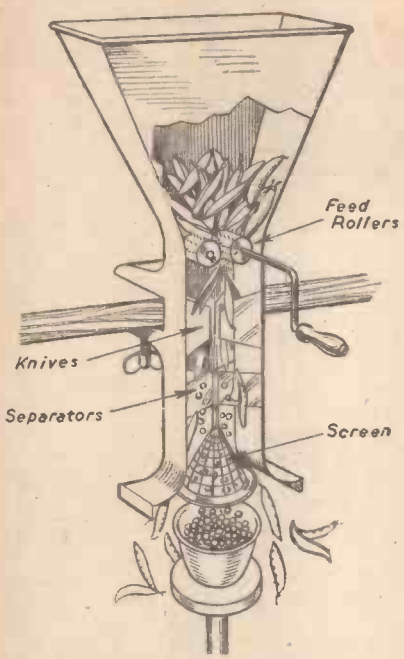

Fig. 5.—A pea sheller. If this could be made to work it would make a lot of money.

someone invented a quick drying metalastic paste, which could be brushed on to the worn part before it is through (Fig. 3), the shoes could be made to last four times as long between repairs. The paste could be made of iron filings mixed with some quick drying synthetic liquid and sold in handy bottles complete with a brush through the cork.

Mechanical Stirrer

There was an appeal in the Press recently from a housewife asking for an automatic stirring device, so that she could get on with the work instead of just standing stirring. A suggested method of approach is shown in Fig. 4. A clockwork unit is fitted to an adjustable stand, so that it can be placed on any sized saucepan. A stirring arm is pivoted by a bar passing through it near the top end, which is connected to the periphery of the drive wheel.

Pea Sheller

One of the biggest headaches for the hotel kitchen staff is the shelling of peas. Devices for doing this have been mentioned in the past, but there does not appear to be any real method. What is needed is a gadget having a hopper for feeding in the peas, these passing between knives which cut the shell and allow the peas to drop through a screen into a receptacle ready for the cook. This is a big order, but no doubt someone will do it some day. To get you started; ready for the next lot of peas, an idea is given in Fig. 5.

Self Hair Cut

What a nuisance it is to keep having to go to the barber, and often to have only the back and sides trimmed. According to the hairdressers very few young people are entering the trade, so we might all have to cut our own hair one day. In any case, an idea would be very welcome by which you cut your own hair easily and accurately. There are combs on the market with blades attached, but these are only a compromise. The real idea would have to cut the hair very short in the neck with a gradual taper to the long hair. This could be worked by an eccentric roller with a spring return attached to an electric or manually operated hair trimming machine, as shown in Fig. 6.

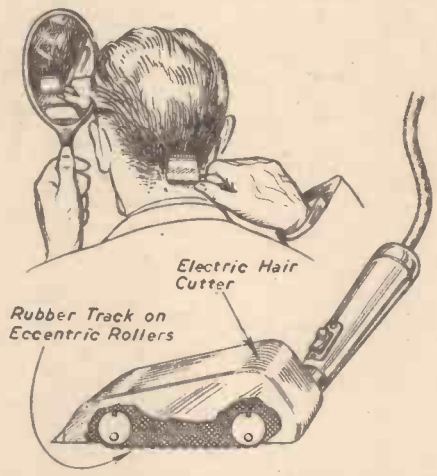

Fig. 6.—Suggested line of thought for self hair-cutting machine.

Mechanical Spade

We already have electric hedge cutters operated off the mains through a transformer and an electric motor. If an electric spade was invented to work off the same equipment the combined effort would indeed make gardening a pleasure. A suggested idea is shown in Fig. 7. An earth screw is mounted on a single wheel and driven through a gear-box by the detachable electric motor. In use the tool is walked across the garden and is connected to the transformer by an overhead lead on a self-winding spool.

The Inventor

Inventing can become a very interesting hobby, thinking out ideas and then working them out in the workshop. The inventor can spend many a happy hour making the models which may bring him a fortune. There is just as much scope for the ordinary handyman as there is for the highly trained scientist. The former may work on ideas which according to theory will not work, but theory is not always right, and whereas the scientist would not attempt a thing unless theory said it was right the ordinary handyman with his trial and error methods may stumble on something really good.

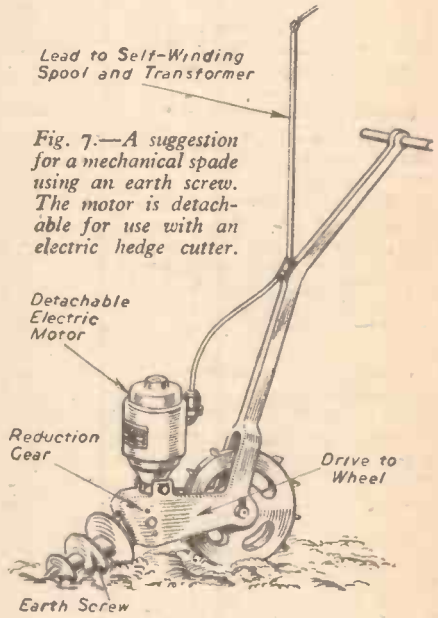

Fig. 7.—A suggestion for a mechanical spade using an earth screw. The motor is detachable for use with an electric hedge cutter.

Photo-electric Race-timing Equipment

A NOTABLE step forward in the application of science to securing precise records of sporting events has been made recently in the installation of a new type of photo-electric timing equipment at Hackney Wick Stadium, London. This apparatus was designed and manufactured by The General Electric Co., Ltd., Magnet House, Kingsway, London, in co-operation with the electrical staff of the Stadium.

For many years, photo-electric timing has been used at Hackney Wick and elsewhere, and has been acknowledged as the best way of securing accurate and consistent figures.

Hitherto this has been done with an electrically-controlled stop watch, but the new apparatus uses a six inch diameter clock which indicates to 1/100 second, and is made by Messrs. Thomas Mercer, of St. Albans, who have been precision chronometer makers for nearly 100 years. The timepiece is clutch-operated from a synchronous motor, and is not subjected to any mechanical impacts such as those which occur when an electrically-controlled stop watch is started or stopped, and which must impose a certain amount of strain on the relatively delicate mechanism.

The equipment is fully automatic in operation and is designed to avoid, as far as possible, all human errors.

Power for operating the apparatus is drawn from the electricity mains and although the frequency of the supply is normally sufficiently accurate for domestic clocks it is quite inadequate to provide the accuracy supplied by this apparatus. Consequently the installation includes a frequency control unit which centres around a valve-maintained tuning fork, temperature compensated and guaranteed to give the correct frequency within a high degree of accuracy.

The photo-electric equipment installed in the Judges' Box at Hackney Wick Stadium, London.

A Door-chime Alarm

A Novel and Interesting Device.

By E. S. BROWN

IN the February issue of PRACTICAL MECHANICS a reader proposed the novel suggestion of utilising the electric door-chimes as an alarm, but is anticipating some difficulty in making an effective actuating mechanism. As many other readers may be interested in this conversion, the writer has pleasure in giving some suggestions and details of a suitable make and break device which should give every satisfaction in use.

In detail, the device consists of a small low-voltage electric motor suitably geared down to a cam. The gearing is arranged to give the cam one complete revolution every two seconds. The protuberance of the cam depresses two brass contacts into electrical connection, then breaks, thus sounding the chimes as would normally occur with the depression of the door-push. This action, of course, continues as long as the motor runs, and a small switch should be placed in the motor circuit to stop same when required.

General Arrangement

The illustration (Fig. 1) clearly shows the working arrangement of the alarm device. A small low-power motor can be purchased from any model stockist for a few shillings. Ascertain, if possible, from the makers, the speed of the motor in revolutions per minute. From that, it is a relatively simple deduction to find the ratio of gear reduction required to give the cam wheel one complete revolution every two seconds. For instance, a motor giving 600 revolutions per minute would require a 20 to 1 gear reduction. In cases of fairly high motor speeds, a double reduction gear will be necessary.

The reader can best determine for himself the most suitable method of fixing the small driving gear wheel upon the motor shaft. As there are no great strains involved, well sweating in with solder should be perfectly satisfactory. The cam (see Fig. 2) can be cut out of either brass or copper of ¼in. thickness. The profile of the cam should be very carefully made to the shape indicated, and the "lift" area must be polished smooth with fine emery paper to minimise drag upon the rubbing surfaces. The cam must be fitted concentric to the large driven gear wheel, either by riveting or bolting together. Do not use solder or brazing, as otherwise the heat may distort the gear wheel and cause uneven running.

The motor is mounted upon a fairly substantial baseboard, and the cam wheel arranged to run freely in engagement with the small driving gear wheel. If the gear wheel standards are made from fairly heavy brass, they will also provide perfectly satisfactory bearings for same. The brass contacts are screwed into the baseboard in a suitable position so that the cam protuberance closes the circuit. The rubbing surfaces between the cam and contact blades should have a spot of light oil applied to minimise friction at this point. Although not absolutely essential, a cover fitted over the assembly not only gives a neat and workmanlike appearance, but also prevent the ingress of dust and fluff, etc., which is, of course, to be avoided.

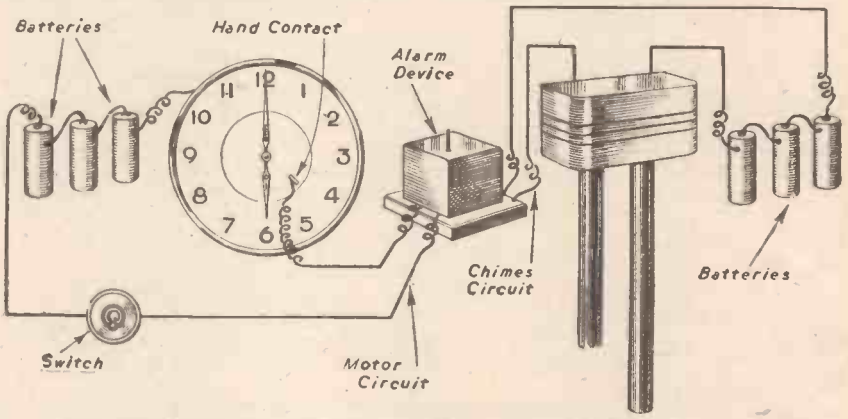

Fig. 3.—Showing the wiring between the clock, alarm device, and chimes.

Wiring Details

Fig. 3 gives a detailed description of the wiring scheme. As stated before, a switch should be incorporated in the motor circuit to disconnect same as required. When the motor is switched off and static, it is, of course, necessary to make sure that the gear cam has not come to rest while closing the contacts. A simple indicator is incorporated in the design (see Fig. 1) which consists of a short length of wire resting upon the brass contact blade and protruding through the top of the case. The hole through which it protrudes should be materially larger in diameter than that of the wire in order that no resistance is offered. When the contacts are open the wire will project an appreciable amount from the case. When closed the wire will be in a lower position. When the alarm is in action the indicator will move vertically up and down as it follows the action of the cam upon the contact blades, and should stop in the higher position.

The motor can be run from a separate battery or from the battery or transformer servicing the chimes, providing that sufficient power is available. The electrical contact is best arranged with the hour hand of the clock. As a suggestion, a smaller secondary dial could be imposed on the original, and so mounted as to turn upon its axis. A small locking device should be installed to secure the dial in the required position. A very light contact strip is fitted on its periphery to enable the hour hand to make contact at the appointed time. The cross section of the strip should be sufficient to enable the clock hand to make continuous contact for about one minute. The contact strip should be adjusted to give the minimum friction consistent with the satisfactory running of the motor. The necessary connection can be made with light flex, but care should be taken not to overturn the secondary dial and so break the flex from its connection.

To set the alarm, it is only necessary to turn the secondary dial to the desired position, lock same, then close the motor switch.

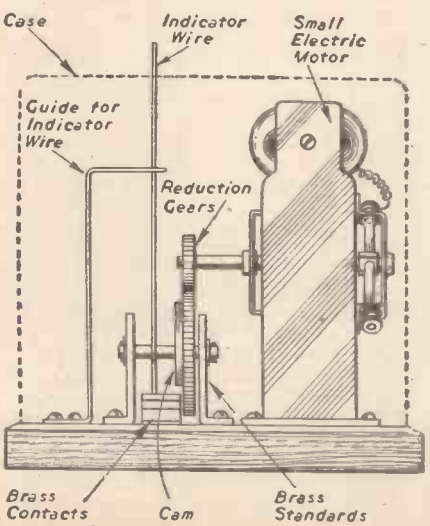

Fig. 1.—General arrangement of the electric door-chime alarm device.

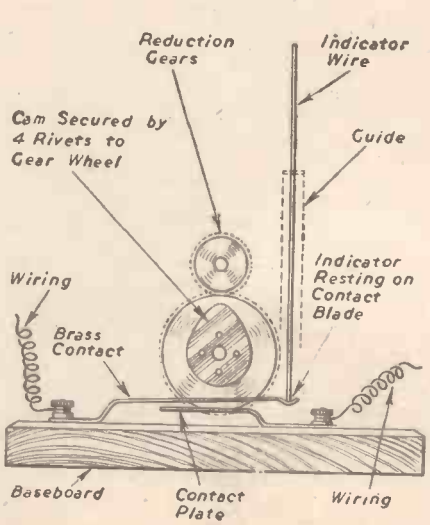

Fig. 2.—End view of the device showing the cam, contacts, and indicator wire.

Building Bicycle Wheels

The Correct Procedure for Fitting Tangent Spokes

By "ENGINEER"

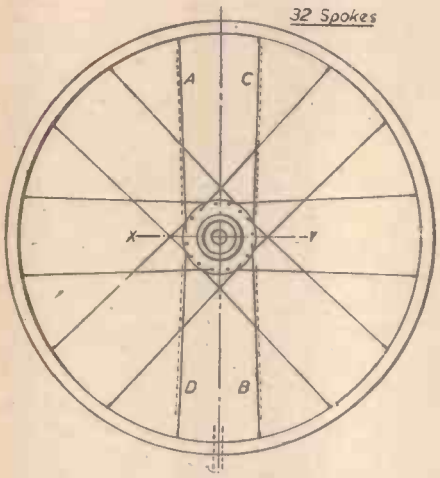

Fig. 1.—Spoking a 32-spoke wheel.

MANY cyclists may find it useful to know the principle of spoking cycle wheels with tangent spokes. In the diagrams reproduced are shown the arrangement of the spokes and particulars as to how to proceed in placing the spokes in the appropriate holes in hub and rim.

The three diagrams, Figs. 1, 2 and 3, show the spoking of one side only of cycle tangent wheels for thirty-two, thirty-six and forty spokes. When the number of spokes in a wheel, if divided by four, give a quotient which is an even number the arrangement shown for thirty-two and forty spokes is adopted. If the quotient is an odd number (as thirty-six divided by four equals nine) the arrangement shown for thirty-six spokes is adopted.

The first thing to do is to get four spokes in one side of the wheel. In the above mentioned diagrams these first four spokes are indicated by dotted lines. When the number of spokes is divisible by eight, as in Figs. 1 and 3, these first four spokes are taken from holes in the hub flange directly above and directly below a line X-Y. The spokes are marked A, B, C, D. A and B go in one tangential direction and C and D in the opposite tangential direction.

The heads of spokes A and B are inside the hub flange. The heads of spokes C and D are outside the hub flange. The spokes are carried across to the rim so that they come each side of a spoke hole on opposite diameters of the rim. That is to say there will be a spoke hole in the rim between each spoke for a spoke going to the other side of the hub. At present we are only concerned with lacing one side of the wheel.

Having got these four spokes in and nipples on them screwed up halfway along the threads we can continue putting spokes in. We take one of the four spokes and put, in the next hole in the hub flange but one to it, a spoke with the head on the same side of the flange—that is, if the head of the spoke we have selected to follow is inside the flange our spoke will have its head on the inside. All spokes going in one tangential direction have their heads on one side of the hub flange, and all spokes going in the other tangential direction have their heads going in the opposite side of the same flange. We are dealing with only one flange of the hub.

The sketches show the heads by black blobs and the end of the spoke is hidden till it leaves the flange. This is so in all the three sketches.

Spoking

Having put the spoke through the flange hole take it to the hole in the rim fourth away from the spoke we are following, leaving three spoke-holes in the rim between two spokes on one side going in the same tangential direction. Two of these three holes are for spokes from the other flange of the hub. Continue following round in this way till all the spokes going in one tangential direction are in. Then take a spoke running in the other tangential direction and follow this round in the same way till all the spokes that side are in. All the holes in that side hub flange will be filled with spokes and every other spoke-hole in the rim will be occupied.

Now put in spokes in the other flange of the hub. To do this sight along the hub in a line with its axis (axle or spindle) and it will be seen that the holes in the other side of the hub are opposite the spaces between the holes in the side we have laced. Put a spoke in one flange hole and take its end to the hole in the rim immediately beside that in which the spoke from the adjacent hole in the opposite hub-flange is nippled, and see that if the hole is to left of the hole we are sighting past the spoke goes into the hub in a hole to the left of the spoke which goes from the hole in the flange we are sighting from.

Then follow round putting all the spokes going in that direction into the flange and

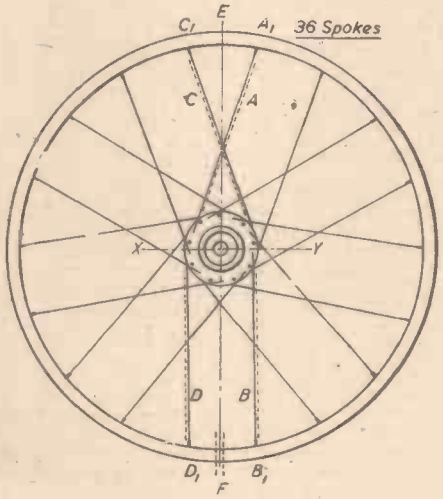

Fig. 2.—Spoking a 36-spoke wheel.

rim. There will then be left holes in hub and rim for the remaining number of spokes going in the opposite tangential direction.

This system of lacing applies to Figs. 1 and 3—wheels with thirty-two and forty spokes. Now look at Fig. 2. This is for thirty-six spokes, and the number is not divisible by eight, but by nine, so the initial spoking is different.

Here the first four spokes one side of the wheel are indicated again by dotted lines, and again spokes A and B go in one tangential direction and C and D in the other. But unlike Figs. 1 and 3, two of the four cross each other. These are A and C.

To put these first four spokes in we take two holes diametrically opposite on the line X-Y

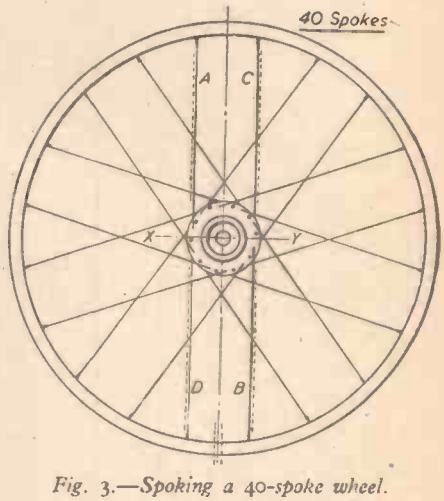

Fig. 3.—Spoking a 40-spoke wheel.

which is the centre line, and lace spokes B and D through the holes B1 and D1 in the rim; these holes are one on each side of the diameter-line E-F, leaving one spoke-hole between in the rim.

Then from two holes next in the hub above those we have put spokes B and D through, we take spokes A and C crossing each other to holes each side of the vertical line E-F which cuts two spoke-holes in the rim and the centre of the hub, these holes being A1 and C1. We then continue to insert spokes round in each direction exactly as explained in the case of the thirty-two and forty spoke wheel, and in the same way in the spokes from the other flanges in the hub to the remaining alternate holes in the rim.

For a hub of standard type we get the length of the spoke from inside the curve of the head by taking half the inside diameter of the rim. The thread on the spoke should be 1/16in. longer than the thread in the nipple, so that part of the unthreaded part of the spoke goes up inside the clearance part of the hole in the nipple.

Spokes and Nipples

The strength of a cycle wheel depends upon proper building and the correct disposition of the spokes in the rim. The spokes lie at a tangent to the hub flange, half the spokes being tangential in one direction and half in the other. In some light machines the front wheel has direct spokes because it has no drive to transmit as between hub and rim as in the case with the rear (driving) wheel of the bicycle. But in both cases a spoke is hooked through a hole in the flange of the hub and holds to the rim by a nipple which is screwed on to the spoke and has a head which beds down into the rim.

The cycle is, in fact, suspended from the rim by the spokes which, being of very thin wire, can take the strain of the load and drive only by tension upon them. They cannot support a compression load.

Principle of the Tangent-spoked Wheel

Fig. 4 shows the principle. A is the rim, B is the hub, CC the spokes and DD the nipples. Where a wheel is direct spoked the spokes run rapidially from hub flange to rim and the holes for the nipples are drilled in a direct line to the hub—and in the centre of the rim nearly but a little splayed to each side so that the nipple beds down in the concave portion of the rim—the "well base." This slight side splaying is shown in Fig. 4, where it will be seen that the nipples lie radial to the

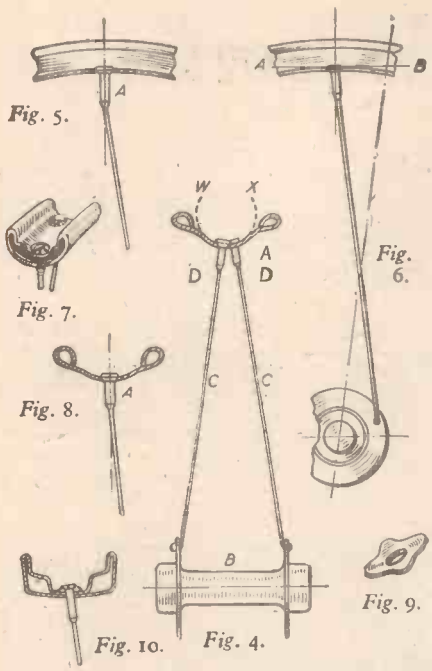

Fig. 5. *Fig.* 6. *Fig.* 7. *Fig.* 8. *Fig.* 9. *Fig.* 10. *Fig.* 4.

Figs. 4 *to* 10.—*The various points in spoking a wheel.*

curve W-X, which is the curve of the rim bed.

If the rim is drilled directly in the centre of the rim bed, as in Fig. 5, the spoke will tend to be held in a plane in line with the wheel centre shown by the thin line, and the pull on the spoke will bend the spoke, as shown at A, where it leaves the nipple. This is the cause of many of the troubles of broken spokes. But this is not the only cause. In a tangent wheel the spoke does not meet the rim square with a tangent, A-B at the point where the rim is drilled. This is shown in Fig. 6.

Here we have a portion of the rim curve and a tangent spoke leaving it in the direction to meet the hub flange at the side. It will be seen that the spoke is not radial to the rim. Since every alternate spoke on each side of the wheel goes off at the opposite tangent to its neighbour it will be seen that if the rim bed is thick, as in the case of an aluminium rim, or is double, as in the case of a Coulay rim (Fig. 7), the drilling of the spoke holes must alternate not only from side to side but also fore and aft, or the spoke will be bent where it leaves the end of the nipple, as at A in Fig. 8.

The holes in the rim should therefore be drilled in the direction in which the spoke will lie.

Some Practical Points

A good many wheels are turned out where these considerations are not fully met. They can be picked out by carefully noting whether nipple and spoke, viewed from all sides, are in dead line with each other. If they are not, if the spoke leaves the nipple at a decided angle sideways or fore and aft as in Figs. 5 and 8 respectively, the wheel will not stand up to its proper work. Washers offset, as Fig. 9, can be used in their rims, and at Fig. 10 is shown a reinforcing washer for their rims and straight spokes.

The nipple should fit the spoke so that it can be screwed down the whole length of the thread with the thumb and finger, but must have no shake. If it is tight it may break when trueing the wheel or adjusting it if it gets a little out of truth. If it is slack the threads in nipples may strip and let the spoke loose and the rim will move, at that point, out of truth sideways.

The spoke and nipple—in correct position—are shown enlarged at Fig. 11. It will be noticed that when the spoke is taut and the wheel true no threads should be visible on the spoke. The end of the threaded part of the spoke should be up inside the clearance bore, A, in the nipple.

Fig. 12 shows the spoke alongside the nipple. The spoke is in relative position to that which it should occupy in the nipple. The non-screwed (clear) part of the spoke is not quite so long from the end of the nipple to the thread as is the cleared part of the nipple from end to thread, as shown by the dotted lines.

The Thread as a Guide

This is important, for if the thread is not long enough the end of the thread on the spoke will reach the end of the thread in the nipple and you cannot screw the nipple down any farther and cannot further tension or true the wheel. The condition is shown at Fig. 13.

If the thread on the spoke is too long it may reach below the cleared part of the nipple (Fig. 14); it will look bad, wet will get in and rust the spoke, and the spoke will be deprived of the lateral support of its thickest (unthreaded) diameter fitting snugly in the nipple—the ideal condition, as in Figs. 11 and 12.

The simple rule is that a little of the unthreaded part of the spoke should be up in the nipple, but should not reach to the beginning of the thread in the nipple.

The heads of the spokes should neatly fit the holes in the hub flange.

Fig. 15 shows the correct position. Here the bend in the spoke follows the contour of the hole in the flange. Fig. 16 shows a hub flange hole too large and with sharp, not rounded, edges to the hole. The spoke is pulled across, catches the sharp edge under the head and at the centre of the bend. Such a spoke will be liable to break under an extra strain—pedalling or hub-braking.

In Fig. 17 is another fault. The spoke fits the hole, but has too wide a bend at A. The bend will "give" a little and throw the wheel out of truth. Also, constant tension on and tension released from the bend, as the spoke takes and leaves the load, will cause the metal to become brittle and the spoke will eventually break.

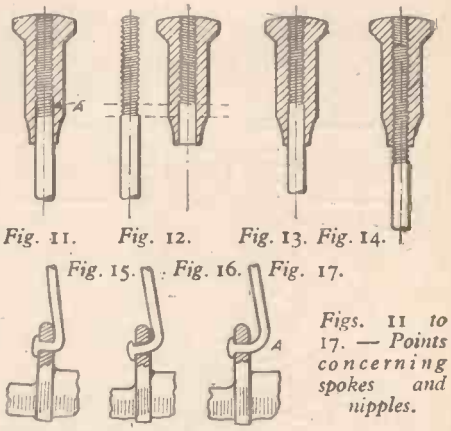

Fig. 11. *Fig.* 12. *Fig.* 13. *Fig.* 14. *Fig.* 15. *Fig.* 16. *Fig.* 17.

Figs. 11 *to* 17. — *Points concerning spokes and nipples.*

List of spoke lengths for cycle wheels

in.	Fronts		Rears		3-Speeds	
	32 holes in.	36 holes in.	36 holes in.	40 holes in.	36 holes in.	40 holes in.
28 x 1½	12 1/16	12	12	12 1/8	11 13/16	11 13/16
26 x 1½	11 1/16	11	11	11 1/8	10 13/16	10 13/16
26 x 1¾	11 1/4	—	—	11 1/4	—	11
26 x 1¼	11 7/16	—	—	11 5/16	—	11 1/4

Books Received

Modern Locomotives. By Brian Reed. Published by Temple Press, Ltd. 84 pages. Price 8s. 6d. net.

THIS book, which is one of the boys' "Power and Speed" Library series, describes all types of locomotives, including those driven by diesel engines and gas-turbines, and explains in simple language the technical details of their construction and operation. The book is well illustrated with line drawings and half tones.

Modern Ships. By F. E. Dean. Published by Temple Press, Ltd. 96 pages. Price 8s. 6d. net.

IN this interesting book, which is another of the boys' "Power and Speed" series, the author describes how a ship is built, and the preparations for launching the vast hull. The illustrations show how a modern liner takes the water; the various types of machinery that drive the ship—steam engines, turbines and oil engines—and their working. Many of Britain's largest liners and cargo vessels are described and illustrated, and also special types of craft such as coasting vessels, tankers, tugs and ferries.

The F.P.A. Journal (No. 6). Published by the F.O.C. Fire Protection Association, 84, Queen Street, London, E.C.4.

THIS issue of the F.P.A. Journal contains details of three fires from which much may be learned of structural, storage and industrial fire hazards. The addition of wetting agents to water in order to improve its value for fire fighting purposes has been a subject of considerable interest in recent months. A short article on the subject appears in this issue, together with technical notes on hazards, "bottle gas" installations, etc.

General Prospectus of the I.C.S. Published by the International Correspondence Schools, Ltd., International Buildings, Kingsway, London, W.C.2.

THIS general prospectus covers, in condensed form, the courses of instruction offered by the International Correspondence Schools to men and women desirous of reaching higher positions in their chosen careers. The prospectus also includes information about the teaching methods, the teachers, the prestige and the successes of I.C. Schools.

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The Elements of Mechanics and Mechanisms—25

Gear Tooth-forms (contd.)

IN a series of gears which will work accurately together, the tooth-form is not the same throughout, but depends on the number of teeth. Consequently, if the gears are produced by a form-cutting process, a different cutter should be used for each number of teeth of each pitch. To avoid this difficulty

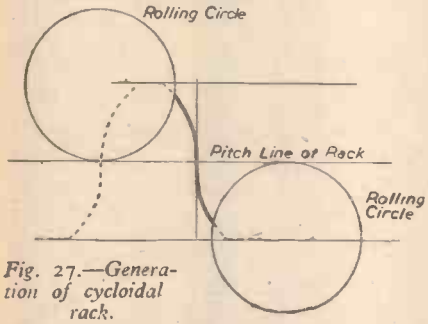


Fig. 27.—Generation of cycloidal rack.

(and also to enable gears to be cut quickly and accurately), modern cutting processes make use of " generating " action. The easiest way to grasp the idea of generation of a tooth shape is to consider the meshing of a pinion and a rack.

A rack is part of a gear of infinite size, any limited length of the pitch circle, therefore, appearing as a straight line. The tooth-form of a rack on the cycloidal system is thus composed of the two curves (cycloids) formed by rolling a circle on each side of the pitch line (see Fig. 27).

It will be seen that the cycloid is the special form assumed by both epicycloid and hypocycloid when the fixed circle is infinitely large.

Generation

The geometrical process known as " Generation " may be described by reference to Fig. 28. Here the straight line AB and the point O are marked on a fixed plane. The rack-form is marked on a separate sheet of paper CDEF set so that the pitch line GH of the rack coincides with AB. Circle No. 1 represents the edge of a piece of tracing-paper located by a drawing-pin at O and capable of rotating about O. On this paper is marked the circle No. 2, representing the pitch circle of a gear meshing with the rack. This circle touches the pitch line GH of the rack at P. The pitch line and the pitch circle are marked at equally spaced points numbered 3, 4, 5, 6, 7, etc. The spacing of the points is the same on the line and on the circumference of the circle.

With the sheets of paper in the positions shown, the rack tooth-form is traced on the circular paper. The rack is then moved horizontally, keeping its pitch line on AB until the point 3 coincides with P. The circular paper is rotated until point 3 coincides with P (thus bringing together the two points marked 3). The rack-form is again traced on the circular paper. The process is repeated for other settings of the papers, and the successive tracings of one tooth of the rack-form appear somewhat as shown in Fig. 29.

It will be seen that they all lie inside a definite " space-shape," which is said to be " generated " by the " rolling " motion of rack and circle.

This rolling has taken place in the condition of uniform velocity-transmission, because each movement of the circumference of the pitch circle has occurred at the same time as an equal movement of the rack along its pitch line. Therefore, the pinion tooth-form developed in this way is one which would give uniform velocity transmission when meshed with the rack. This statement is, however, subject to some qualification, because in certain circumstances a part of the rack tooth-form may overlap a part of the pinion tooth-form which is required for correct contact with the rack-form at some other state of engagement. This effect is called " interference."

Rack Tooth-form

The generation of a pinion tooth-form by a rack has been described because it is typical of generating processes. It is not essential that either of the pair of gears concerned in a generating process should be a rack, but it is convenient to consider rack generation because

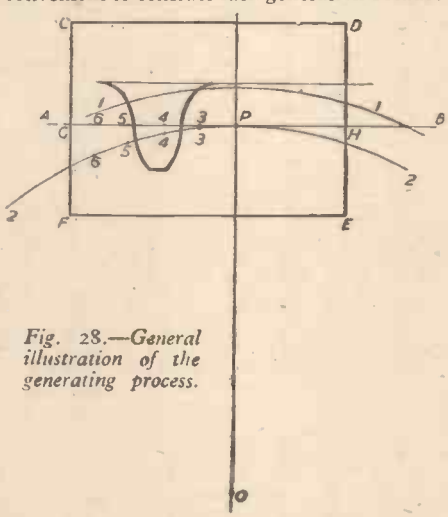


Fig. 28.—General illustration of the generating process.

the process is somewhat simplified by the fact that the pitch line of the rack is straight.

Starting from a particular " basic rack " of symmetrical form, it is possible to generate from it the tooth-forms of two gears having any required numbers of teeth, and (unless interference occurs in generation) these two gears will mesh together to give uniform velocity transmission. In Fig. 30, the rack tooth outline is seen in mesh with teeth of one gear with centre A and the other with centre B. If the rack is of cycloidal form, the path of contact of rack and either gear above its pitch line is the circular arc PQ, and the path below the pitch line is PR. Now, as a single rack profile in any position can cut the path RQ at only one point, a tooth of the upper gear must touch the lower tooth profile at the same point as a tooth in the lower gear touches it. Since the rack tooth outline has no thickness, the teeth touch each other at the same point. Since the rack gives uniform velocity transmission with each gear, the gears transmit uniform velocity between themselves.

The rack tooth-form is important because it is the simplest form in any particular system of gearing, and because tooth-forms for all other numbers of teeth may be developed from it by the generating process.

Straight-sided Rack-form

Accepting the rack as the basis of tooth-form generation, it is natural to enquire whether it is possible to use a simpler shape than the cycloidal one which has just been considered. This is, in fact, the case, and the straight-sided rack (Fig. 31) is the basis of the widely-used involute system of gearing. In Fig. 31, AB is the pitch line of the rack, circle No. 1 is the pitch circle of the gear, and P is the pitch point. The line XPY is drawn through P perpendicular to CD. Since CD is a straight line, no other perpendicular to it can pass through P. Now, for uniform velocity transmission, the common normal (or perpendicular) at the point of contact must pass through the pitch point. Hence, XPY must be that common perpendicular, and hence E is the point of contact of rack profile CD and pinion tooth profile for that particular position of the rack. As the rack moves parallel to its pitch line CD remains parallel to its original direction and, therefore, the perpendicular XPY to CD does not change its position. The point of contact of CD and pinion tooth always lies on XPY which is, therefore, the path of contact. As it is always the straight line from the point of contact to the pitch point it is at the same time the line of pressure. The angle between XY and AB is the pressure angle, and this is the same for all stages of engagement.

The line OF is drawn perpendicular to XY and the circle No. 2 is drawn through F. The pinion tooth profile that touches CD meets circle No. 2 in G. It can be shown that when CD makes a movement accompanied by an equal circumferential movement of circle No. 1 the distance by which the point of contact E moves along XY is equal to the movement of G along the circumference of circle No. 2. This is equivalent to saying that the pinion tooth profile extending outwards from G is the path of a point E fixed on a straight line XY, which rolls on circle No. 2. The path is called an " involute " to circle No. 2, which is the " base circle " of the involute. (It is useful to note here that no part of an involute can lie inside its base circle.)

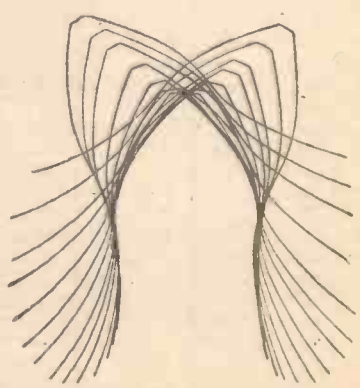


Fig. 29.—Showing stages in generation of a tooth-form.

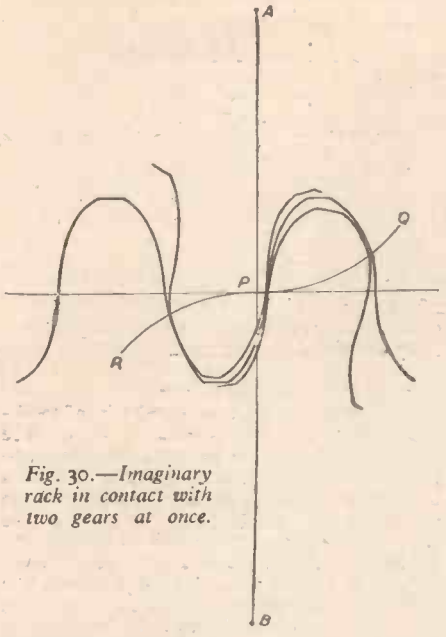


Fig. 30.—Imaginary rack in contact with two gears at once.

Involute Tooth-form

The foregoing description of the generation of the involute pinion tooth from a straight-sided rack tooth makes it clear that the whole profile is part of one curve and does not change character in crossing the pitch line as does the profile of the cycloidal tooth. The important feature of the involute gear is not the pitch circle but the base circle. In fact, when an involute gear is not in mesh with any other gear or rack, it cannot strictly be said to have a pitch circle at all. As the gear has usually been generated by a cutter of some standard pitch, the pitch circle of generation is often regarded as the pitch circle, and it is, in fact, a useful circle of reference for detailing the dimensions of the teeth, but it is not a pitch circle in the true sense of an equivalent to a rolling circle, except when the gear is meshing with another gear in a way which causes the pitch circle of engagement.

The tooth spacing on the base circle is called the base-pitch, and this is the fundamentally important dimension of an involute gear. Two involute gears cannot mesh correctly together unless their base-pitches are equal. If this is so, and tooth thicknesses and depths are such as to give continuity of action, the gears will mesh together with uniformity of velocity transmission regardless of centre distance. Of course, there are limits to the possible variation in centre distance. If it is too great, the teeth are only partially engaged, and one pair may lose contact before the next pair are in a position to take up the load, in which case the tooth action will be irregular. There is a limit to reduction of centre distance because of jambing of the engaging teeth or interference between tips and roots.

Pressure Angle of Involute Gears

The construction of an involute is such that a perpendicular to it at any point is a tangent to the base circle. Therefore, when two involute gears are in engagement the common perpendicular at any point of contact touches the base circle of each gear.

In Fig. 32 AB is the line of pressure for contact between clockwise-facing flanks of teeth in the lower gear and counter-clockwise-facing flanks of teeth in the upper gear. For contact between the other pairs of flanks the line of action is $A^1 B^1$. These lines intersect each other on the line of centres at P, which is the pitch point.

The pressure angle Ψ is the angle BPC, and this is equal to angle BSP. Now, in the rightangled triangle RSD,

$$SD = SB + BD = SB + AR$$
$$= \text{sum of base radii},$$
$$SR = \text{centre distance}.$$

Hence:

$$\frac{\text{Sum of base radii}}{\text{Centre distance}} = \frac{SD}{SR} = \cos RSD = \cos \Psi.$$

The pitch circle of the upper gear is a circle whose centre is S and which cuts the line SR at the point P. The pitch circle of the lower gear is a circle whose centre is R and which cuts the line SR at the point P. These circles touch each other at the point P.

If the centre distance of the gears is increased, i.e., if the point S is moved farther from R, this does not affect the size of the base circles but it alters the angular position of the common tangent AB, and the position of the point P is therefore changed.

Consequently, the pitch circles are also altered in size although the ratio of the diameters is always the same as the ratio of the diameters of the base circles. This follows because the triangles PSB and PRA are similar, and the ratio PS to PR is therefore the same as that of SB to RA.

In a standard system of gearing it is found convenient to determine the depth of tooth as a multiple of the pitch of the basic rack. In the British Standard system the total depth of the tooth, from the tip to the root, is 0.716 times the pitch. The full depth of the tooth is not effective in making contact

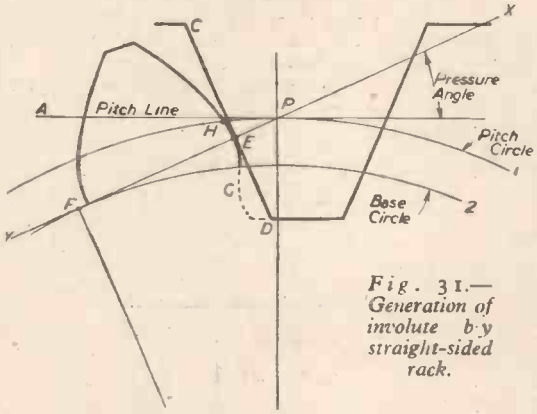


Fig. 31.—Generation of involute by straight-sided rack.

with the mating tooth, however, as it is as necessary that there should be a clearance between the tip of one tooth and the root of the space which it occupies between the two teeth of the mating gear. The working depth is the distance between the tip circles of the mating gears, and this is equal to 0.637 times the pitch of the basic rack. The distance from the pitch circle to the tip circle is called the "addendum." The distance from the pitch circle to the root circle is called the "dedendum." The sum of addendum and dedendum is equal to the full depth of the tooth, and is therefore 0.716 times the pitch of the basic rack. In the cycloidal system of gearing, and also in the involute system as first used, the addendum is made a constant multiple of the pitch. In the involute system it was usually 0.318 times the pitch.

In the involute system of gearing, however, even with a fixed basic rack, there is no necessity to make the addendum a constant multiple of the pitch, and, in fact, in British Standard practice the addendum for any particular gear is determined by a formula which depends upon the number of teeth in that gear, and upon the number of teeth in the mating gear.

Fig. 33 refers to the generation of the teeth of a gear by means of a racktype cutter. In the position shown, the point of contact of rack and gear tooth is A. If the rack moves to the left (with corresponding counter-clockwise rotation of the gear) the point of contact A moves along the line PB towards B and contact is made with the rack tooth at

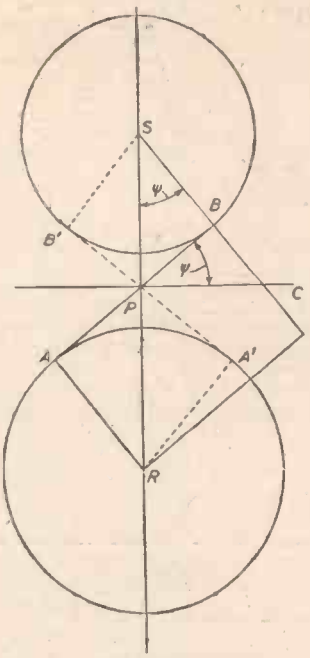


Fig. 32.—Relation between centre distance, base radii and pressure angle of involute gears.

successive points along the line AC. Points A and C reach B at the same time, and this point is the last point on the path of contact of rack tooth and involute gear tooth. Further movement of the rack to the left will cause the part of the rack tooth between C and D to complete the generation of a shape which is not involute, and the general form of the gear tooth produced is as shown in Fig. 14. Here the curved line EF is the involute produced by the generating action of the part of the rack tooth which lies between Q and C (Fig. 33). The remaining part GH of the gear tooth profile (Fig. 14) is generated by that part of the rack tooth profile which lies between C and D (see Fig. 33 below).

This curve is called "trochoid," and it is quite useless so far as effective contact with the mating teeth is concerned. Furthermore, it actually cuts away the part of the involute profile which was originally formed between H and F so that of the whole depth of the finished tooth, only EH is effective. The condition which causes removal of part of the involute profile is known as "interference." The gear tooth itself tends to be of a weak form, owing to the fact that it is comparatively narrow near the root, and it is said to be "undercut."

(To be continued.)

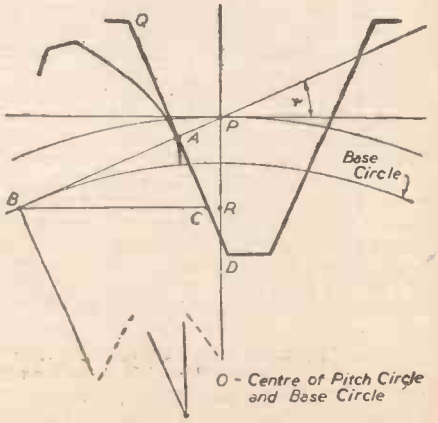


Fig. 33.—Interference in the generation by rack.

Long-distance Telephones

Interesting Particulars of the Bell Telephone System in the United States

By THE MARQUIS OF DONEGALL

COMPARISONS are odious and I do not propose to make any. Suffice it to say that we had most of our telephone system blown up at one point or another during the war and have, even up to this day, not sufficient material available to replace everything that was destroyed.

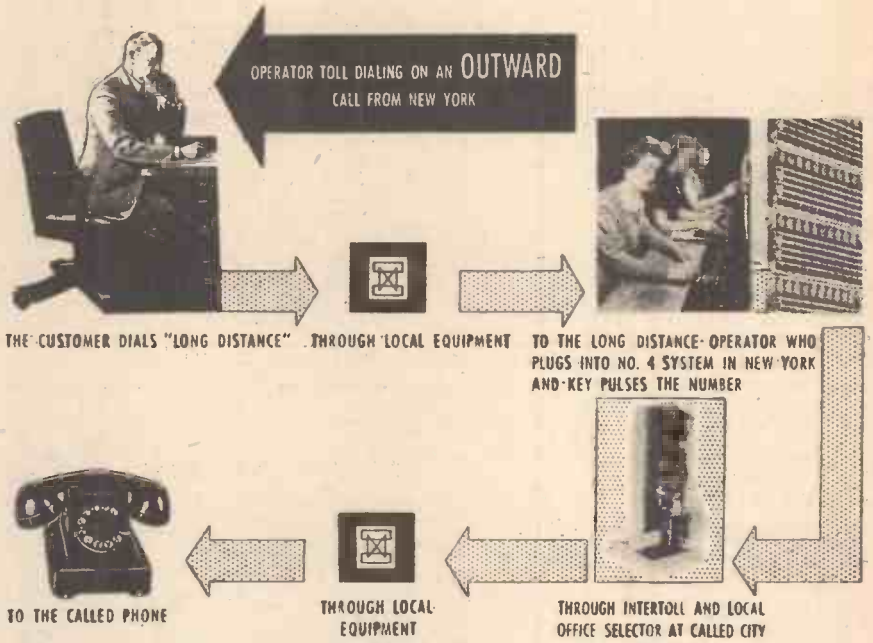
But there is no doubt that the G.P.O. are getting on with things, and I was interested to read the other day that in a number of years it will be possible for a subscriber to dial " Trunks " and the " Trunks " operator will immediately dial the distant subscriber without going through the exchange of the town concerned. Eventually, one imagines, that a subscriber in London will be able to dial Manchester or Edinburgh and get straight through. That is possibly a futuristic view.

In about the middle of my American tour, from which I returned some time ago, I had the privilege of going over the Bell Telephone System in Chicago. When I say that I mean that in one day I was able to go over about one-third of it, and was very tired at the end of that period.

There are three things in that system that I think should interest us particularly here and the first is the dialling by the subscriber of a long-distance call, as they call it, or " trunks," as we call it. Just to make things more difficult between the English and American language, they call this operator-toll dialling. They contend that a major step has been taken towards faster and more accurate long-distance telephone service by the installation of a new type of electronic telephone switching in New York and Chicago on the long-distance centres.

New Switching Equipment

This was announced on 6th January. The new switching equipment makes it possible for a long-distance operator to put through calls to distant telephones directly, without the aid of the operators en route.



Pictorial diagram showing the sequence of operations used in long-distance telephony in the United States.

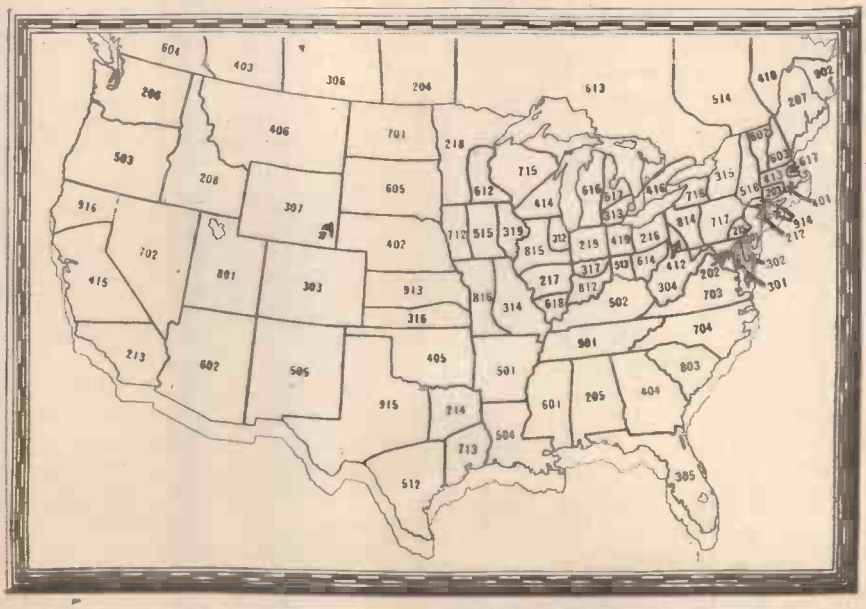
Already about a third of the long-distance calls originating in New York City are being handled through this new equipment, which has just been installed in the long-lines headquarters of their building.

Ultimately, of course, the Bell System plans to extend this new method throughout the United States and Canada. It will be just about as easy as a subscriber now dials in his own town in this country. As the system works at present, the operator can dial calls through to distant telephones in some three hundred cities, but that only represents about ten per cent. of the whole of the American Continent's long-distance calls.

After five months in the United States I can say that if you ask long-distance to get you a number in New York from Chicago, it is nearly as quick as dialling a number in London. On the other hand, if you want New Orleans from Chicago there will be a slight interval because the system of automatic from Chicago to New Orleans is not yet in operation.

All long-distance calls in the United States on the Bell System now go through in about two minutes on an average, but the extension of what they call the dial-operator-toll system should reduce that average to about one minute. One of the points, of course, is that when dealing with great distances as they do over there, the toll-dialing service gives greater accuracy and less difficulty with cut-offs and interruptions from intermediate exchanges.

This continent-wide extension of toll dialling requires a numbering plan under which the whole U.S.A. and, of course, Canada, is being divided into about eighty numbering plan areas. Each of these will be designated by a three-digit code, one which does not conflict with the code of any office within the area nor within any other code. Thus the operator will generally be able to meet any " toll " call by dialling a maximum of ten digits: the six digits of the area and office codes, and the four digits of the called telephone number.



The Bell System plan for nation-wide operator-toll dialling provides for the division of the United States and Canada into about 80 areas, each bearing a three-digit identifying number.

Tone-pulse System

In dialling distant cities the operator does not actually dial the numbers. Instead she uses a ten-button key which is capable of working about twice as fast as an ordinary dial. Each time she punches, a tone-pulse is sent out over the regular voice channels

to the switching centre. Each tone-pulse, as I understand it, is a combination of two different audible frequencies. These are sorted out and classified by the "brains" in the switching equipment which then interprets their meaning. This switching equipment also provides the electronic "hands" which assume much of the complex switching operation.

When I went over the Bell System in Chicago they were having some kind of a Graham Bell anniversary and I learned a lot from that. He wrote, for instance, in 1878: "It is conceivable that cables of telephone wires could be laid underground or suspended overhead communicating with private dwellings, counting houses, shops, manufacturies. Not only so, but I believe in the future wires will unite different cities, and a man in one part of the country may communicate by word of mouth with another in a distant place."

As most people know, Graham Bell was a teacher of the deaf. In a sense we can take credit for the invention of the telephone because Alexander Graham Bell was born in Edinburgh, Scotland. Incidentally, his mother was the daughter of a surgeon in the Royal Navy.

It was in August, 1870, that the Bell family moved to Canada because two sons had already died from tuberculosis and Alexander was threatened.

Bell was still primarily interested in what he called vocal physiology and mechanics of speech in order to teach the deaf to speak. The idea of transmitting speech artificially was still not in his mind in 1872, in Boston.

The "Harmonic Telegraph"

The initial idea of the telephone came through tuning-forks in order to help his deaf-mute patients to receive sound-waves. He devised a method of doing this and he called it the "harmonic telegraph." It was with this object that he got in touch with Thomas A. Watson, of Boston, and to Watson must be given a great deal of credit for the invention of the telephone which came out of this partnership.

What Bell asked himself was this. If a lot of reeds of different pitches were vibrating simultaneously over an electro-magnet, would they not generate one complex varying current resulting from the combined motion of all the reeds? He thought they would. From that moment he was on the track. Then he discovered that the end of one magnetised reed could be attached to the centre of the diaphragm as it vibrated to voice waves or music, it would generate a current that would vary in intensity just as the air varies in density when a sound is passing through it.

By that time he had got it. It was in the summer of 1874 while on vacation that he told his father that he thought the idea would work.

The rest of the story is too well known to take up space here. But I think it is just worth recalling that Alexander Graham Bell was a British subject at the time that he invented the telephone. He did not become an American citizen until 1886, which was after the invention.

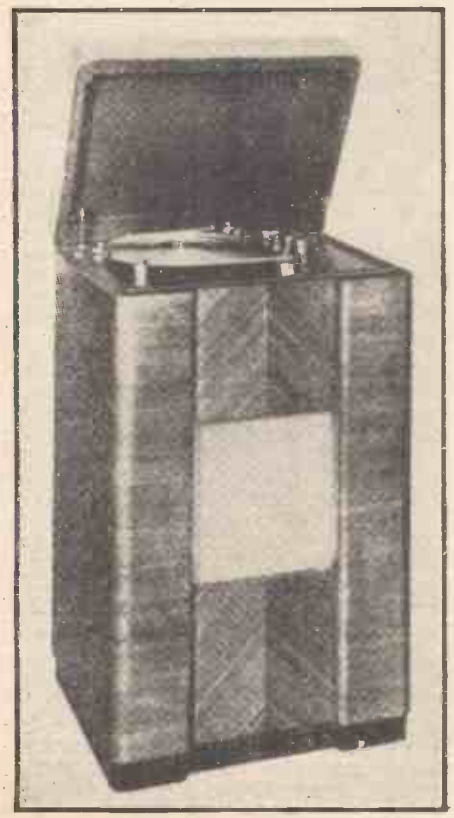
Magnetic Tape Recorder

A High-fidelity Instrument for Recording and Reproducing

THE new magnetic tape recorder made by the General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2, has been designed as a high-fidelity speech and music recorder suitable for educational purposes, recording scientific lectures, medical purposes (speech therapy, psychiatry), police and railway use, orchestral and theatrical rehearsals and the recording of radio programmes.

Recordings can be made from a microphone, radio receiver or telephone line, and can be stored or replayed indefinitely without deterioration.

When no longer required they can be erased magnetically and new recordings made on the same length of tape, which is made of plastic and coated with magnetic iron oxide. A remarkable feature of the tape, which is of standard dimensions, is its strength and the ease with which it may be cut for editing purposes and rejoined with ordinary adhesive plastic tape. Additional spools of tape can be purchased as required. The models now in production have 1,000 yards of tape, which gives a running time of 80 minutes' high-fidelity recording, the tape speed being 7½in. per second. Coloured paper tape can be attached to the magnetic tape, at intervals, to act as a visible marker or, alternatively, metallised tape may be used in conjunction with the mechanism, to act as an automatic selector or stop.



General view of the G.E.C. magnetic tape recorder.

Simple to Operate

The equipment is very simple to operate and has four push-button controls marked "Play and Record," "Fast Forward," "Rewind" and "Off." An independent lever has to be operated at the same time as the "Play and Record" button for recording, and prevents the accidental erasure of a programme which might otherwise occur, since erasure is automatic as a new recording is made.

Three separate heads are used for erasing, recording and reproducing, and the use of a separate replaying head and amplifier permits continuous monitoring of the signals actually recorded. This gives a complete functional check of all parts of the equipment and the adjustment of correct sound level, neither of which would be possible if the monitoring merely consisted of reproducing a fraction of the input signal.

The recording and reproducing heads are each fitted with adjusting screws to permit exact alignment for maximum treble response, either with each other or with recordings made on other machines.

Reproduction is by means of a built-in 12in. loudspeaker, and special amplifiers are used in the recorder with audio frequency response characteristics which are complementary to the response of the recording system, thereby securing a remarkably high degree of fidelity.

Characteristics

Overall audio frequency response (Record—to—Reproduce): Flat with 4 db. for the frequency range 40-8,000 c/s.

Total noise and hum level: Better than —48 db.

Rewind time and fast forward winding time: 2½ minutes for 1,000 yds.

Short term speed variation (Wow): ± 0.1 per cent.

Inputs.—High impedance (radio). Single-sided: 0.5 volt into 1 megohm. Low impedance (microphone). Balanced: 15 ohms for moving coil microphone.

Audio output: 4 watts into built-in 12in. loudspeaker or external loudspeaker.

Voltage output: 4 volts (average) into 50,000 ohms—1 megohm.

Recording or replaying time: 1 hour 20 minutes per 1,000yd. reel.

Tape speed: 7½in. per second.

Power supply: 200-250 volts 50 c/s.

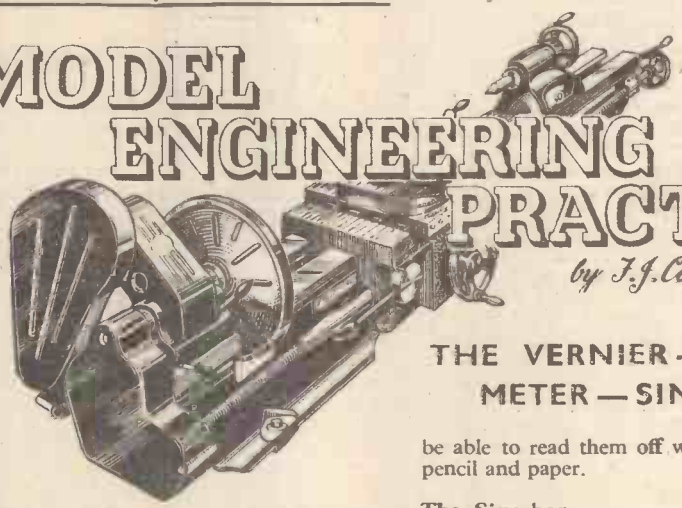
Power consumption: 200 VA.

Close-up view of top panel of recorder, showing controls and the three separate heads.

5th Article of a New Series

MODEL ENGINEERING PRACTICE

by J. J. Camm



THE VERNIER — MICROMETER — SINE-BAR

FIG. 52 in Art. 4 gives a further example of a vernier reading. In this case the readings are one inch, plus two-tenths, plus three-fortieths, plus seventeen-thousandths, or

1 inch	=	1.0
2 tenths	=	.2
3 fortieths	=	.075
17 thousandths	=	.017
		1.292

The Protractor Vernier

Now that the principle of the vernier has been explained, we can return to the verniers provided on the bevel protractor shown in Fig. 53. These verniers are graduated to one-twelfth of a degree (which is five minutes), and this degree of accuracy is sufficient for most ordinary jobs in the workshop. On the vernier each space is 5 minutes shorter than two spaces on the main scale, and when the line 0 on the vernier coincides with the line 0 on the main scale, the edges of the blade and base are parallel.

But when, by setting the protractor to a slight angle, the swivel head is moved so that the line on the vernier next to 0 coincides with the line *next but one* to 0 on the main scale, then the angle between the blade and base has been changed to five minutes or one-twelfth of a degree.

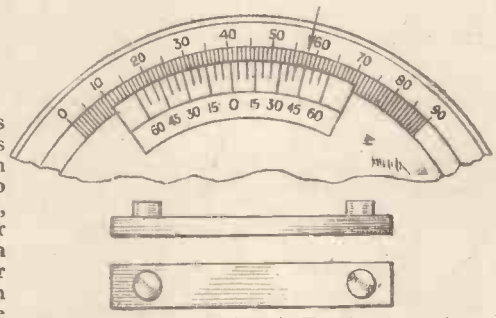
The method of reading the protractor vernier is similar to that in the case of the straight beam and vernier; when the blade and base have been accurately set to the angle of the job to be measured, the number of whole degrees is first read off direct from the main scale (in the same way as the whole inches were read off from the beam in the straight type of vernier). Then, reading in the same direction, count the number of spaces from zero on the vernier scale to the line which coincides with a line on the main scale; note the number of the vernier line in question, multiply by five, and the answer will give you the number of minutes to be added to the number of whole degrees already read off from the main scale.

An example is given in Fig. 53. In this case, it will be seen that the number of degrees between 0 on the main scale and 0 on the vernier is 40. The vernier line 45 coincides exactly with line 58 on the main scale; the number of spaces between line 45 and zero on the vernier is 9. Consequently the number of minutes becomes $9 \times 5 = 45'$, and therefore the correct reading of the angle in question is $40° 45'$.

In order to familiarise yourself with vernier readings you would be well advised to take every opportunity of practising with the vernier instruments in your own workshop; you will be surprised how quickly you will be able to read them off without recourse to pencil and paper.

The Sine-bar

This is an instrument of the simplest construction but can be used for the measurement of angles in those cases where it is inconvenient or impracticable to use the bevel protractor. Fig. 54 shows that the sine-bar consists merely of a straight edge in which



Figs. 53 and 54.—(Above) The bevel vernier. (Below) The sine-bar.

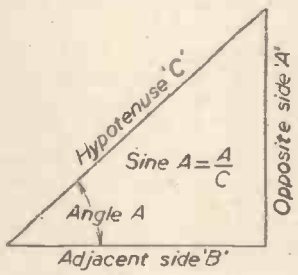


Fig. 55.—Right-angle triangle.

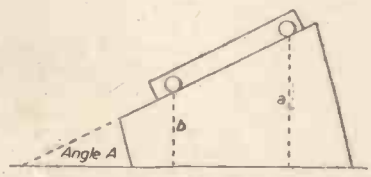


Fig. 56.—Sine-bar measurements. Sine of angle $A = (a - b) \div 5$.

two pins are on the centre-line of the bar as shown, and in order to make calculation easy the distance between the pins is usually some even dimension such as five, 10 or 15 inches.

To explain the principle of the sine-bar we have to assume some knowledge of simple geometry, but in order to refresh your memory, a right-angle triangle is shown in Fig. 55. The angle to be measured is that marked "A"; *a* is the "opposite side," *b* the "adjacent side," and *c*, the hypotenuse. The formula represented by:

$$\text{Sine A} = \frac{a}{c}$$

will no doubt be familiar to many readers. To clarify the point, however, if the length of *a* is 6in. and the length of *c* is 9in., then the *sine* of A would be 6 divided by 9, or .6667.

Once having obtained the sine, one has only to refer to the standard list of sines as published in many technical handbooks, when it will be found that from this sine of angle A becomes 41° 49'. In applying this simple principle to the sine-bar, the length of the hypotenuse of the triangle can be considered as the distance between the two pins, and the difference in the heights of the pins above the base of the work can be taken as the length of the "opposite side."

Let us suppose that, using the sine-bar for the purpose, we have to measure the angle formed between a line on a piece of work and a base-line; first, the edge of the sine-bar is placed parallel with the line to be measured (see Fig. 56). We then take careful measurements of the heights *a* and *b*; for example, we will assume the height of *b* to be 2.75in. and of *a* 4.25in.; the distance between the pins on our sine-bar we shall assume to be 5in.

Now, by subtracting height *b* from height *a*, we get 2.5in., and this figure may be taken as equivalent to the length of the "opposite side" of a right-angled triangle, and the sine of the angle "A" will be the difference in the two heights, namely 2.5in. divided by the distance between the sine-bar pins, which is 5in. Therefore, in this case, the sine of angle "A" is 2.5 divided by 5 = .5, and the sine tables will show that .5 equals 30°.

As an example of a little more difficult case, we can take a measurement in which height *a* is found to be 3.174in., and *b* 1.941in. (sine-bar, 5in.). The sine of angle A in this case becomes $(3.174 - 1.941) \div 5 = .246$, and the table of sines shows this sine to be equal to just under 14° 20'.

Sliding Vernier Caliper

In effect, this tool is a simple straight edge or ruler, graduated (usually in inches and fractions of an inch) and fitted with a sliding vernier attachment. The graduations on the beam are in fortieths of an inch, and this, together with the vernier, makes it possible to read measurements to an accuracy of .001, i.e., one thousandth of an inch. A sliding vernier of this type is shown in Fig. 57.

To read this caliper, first find the number of graduations per inch on the ruler section, and then the number of spaces on the vernier; the smallest measurement possible is the product of the former fraction and the latter. For example, if each inch is divided into twentieths and the vernier has 10 equal spaces, the possible degree of accuracy is one-tenth multiplied by one-twentieth, which is one-two-hundredth, or .005. If the vernier has 25 divisions, and the beam is divided into fortieths of an inch, then readings down to one-thousandth of an inch can be taken, for

$$\frac{1}{25} \times \frac{1}{40} = \frac{1}{10000} = .001.$$

The method of reading this caliper is exactly the same as already mentioned above in the paragraph dealing with the basic principle of the vernier.

The Spirit Level

One of the most common implements in all trades as well as in engineering, and essential in all erecting work and also on the marking-out bench is the spirit level.

There are many different types of spirit-level: the one shown in Fig. 63 is fitted with a double plumb, the top one being adjustable. Some levels are fitted with an additional plumb at right-angles to the usual longitudinal one, and these are particularly advantageous, as work can be tested vertically as well as horizontally at the same time. As

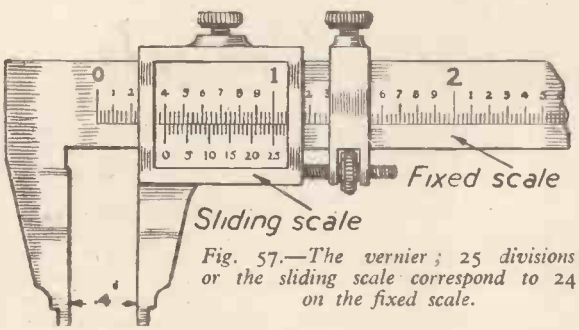


Fig. 57.—The vernier; 25 divisions of the sliding scale correspond to 24 on the fixed scale.

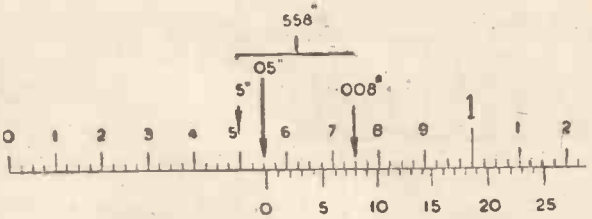


Fig. 58.—This diagram shows how the vernier is read. The sliding scale is shown below the larger fixed scale.

is well known, the work is level when the air-bubble in the plumb is exactly centred on the centre mark.

The Micrometer

The micrometer, or micrometer gauge, provides the most convenient method of taking accurate measurements of diameters and thicknesses of small parts. In general, a micrometer is suitable for reading in thousandths of an inch; it is possible, however, to obtain instruments to read in half-thousandths, or even ten-thousandths.

The essential of a micrometer is an accurate-threaded rod which can be turned in an equally accurate-threaded guide. The usual pitch of the thread for instruments made for English measure is 1/40in.; thus there are 40 threads per inch. In addition, there are instruments made for measuring in the metric system, and these have a screw with 20 threads per cm.—a pitch of half a mm.

The Fundamental Principle

It will be sufficient to consider the action of the micrometer calibrated in English measure, for the principle is precisely the same for any other calibration. A screwed spindle of 1/40in. pitch is passed through a threaded sleeve. Each time the screwed spindle is given a complete turn it will move backwards or forwards (according to the direction of turning) 1/40in. Thus, if a line were scribed along the thread and another were made along the outside of the sleeve, it would be a simple matter to count the number of turns given to the rod. This would be an indication of the number of one-fortieths of an inch that the spindle had been moved.

Figure 59 shows a section through a micrometer of the simpler and widely-used type. It will be seen that there is an anvil with a square face arranged to meet the squared end of the spindle. On the spindle is fitted a thimble, a scale being formed round its end. A longitudinal scale is also provided on the sleeve. The only additional device is the locking ring. This consists of a knurled ring located in a slot in the frame. Inside this is a split ring with an inclined recess on its outer face; a small roller fits in this, so that when the knurled ring is turned the roller closes the split ring and so locks the spindle. The purpose of this locking device is simply to prevent movement of the spindle when a number of articles of similar size have to be checked.

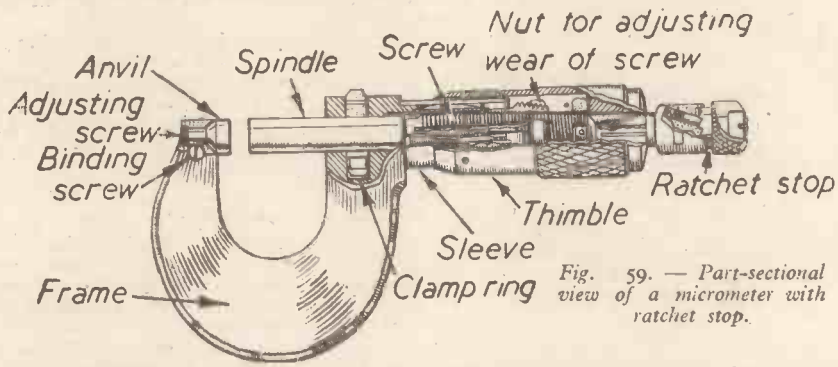


Fig. 59. — Part-sectional view of a micrometer with ratchet stop.

Method of Reading

The scale on the sleeve is divided into fortieths of an inch, and every fourth division is numbered from 1 to 10. On a 2in. micrometer there would be double this number of divisions. It will be seen from this that each number represents 1/10in., and each of the smaller divisions 1/40in. Round the bevelled end of the thimble there are 25 equal divisions, this time divided into fives and numbered 0, 5, 10, etc.

When the spindle and anvil are closely together the O on the thimble is exactly on the zero line of the sleeve scale and the zero mark on the datum line forming the upper edge of the sleeve scale. If the thimble is given a complete turn its zero mark will again be in line with the datum mark on the sleeve and the edge of the thimble scale will be in line with the first division line on the horizontal scale. The reading would then be 1/40in.

If the thimble were given four complete turns the readings would be zero on the thimble scale and one on the sleeve scale. The reading would, therefore, be 4/40 or 1/10in. From this it will be seen how readings are taken in complete fortieths. If the reading on the horizontal scale were, for example, 3 (3/10in.), and the thimble were turned from the zero mark to the first small division, the gap would be opened by an amount represented by 1/25 of one complete turn of the thimble, which is 1/25 of 1/40; this is, of course, 1/1,000in.

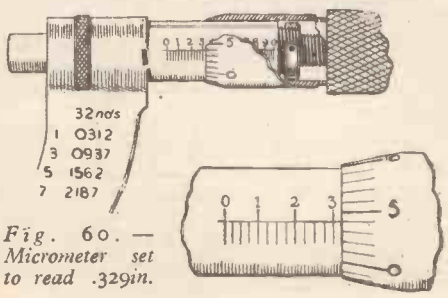


Fig. 60. — Micrometer set to read .329in.

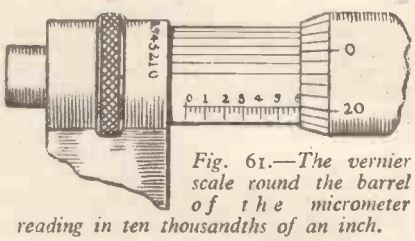


Fig. 61.—The vernier scale round the barrel of the micrometer reading in ten thousandths of an inch.

An Example

We can now take a definite example, such as that illustrated in Fig. 60. It will be seen that the sleeve has been turned one small division past the 3 mark, and then to the fourth line on the thimble or vernier scale. The reading is, therefore, 3/10in. plus 1/40in., plus 4/1,000in. It is best to consider these dimensions as decimals instead of fractions, for their addition is then considerably simplified. There is a list of decimal equivalents engraved round the frame of most micrometers, and a corresponding list of equivalents is given in an accompanying table. Readers will be aware, however, that 1/10in. is the same as .1in., that 1/40in. is the same as .025in., and that 1/1,000 in. is equal to .001in.

If we now revert to the reading given above we can replace our sum of fractions by the following: .3in., plus .025in., plus .004in., which equals .329in. That is the distance between the anvil and the spindle of the gauge, and would be the thickness or diameter of a piece of metal which was a close fit in the gap.

Method of Use

Since the micrometer gauge is capable of giving readings which are accurate to 1/1,000in.

Fig. 63.—Spirit level (adjustable).

it is evident that it must be properly used; any error could easily result in an incorrect reading. One of the most important points is that the gauge must be kept scrupulously clean and free from rust. This applies especially to the contacting faces. To ensure accuracy the reading should occasionally be checked after closing the gap; when this is done the reading should be zero precisely.

The correct method of holding the gauge is with the frame resting in the palm of the right hand, while the thumb and finger hold the knurled portion of the thimble. By holding the instrument in this way the left hand is free to hold the material being measured or tested.

(To be continued)

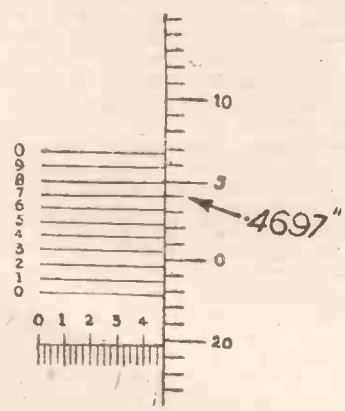


Fig. 62.—Scale of a ten-thousandths micrometer set to read .4697in.

Our Lathe Competition Result

Mr. J. R. Fawcett's Prize-winning Design for a 3½in. Screw-cutting, Back-geared Centre Lathe With Milling, Gear Cutting, Keyway Slotting and Sawing Attachments.

Full list of prizewinners appears on page 57.

A LATHE which is designed so that it can be made by a model-maker with the equipment which would normally be available to him, and which would show sufficient saving in cost to compensate him for his labour, must necessarily deviate in many ways from the machines produced in quantities by the recognised lathe makers. They will, of course, have a full range of patterns, not to mention planing machines and special boring machines, special jigs, etc., whilst it can be assumed that the amateur will usually have access to only a lathe and drilling machine, aided by such hand tools as a hacksaw, file and scraper. Fortunately there is usually a jobbing welder within easy reach, even in the most remote districts, who can give valuable assistance with the framework.

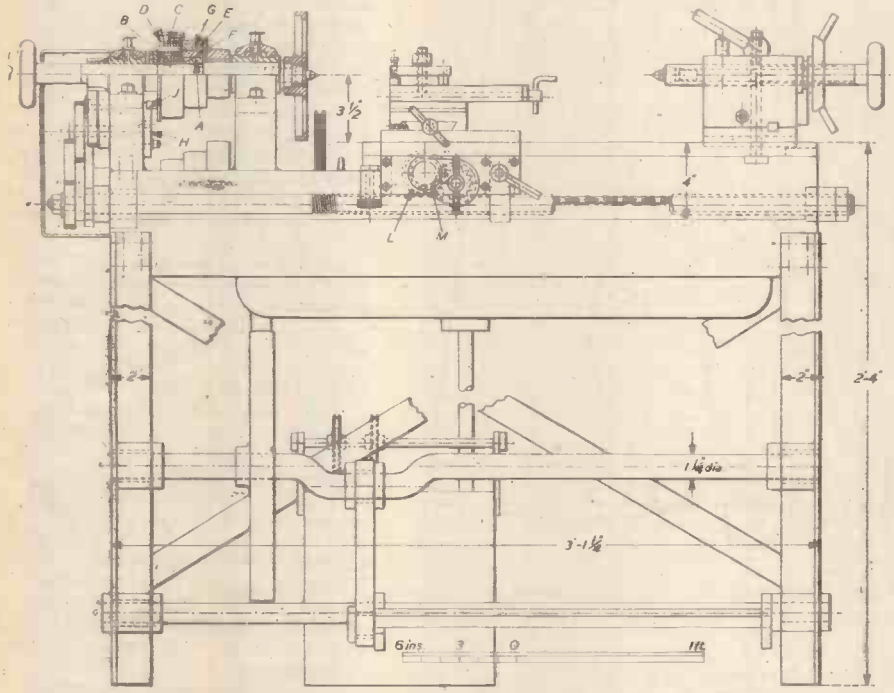


Fig. 1.—Front elevation of the prize-winning 3½in. centre lathe.

Although it is impossible to do anything without a borrowed lathe, it would be possible to use this only for making a few of the parts, such as the main spindle, lead-screws, etc., and then complete the work on the partially finished machine. It would even be possible to cut the gears in this way, but it is probably better in the long run to buy these; there would certainly be little saving in cost after taking into account the expense of the cutters.

To eliminate castings the greater part of the structure of the lathe is made from bright drawn mild steel rectangles, which are available in a wide range of sizes and which can be bought cut to length from a steel stockist, and from rolled section. These have been shown on the drawing in their original shape, but if the builder wishes to improve the appearance of the machine he can round off the corners, although some may find this rather tedious. Personally, as there is no need to save weight, I consider it rather unnecessary and prefer the original appearance. As it is most inadvisable to have two mild steel surfaces running together, the main slideway or bed is made of cast iron. At first this seemed to indicate that it would be necessary to have this part planed, but, fortunately, I discovered that accurately machined I-section cast iron, made by Messrs. J. B. Purefroy Tooling Ltd., could be used. So the bed is made from 4in. by 4in. by ¾in. I-section.

Fig. 4.—Section through cone pulley.

Judging by the elaborate devices used by lathe makers for boring the headstock bearings, it seemed most advisable that the conventional design should be departed from, so the head stock is formed by two British Standard Plummer Blocks, a 1¼in. one for the front and a 1in. for the rear. These are supported on a welded block of substantial proportions and bolted and dowelled in position after aligning with the main slide. When doing this it is an advantage to substitute the spindle by an accurately turned test bar which projects the full length of the bed, and take readings with a clock indicator clamped in the tool-holder.

Epicyclic Back Gear

To eliminate the boring of the holes for a separate set of bearings for the conventional back gear, which would present difficulty without proper equipment, I have adopted an epicyclic back gear housed within the cone pulley, and which operates in the following manner. The gear A is shrunk on to the spindle, as is also the larger gear B, and engaging with these is the cluster of planet gears C, of which there is a pair, diametrically opposite each other. The clusters are made by driving the larger gear over the smaller. These gears are carried on pins driven into the cover plate D. When driving direct the clamping ring E is tightened on to the sleeve F, keyed to

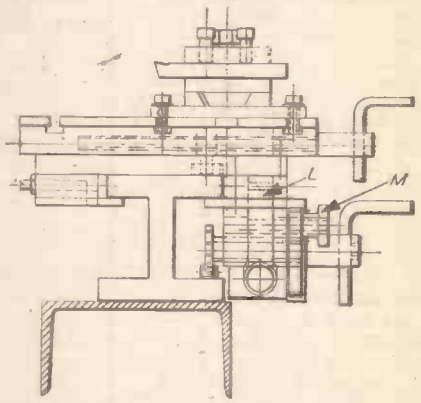


Fig. 5.—Side view of the saddle.

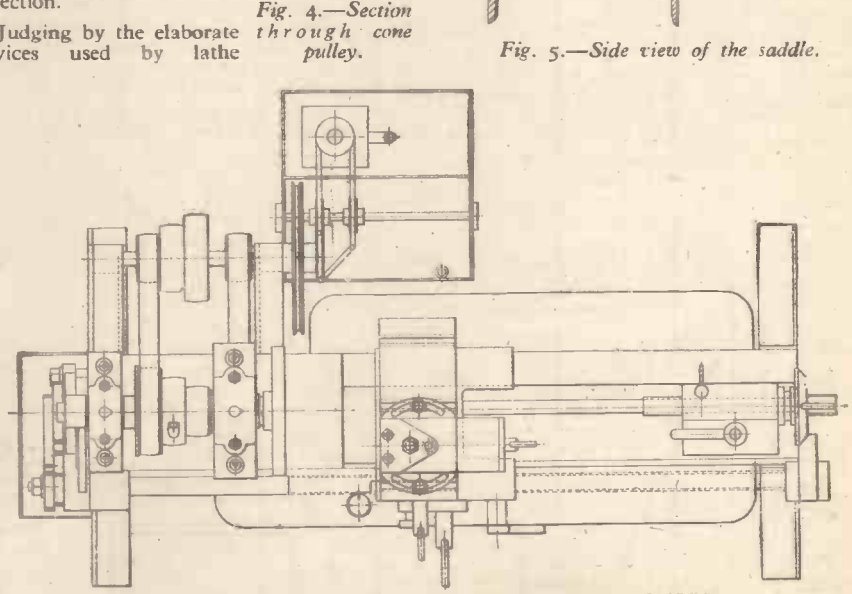


Fig. 2.—Plan of lathe, showing suds sump.

gear A by the screw G. (See the front elevation, Fig. 1, and small sectional drawing, Fig. 4). This renders the epicycle train inoperative and the whole assembly rotates as a unit. To engage the back gear it is only necessary to slacken the screw G and slide up the stop H (which is slotted for the purpose) to engage the pin J on the cover plate and so stop it rotating. The drive is thus taken through the planetary gears from gear A to gear B and the spindle is revolved at reduced speed.

The change wheel gear-train is of conventional design, and I think that the extra trouble in fitting a reverse gear is well worth while. The gear is held in position by the pin K, Fig. 3, but, if desired, the more elaborate spring plunger could be used instead.

Saddle and Cross-slide

These are outwardly of conventional design, but are actually made throughout of mild steel flats, except for the vee-slides, which should be made of ground stock to give a contrasting material for a bearing surface. The component parts are held together by socket-head cap screws and are dowelled after aligning. It might be mentioned here that socket-head screws, made from 90-ton steel, are strongly recommended and should be used wherever possible, the heads being recessed when convenient. Even the smaller sizes, such as 3/16in. (No. 2 B.B.), have considerable gripping powder. Advantage is taken of this to eliminate the milling of the tee-slots in the cross-slide and vertical slide. Milling tee-slots is not an easy job, even with the proper equipment, but by the method suggested it is only necessary to file three grooves to clear the nuts, and these need not be very accurate, and then fit four ⅛in. thick ground stock cover plates spaced to form the screw slots and secured by 2 B.A. screws and dowels. To eliminate cutting a rack, roller chain is used, stretched along the lower flange of the bed. Chains have been used for this purpose on machines other than lathes for many years, and even if not quite as good as a rack, are entirely satisfactory. Separate leadscrews and feed shafts are unusual on small lathes, and the general practice is followed of making the leadscrew do both duties. The drive for the feed is taken by the helical gear L (Figs. 1 and 5). This is a gear cut with the same helix as the leadscrew and need not be a worm wheel with teeth which fit round the leadscrew. It drives the chain sprocket through the reducing gear and is engaged and disengaged by the clamping nut M. The leadscrew nut is of conventional design and slides between two guides, which also act as distance pieces between the two plates forming the saddle apron. A thread indicator of conventional design is fitted on the left hand end of the saddle.

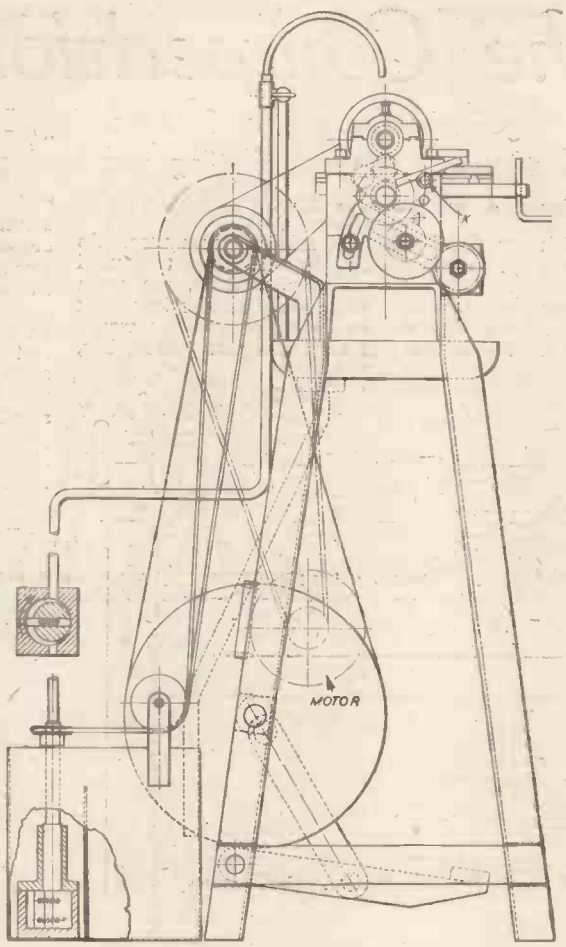


Fig. 3.—End elevation, showing the arrangement of countershaft, motor and treadle drive, and suds tank and pump.

Tailstock

Because of the I-section bed the tailstock (Fig. 6) cannot be made in the usual way, and a groove is milled in the bed to form the tailstock slide. This groove should be cut with an end-mill mounted on the saddle-mounted vertical slide in a bracket similar to that shown for gear cutting, but fitted with bearings, a drive being taken from a motor mounted temporarily alongside. The tailstock quill is identical in the bore with the main spindle and will take collets or a centre, the latter being made either interchangeable with the collets or made cylindrical and held in a collet. A cotter-type clamp is used for the quill, which should preferably be hardened. The clamping bolt passes right through the tailstock on an angle, just missing the quill and applying the clamping pressure right under the centre line, where it is most needed.

Countershaft Drive

Various methods of arranging the drive were considered, but none seemed as good as the fitting of a countershaft on simple brackets at the rear of the machine. This is driven by either the electric motor or a treadle and will accommodate either or both without alteration. A countershaft makes it possible to use a comparatively small, single-diameter pulley on the treadle crankshaft, so that it should be possible to buy this item without difficulty from a dealer's yard. Without the countershaft a larger, three-step pulley would be needed, and this would be difficult for most amateurs to make or obtain.

Suds Tray and Sump

The headstock and bed are mounted on a 6in. by 3in. channel, to which are bolted the 2in. by 2in. angle-iron legs stiffened as shown. A suds tray is fastened under the channel and is shaped to clear the driving belts from below. A sump with strainer is fitted, and this discharges through a pipe to the suds tank on the floor at the rear of the machine which has two compartments with a weir to stop swarf passing to the pump compartment. The pump is of the vane type and is of very simple construction; it is permanently submerged to eliminate priming troubles and is driven by a round belt from the countershaft. To shut off the suds supply in the usual way with a tap would increase the back pressure, even if a relief valve were fitted, and so make it harder to treadle. The suds are therefore controlled by a by-pass tap, which allows the surplus to pass into a large pipe and so back to the tank.

Vertical Slide

Gear cutting, keyway slotting and milling are carried out with the aid of the vertical slide, which is fastened to the cross-slide

(*continued on page 57*)

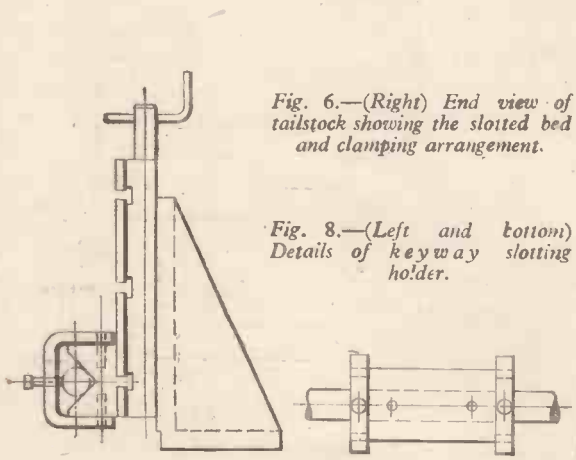


Fig. 6.—(Right) End view of tailstock showing the slotted bed and clamping arrangement.

Fig. 8.—(Left and bottom) Details of keyway slotting holder.

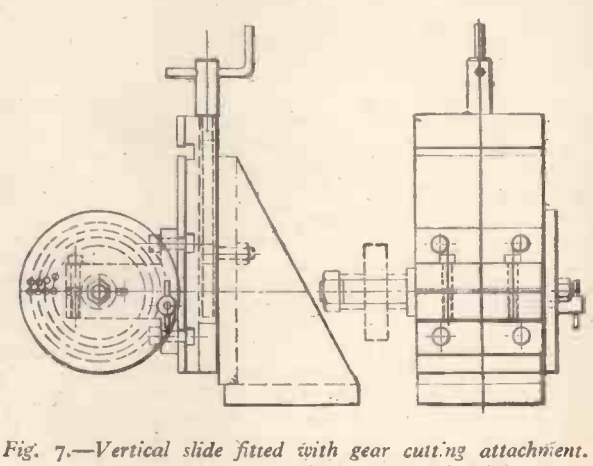
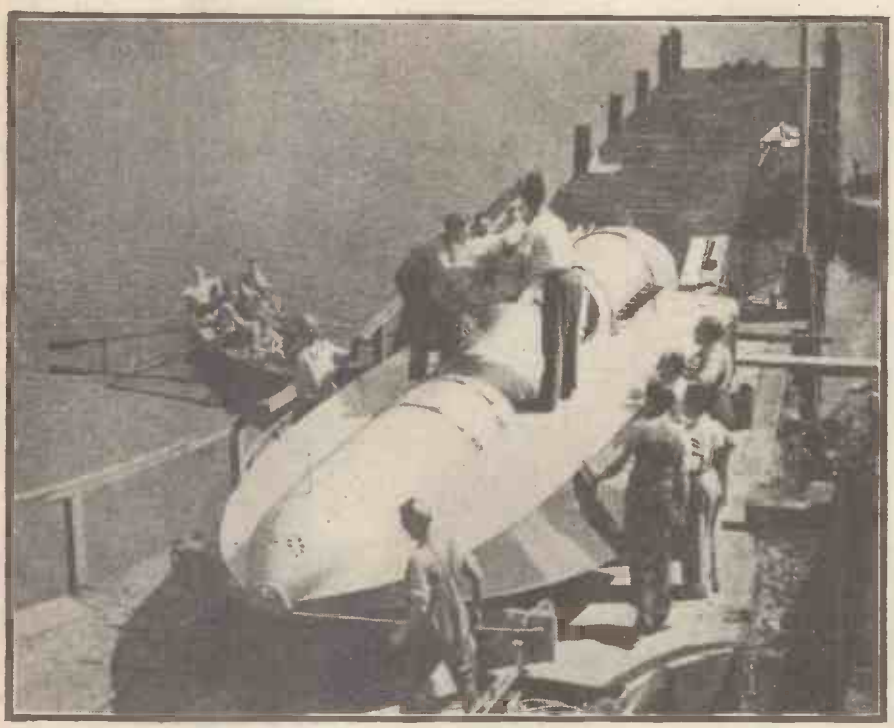


Fig. 7.—Vertical slide fitted with gear cutting attachment.

The "Bluebird"

Particulars of the Famous Speed-boat Now Being Re-designed and Equipped for Another Record Bid on Lake Coniston



"Bluebird" being uncovered on the landing stage preparatory to making an attempt on the record on Lake Coniston last August when the average speed attained for two runs was 135.34 m.p.h., which was 6.4 m.p.h. below the record.

GREAT BRITAIN still holds the world's water speed record which the late Sir Malcolm Campbell established with the *Bluebird*, substantially the same as she is to-day, at Lake Coniston in 1939.

When Mr. Henry Kaiser issued a challenge to this record on behalf of America, Sir Malcolm's son, Mr. Donald Campbell, was determined that this challenge should not go unanswered from this country.

Mr. Campbell's primary object has been to place Britain in a position to meet this threat should it materialise and, at the same time, endeavour to gain some valuable technical data. The problem has resolved itself into reverting to *Bluebird's* original specification as opposed to her experimental form of 1947, for it will be remembered that during that year Sir Malcolm conducted intensive research in the field of high-speed marine jet propulsion.

Bluebird is now rather more powerful and somewhat lighter than in 1939; she is a single-seater hydroplane, designed on the principle of three-point suspension, which means, in effect, that when at speed she planes over the surface supported on three points of the hull, the remainder of the bottom of the boat being quite clear of the water. Her overall length is 27ft., with a beam of 10ft. 10in. at the broadest point. The gross weight, including all machinery, is considerably under two tons. She is constructed of wood, with alloy engine bearers and stiffeners, the cowlings being fabricated of aluminium.

Engine of 2,400 B.H.P.

The power unit, which is placed right aft, immediately behind the pilot, is a 12-cylinder supercharged Rolls-Royce Schneider Trophy engine, developing in the region of 2,400 brake horse-power at 3,500 revolutions per minute. It is interesting to note that this unit is probably the most powerful of the "R" series ever produced, and is the identical engine fitted to the *Bluebird* car when Sir Malcolm achieved his life's ambition of establishing the world's land speed record at 300 m.p.h. on the Bonneville Salt Flats in 1935. It has never before powered the *Bluebird boat*, and is now nearly 20 years old.

The drive is carried right forward to a special Vee gear box designed and built by Messrs. Thomson & Taylor, Limited, which is coupled directly to the propeller tail shaft; the propeller itself rotating at 9,000 revolutions per minute at full throttle.

The craft is not fitted with a clutch, and therefore moves forward directly the engine fires; consequently, the starting arrangement has to be self-contained, and this is accomplished by means of compressed air stored in special high-pressure lightweight cylinders within the hull itself.

The engine is liquid cooled, and an open circuit is employed, water being picked up by a single scoop mounted on the transom and fed to the engine through a header tank and thermostatically controlled by-pass valve. The excess and exhaust coolant is passed to atmosphere over the stern.

Steering is effected by a normal marine stern rudder actuated through an Arens control.

Fuel and Oil Tanks

Two fuel tanks, with a total capacity of 30 gallons, are mounted beside the pilot on the port side, with a 20-gallon lubricating oil tank to starboard.

The hull was reconstructed by her original builders, Messrs. Vosper Limited, of Portsmouth, under the direction of their managing director, Commander Peter Du Cane, O.B.E.

The engine bench testing and machinery installation has been undertaken by Messrs. Thomson & Taylor, Limited, of Brooklands Track, under the direction of Mr. Ken Taylor in conjunction with Mr. Leo Villa, chief engineer of the Campbell Marine & Equipment Company. Messrs. Thomson & Taylor were responsible in the past for the construction of the *Bluebird* car.

As already stated, it was hoped, during the trials, to establish certain critical data, and in order to achieve this end Messrs. Smiths' Motor Accessories, Ltd., produced a set of special instruments which are fitted beneath a Perspex panel in the hull in order that a continuous photographic record can be made of them during a series of predetermined trials by an apparatus supplied by Messrs. Kodak Limited.

OUR LATHE COMPETITION RESULT

(Continued from previous page)

and is of somewhat similar construction (Figs. 7 and 8). For gear cutting an extension block is bolted to the vertical slide and is bored to take a spindle which carries the dividing plate on one end, the gear being cut on the other. A dividing plate with four or five rows of holes should meet most requirements. Shafts for keywaying are carried in the vee-cradle and held by clamps. Milling operations are carried out by securing the parts to the vertical slide or the cross-slide, tee-slots being provided for clamps; and either end mills or saw-type cutters can be used. A plate attached to the top of the cross-slide enables sawing to be done (Fig. 9). The saw is carried on an arbor and supported by a centre in the tailstock.

Phosphor Bronze Bearings

I would recommend that all subsidiary bearings are fitted with phosphor bronze oil-retaining bushes which are of the porous type and are made from powder. The pores retain about 40 per cent. by volume of oil, which means, on a machine of this sort, that the oilcan and oil holes and lubricators can be forgotten, as they will not be needed during the life of the lathe. These bearings are available in a wide range of sizes from stock and cost less than phosphor bronze bar would before machining.

LATHE COMPETITION PRIZEWINNERS

1st Prize: £20
J. R. Fawcett, 37, Mosley Road, Timperley, Cheshire.

2nd Prize: £7.10.0
G. Marston, 118, Fir Tree Avenue, Coventry.

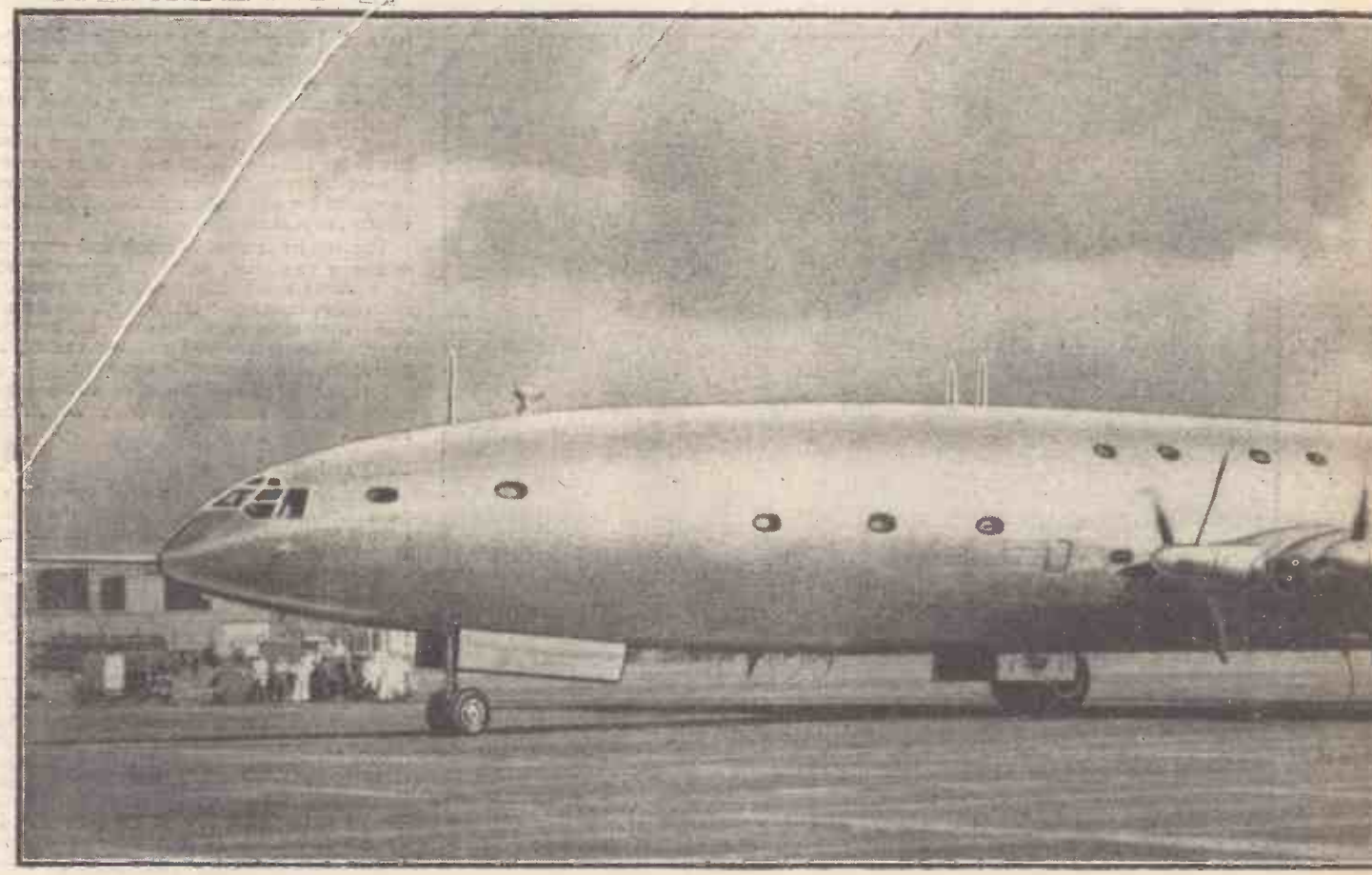
3rd Prize: £5
W. C. Owen, 50, Fellows Road, Farnborough, Hants.

4th Prize: £3
J. H. Halford, (Address wanted)

The "Bristol" Brabazo

The Trial Flight of the World's Largest Civil Lan

BEFORE over three hundred Press representatives from all parts of the world and thousands of watchers who gathered at vantage points round the Filton airfield on Sunday, September 4th, the "Bristol" Brabazon I, largest civil landplane in the world, successfully made her maiden flight,



The Brabazon I taxying along the runway during its rec

This was indeed a day of triumph for the Bristol Aeroplane Company and British aviation generally.

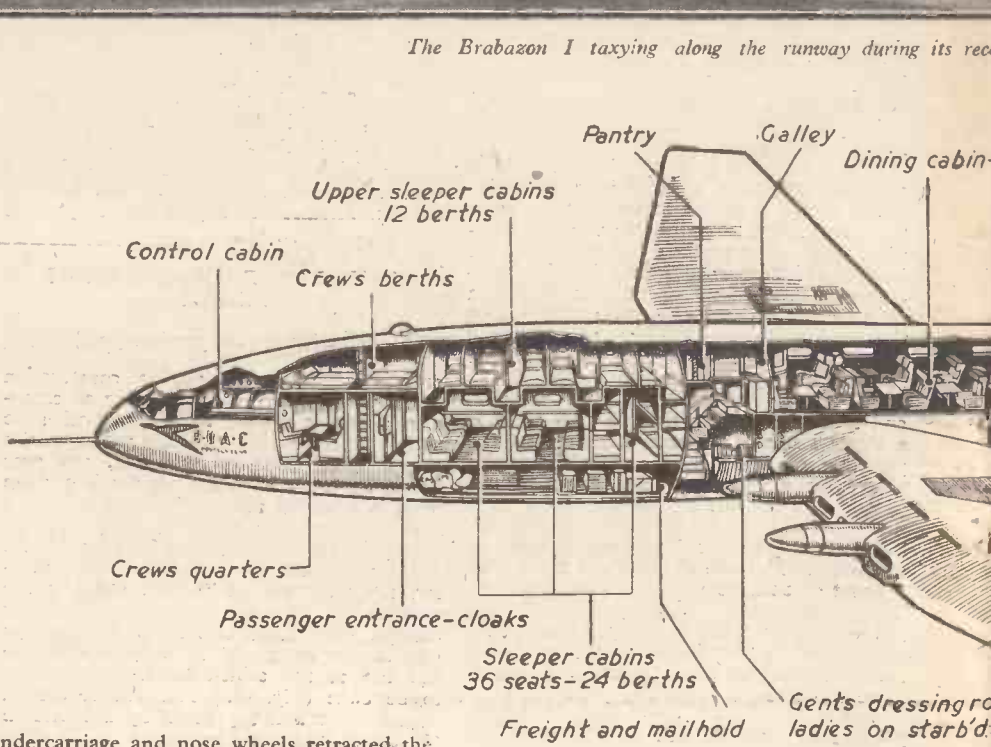
Lord Brabazon of Tara, after whom the aircraft is named, and who was chairman of the Government committee which recommended the aircraft's construction six years ago, watched the take-off from the Filton control tower. He joined in the spontaneous outburst of cheering which went up as the great aircraft, piloted by Chief Test Pilot A. J. Pegg, lifted clear of the runway after a run of about 500yds. and climbed steadily to the east.

The flight took most spectators by surprise. It had been expected that taxying trials, begun the previous day, would last for several days at least and that a circuit would be preceded by a number of "hops." But Mr. Pegg said afterwards that he made up his mind to take the aircraft off while he was taxying to the west end of the 2,750yds. runway.

The Brabazon certainly looked like business as she turned about at the end of the runway. The roar of her eight Centaurus engines deepened into a throbbing, vibrant hum, the control surfaces moved slowly. Then the brakes were released and the aircraft set out along the runway, slowly gathering speed. After 400yds. the nose wheel went up. Then, effortlessly, with barely perceptible movement of the elevators, the great aircraft lifted gently from the runway and began to climb.

The pilot took the aircraft round the Filton airfield in a wide, sweeping circuit which carried her over a large area of Gloucestershire and South Wales. With undercarriage and nose wheels retracted the Brabazon, glistening like silver in the bright September sunlight, revealed grace and beauty not perceptible on the ground.

After 27 minutes' flying, Mr. Pegg turned east over Avonmouth—10 miles from Bristol—

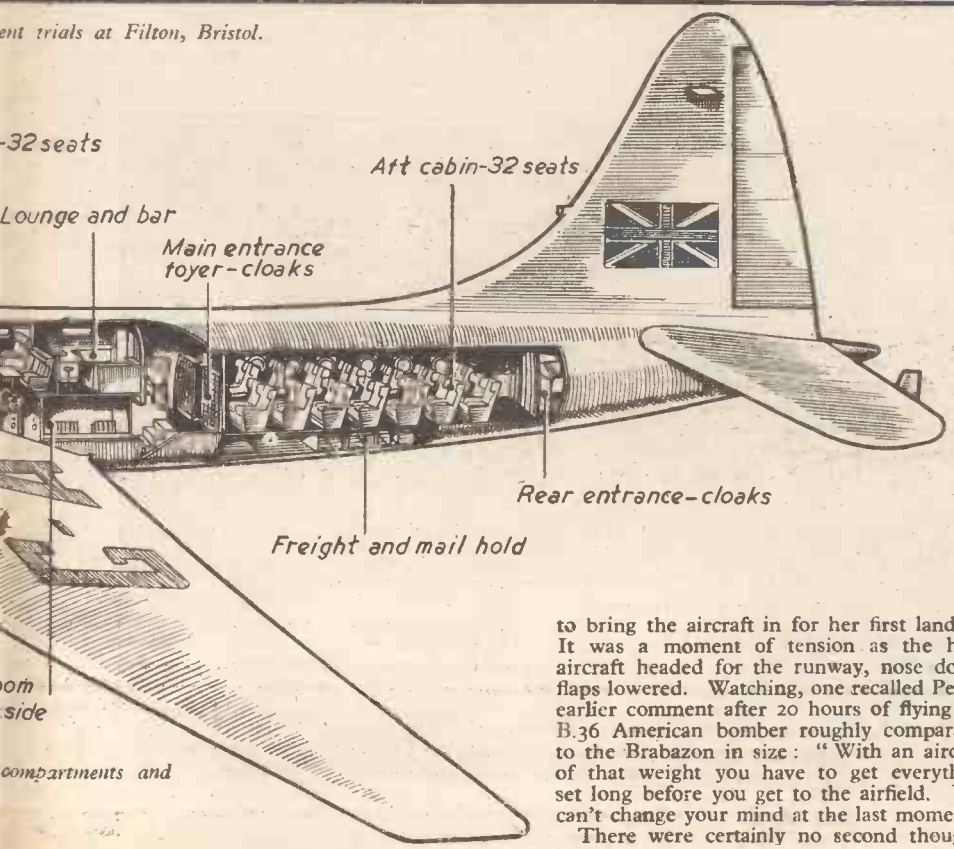


Sectional view of the Brabazon I showing the various accommodation.

on I "Takes the Air"

dplane, and Details of Its Equipment and Runway

ent trials at Filton, Bristol.



to bring the aircraft in for her first landing. It was a moment of tension as the huge aircraft headed for the runway, nose down, flaps lowered. Watching, one recalled Pegg's earlier comment after 20 hours of flying the B.36 American bomber roughly comparable to the Brabazon in size: "With an aircraft of that weight you have to get everything set long before you get to the airfield. You can't change your mind at the last moment."

There were certainly no second thoughts about this landing. The main wheels found the tarmac smoothly, precisely. There was no jar, no suggestion of a bounce. Within 600yds. the Brabazon came to a stop, her landing run shortened by the braking power of the inboard Rotol propellers, which Mr. Pegg put into reverse pitch.

When the crew climbed from the aircraft Lord Brabazon was one of the first to congratulate them. He said: "Never in my experience have I seen such a smooth take-off and such a perfect landing. It was wonderful."

Mr. Pegg commented: "It was a very comfortable ride. Everything went just as we expected." He announced the following details:

Weight at take-off	210,000 lb.
Fuel load	30,000 lb. (4,000 gallons)
Take-off run	500 yds.
Take-off speed	85 m.p.h.
Cruising speed throughout flight	160 m.p.h.
Approach speed	115 m.p.h.
Landing speed	88 m.p.h.
Altitude at which flown	3,500 to 4,000 ft.

The Brabazon Mark I is a trans-oceanic airliner intended for B.O.A.C. non-stop service London-New York. It is a fully pressurised, high-altitude, long-range monoplane. Chief dimensions are as follow:

Wing span	230ft.
O.A. length	177ft.
O.A. height	50ft.
Max. take-off weight	290,000 lb.
Landing weight	240,000 lb.
Empty weight	159,310 lb.
Still air range	5,500 miles.
Operational height	25,000ft.
Max. est. speed	300 m.p.h. at 25,000ft.
Cruising speed	250 m.p.h.
Climb	750 ft./min.
Pressurised to	5.5 lb./sq./in.=8,000ft. at

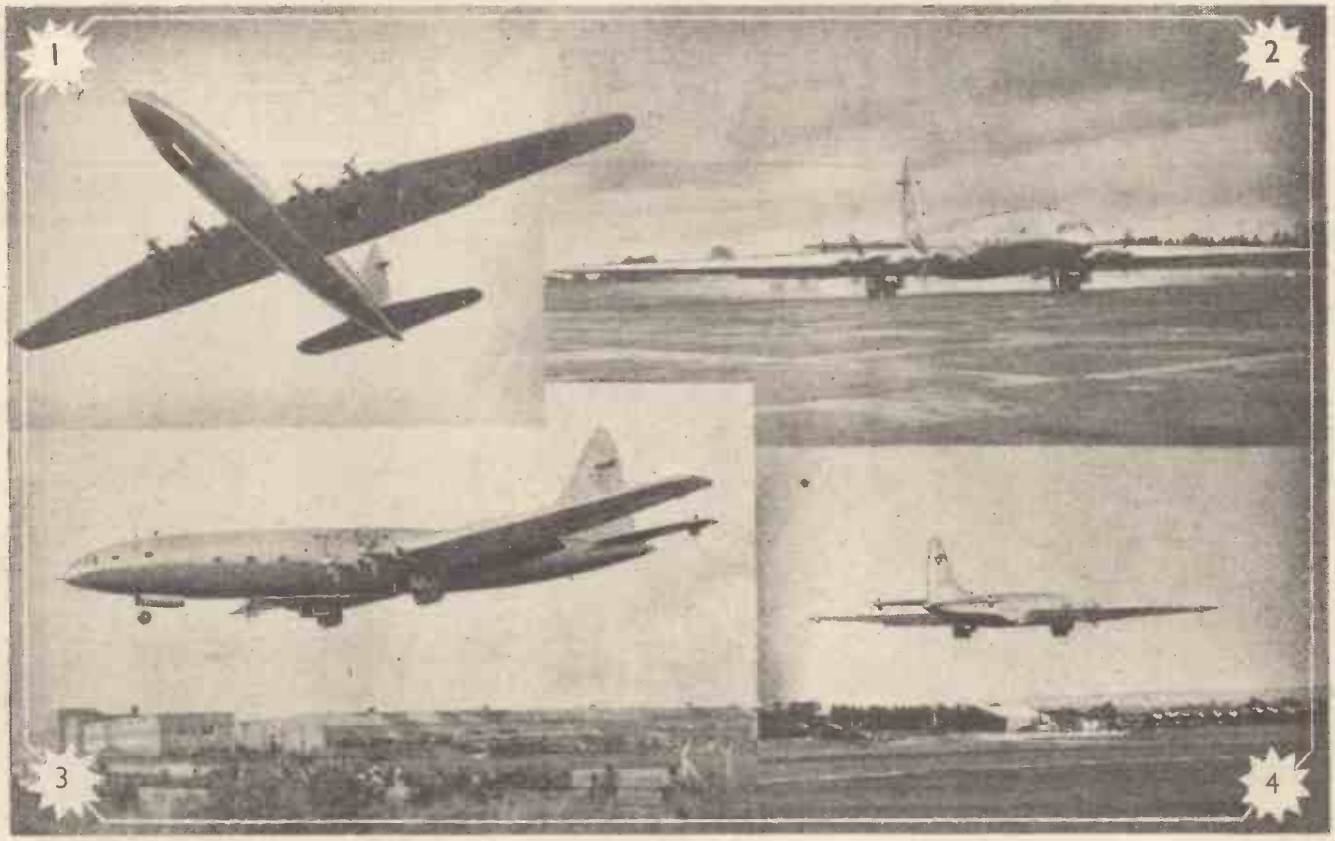


Fig. 1.—An overhead shot of the aircraft taken as she flew over Filton airfield on her first flight.

Fig. 2.—The aircraft taxies in at the end of preliminary taxying runs on its recent trials.

Fig. 3.—The aircraft coming in to land at the east end of the runway after her 2½ hours' test flight, which followed two days after the first flight.

Fig. 4.—A rear three-quarter view just after take-off.

25,000ft. Pressurised from bulkhead at windscreen to R.680 aft.

The fuselage is 16ft. 9in. diam.

Wings

Centre section 110ft. span; outer wings 65ft. span each. Chord at body 31ft. by 6ft. 6in depth. Chord at tip 10ft. Outer wings carry flexible fireproof fuel tanks, 13,500 gallons in all. Wing area 5,317 sq. ft.

Tailplane

75ft span.

Fin and Rudder

50ft. to tip standing.

All-hydraulic Operation

For flaps, U/C. doors, engine fire flaps, etc.

Anti-icing

Double skin, i.e. warm air from Janitrol heaters.

Undercarriage

Twin wheels on each leg (60in. by 35in.). (As temporary measure—twin tyres on each of two wheels.) Mk. II will have four-wheel bogie.

Static reaction at take-off weight: main wheels 134,050 lb.; nose wheels 21,900 lb.

Track of main wheels 55ft. centres. Pneumatic brakes.

Engine installation (Mk. I only)

Eight "Centaurus" 20 (18-cylinder sleeve-valve) each 2,500 h.p. take-off, completely enclosed in inner wing. Four pairs at 64 deg. (32 deg./32 deg.) coupled to a gearbox, each driving a 16ft. Rotol propeller. Props are contra-rotating, co-axial, three-blades, with self-contained constant speed, feathering and pitch-reversing mechanism. Engine drivers are independent. Engines are accessible in flight. Accessories driven off two gearboxes—one on each inboard installation and all services are duplicated. Mk. II will have "Proteus" propeller turbines.

The Brabazon Assembly Hall

The assembly hall, largest of its type in the world, was planned specifically for the assembly, initial production and flight testing of the Brabazon. Design was initiated in April, 1944, work on site began in April, 1946, and the east bay was ready to receive the fuselage and major components of the Brabazon when they were transferred from the flight shed in October, 1947.

Throughout final assembly and the long programme of structural tests the Brabazon I had been housed in the east bay except for one brief period earlier this year when it was transferred to the centre bay while weigh-bridges were built into the floor of the east bay. In the central bay work has begun on the Mk. II aircraft and on a nose compartment which is being specially built for pressure tests. The west bay is the headquarters of B.O.A.C.'s Atlantic Division.

An early picture of the aircraft, taken in January, 1946, when the Brabazon was no more than a metal skeleton.

Main Dimensions

Overall width of hall	1,052 ft.
Overall depth of the full centre bays	420ft.
Overall depth of the "half" side bays	270ft.
Clear span of the roof trusses ..	331ft.
Height of the building to eaves ..	83ft.
Height of the building to roof apex	117ft.
Floor area of the hall	325,000 sq. ft. (7½ acres).
Area of the apron	290,000 sq. ft. (6⅔ acres).
Cubic capacity of the hall	33,000,000 cubic feet.
Size of the doors	1,045ft. long, 65ft. 9in. high.
Size of the north wall window	1,045ft. long, 50ft. high.

The Runway

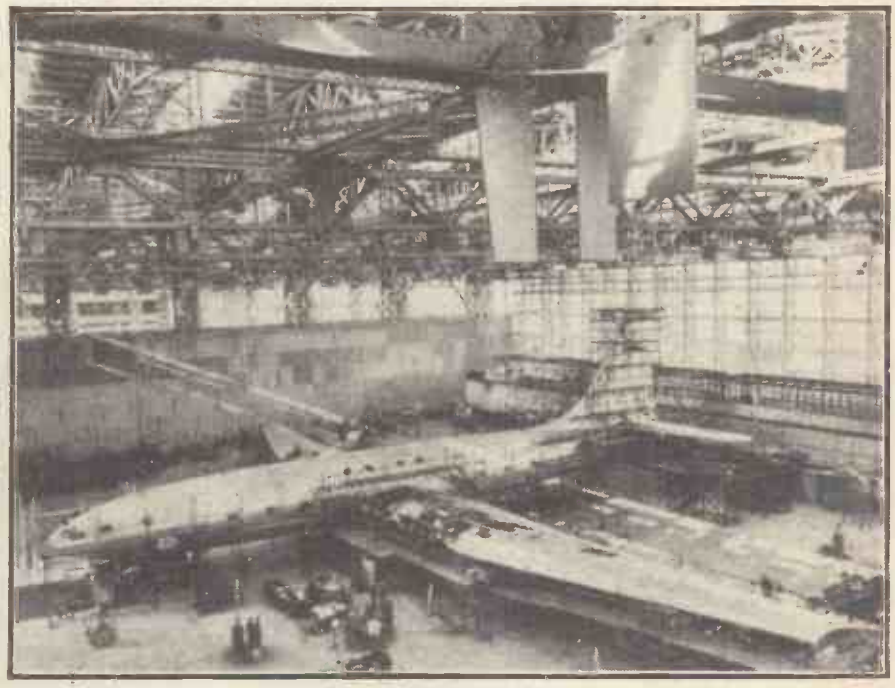
When it was decided that the task of building the Brabazon I should be entrusted to the Bristol Aeroplane Company, high priority was given to the problem of extending the existing 1,500yds. runway at Filton to a length sufficient to allow an adequate margin of safety for initial flight testing.

The location of Filton airfield made the extension possible only in a westerly direction, involving the removal of the small village of Charlton, directly in line with the runway at its western end.

On April 1st, 1946, with the Brabazon I already beginning to take shape on the jigs, the contractors for the runway, Messrs. John Laing and Sons, began to build houses at Patchway to accommodate the villagers. By August 31st, the contract for 50 houses was completed, and a week later a formal opening ceremony was performed by the Minister of Health.

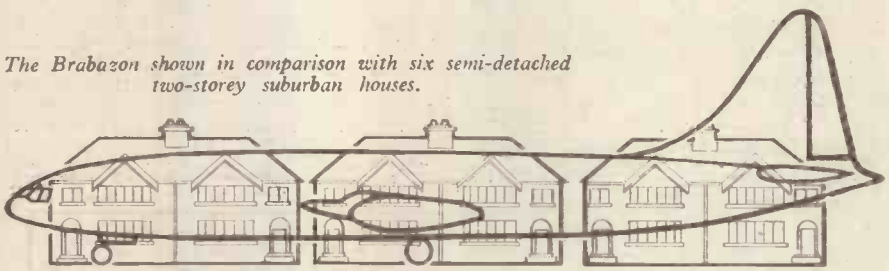
With the people of Charlton transferred to new homes, bulldozers set to work. Soon the village had vanished, and giant machines began to make the main cut at the western end of the runway. The depth of excavation varied with the lie of the ground from 8in. to as much as 14ft. Something like 1,000,000 cu. yds. of excavation had to be made. 650,000 cu. yds. of earth were shifted, and roughly 655,000 cu. yds. of soil were used to fill natural depressions, old wells, cesspits, and so forth.

To enable flying to continue at Filton while the runway was being built, a temporary flying strip, 1,400yds. long, was laid down and a system of traffic control devised to keep lorries and machines clear of the landing area.



The aircraft almost structurally completed in January, 1948.

The Brabazon shown in comparison with six semi-detached two-storey suburban houses.



The new runway is one of the strongest in the world, capable of standing up to aircraft heavier than any yet built. 2,725 yds. long and 100 yds. wide, it has concrete circles 200 yds. in diameter at each end. The base contains 400,000 tons of hard core, in three 8in. layers. On top of this, 70,000 cu. yds. of concrete form a sub-base 8in. thick. For the 12in. top layer, 105,000 cu. yds. of fine concrete was laid in bays 20ft. wide, and the topmost layer was spread dry enough to enable a 10-ton roller to compact it a couple of inches.

Lighting System

Runway lighting is carried out with 140 contact light fittings, 70 on each side of the runway, spaced at 100ft. intervals from east to west. The top of each fitting is level with the runway surface, and the power of each is approximately 1,000 candlepower. The lights are connected as two circuits, one from each of the two control houses at either end of the runway, each circuit supplying alternate light fittings, thereby reducing the risk of the whole lighting system being out of commission through a fault in one control house.

From the east and west ends of the runway and on its centre for a distance of 4,500ft. in each direction, 140-watt sodium approach lights are located at 300ft. intervals to guide aircraft on to the centre line of the runway so that they can pick out the contact lights marking the edges.

Supply for the runway lighting system and for the radio aid system is taken from the assembly hall sub-station, in which have been installed two 50 K.V.A. 420/3,300-volt transformers and 3,300-volt switchgear. The supply is given at 3,300 volts and transmitted by two underground cables to the control houses at each end of the runway. These control houses contain the various items of equipment necessary for all the services on the airfield.

Control of the various airfield lighting circuits—with the exception of the obstruction lighting—is carried out from the local tower, situated on the south side of the runway towards the west end. Radio aids on the airfield and at points on the east and west approaches are never without electricity supply, being controlled locally where necessary and not from either of the two control rooms on the flying field. In both control towers, the duty officer has an indicator for each lighting circuit so that he can tell at a glance if they are operating correctly.

Between the south side of the runway and the assembly hall runs a branch railway line. To enable the Brabazon to cross this, Messrs. G. K. Jensen and Co, Ltd., were commissioned to design and erect a level-crossing gate far larger than anything previously designed.

Completed late in 1948, the scheme embodies two gates, one on each side of the railway track. Each gate measures 110ft. wide with a protective fence 4ft. 6in. high. They are operated from a control house which is connected by telephone both to the flying control and to the railway signal box at Filton Halt. The gates are the largest and only power-operated level-crossing gates in the world.

THE WORLD OF MODELS

Some Interesting Gauge O and HO Model Railways in Switzerland

By "MOTILUS"

Fig. 1.—A general view of the scenic, Gauge 1 railway of Mr. H. Kurz, of Bern. Good use has been made of the natural properties of the garden itself to form some interesting scenic features.

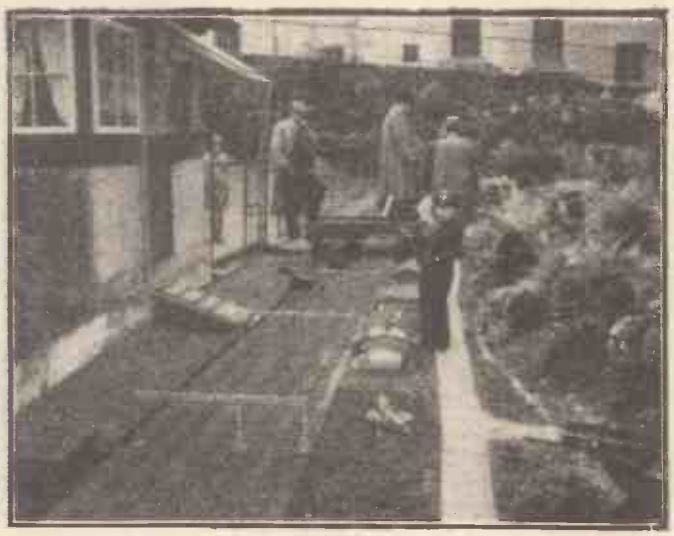


Fig. 2.—A youthful "guard" awaits a train arrival on Mr. Kurz's garden railway. Members of the Berne Model Railway Club are seen also, admiring this unusual scenic layout.

CONTINENTAL model-makers are certainly well ahead with new ideas in all phases of model-making, including design, production and display. For the benefit of readers interested I would like to record some of the progress I was happy to see in Switzerland this summer, and which added to the knowledge I have gained from Continental correspondents and featured in previous articles during past months.

Berne Model Railway Club

Last June I spent a few days in Berne, the fascinating capital of Switzerland. While there I was very pleased to have an opportunity of meeting members of the Berne Model Railway Club, including the president, Mr. W. Haas, the vice-president, Mr. Brunner, and also Mr. H. Gossett, a past-president of the club.

The Berne Club is quite an important one and has over 200 members of all trades and professions. The City Council of Berne have been sufficiently interested to place a well-equipped workshop at the disposal of club members. Among the founder members are Mr. Gossett and also a well-known Swiss violinist, Mr. Kaegi. Mr. Arthur Honegger, a famous modern composer, is an enthusiast for model railways, and during a visit to the club some time ago he was snapped while astride an English model locomotive of Bassett-Lowke manufacture, although I have not been fortunate enough to secure a print. Readers may know that Mr. Honegger wrote a symphony on the theme of the French locomotive, "Pacific" 231.

Like most Swiss clubs, these model-makers concentrate on electricity as a prime mover, although a few members are steam propulsion fans. The popularity of Gauge 0 still predominates in this club as it does in the majority of the other clubs over there.

Through the courtesy of Mr. W. Haas I had the great pleasure of seeing a beautiful model railway built by club member Mr. H. Kurz. It is situated in the large garden of the owner, and represents the northern portion of the famous St. Gotthard railway. The garden is spanned by one of the huge concrete arches of the Swiss Federal Railway main line between Zurich and Olten. This gives an unusual railway atmosphere for the miniature railway that lies below it.

The railway is Gauge 1, with flat-bottomed rail, partly brass and partly steel. The total length of the running track is 1,000ft., but with sidings it amounts to approximately 1,750ft. There are five track levels, the highest being some 6ft. above the lowest, and with the scenery the whole model reaches a height of 25ft.

Fig. 3.—(Above) The interior of Mr. Kurz's control cabin, from where his whole garden railway can be operated.

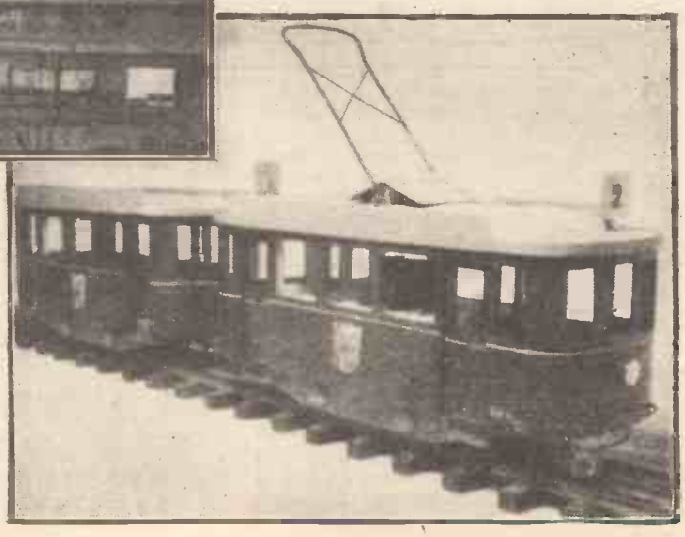


Fig. 4. — A model Swiss tramway car, of excellent finish: an example of the Gauge O work of Mr. W. Boegli of Berne.

D.C. Generating Plant

Mr. Kurz is in the signal control department of the Swiss Federal Railways. He has himself built the electricity generating plant for providing current for the railway at 35 volts D.C. This is unusual in Switzerland, as most of the model railways are run on A.C., although D.C. is now gaining favour owing to its special properties, that enable distant control of siding and shunting yard operations to be carried out with greater accuracy and precision. The enthusiasm of Mr. Kurz for signal control and point operation is apparent in his splendid control cabin, from where the whole railway can be operated. The accompanying illustrations, Figs. 1, 2 and 3, give some idea of this excellent work.

The scenery and general layout of the

track is most realistic. There are six tunnels, natural vegetation and a large lake, fed with running water, which is supplied through a rotary pump operated by a stationary steam engine. It also includes a special feature of the St. Gotthard railway, the Wassen church, which is seen from the train at three different levels when travelling on the real railway.

Many types of locomotives are used on the railway, including a model of the famous high-speed Red Arrow locomotive.

The model has taken three years to build, the combined work of Mr. Kurz and two other enthusiasts. As a scenic, outdoor model railway this is one of the finest I have ever seen, even in Switzerland!

Another visitor who came to see me from the Berne Club was Mr. W. Boegli, who is an amateur specialist in the building of wooden vehicles for Gauge O (35 mm.). Mr. Boegli's models are well proportioned and excellently finished: the range includes both standard railway vehicles, such as goods wagons, open wagons, timber wagons, etc.,

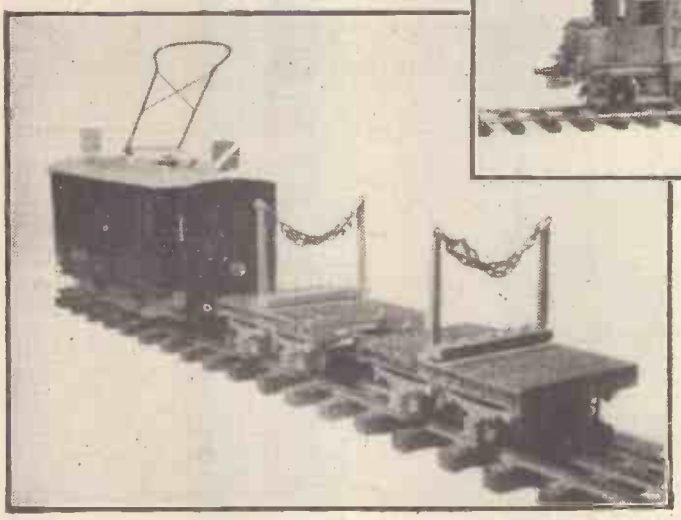


Fig. 5.—A model Swiss timber wagon : another of Mr. Boegli's Gauge O masterpieces.

and also tram-cars of the Swiss type, to the same scale, all of them being electrically driven by the overhead system (Figs. 4 and 5).

Zurich Model Railway Club

This year I had the first opportunity of attending a meeting of the Zurich Swiss Model Railway Club, which took place at a Zurich restaurant in a typical Swiss atmosphere. Being in the German section of the country, the lecture and discussion that took place were in German, with which I am not conversant, especially in relation to technical subjects. However, the main points of procedure could be followed and I certainly spent a pleasant evening.

About a hundred members attended this meeting, of all ages and of varying occupations in daily life. Proceedings opened with an address from the chairman, club president Mr. Walter Siegwart, who is also president of the combined model clubs of Switzerland. Following the usual business announcements and greetings, a club member (one of the technical electricians of the Swiss Federal Railways signalling and controls department) delivered a lecture on some tricky points of electrical control for model railways, amply illustrated with blackboard diagrams. From the studious interest taken in the talk by club members it was clear to me that the lecturer knew his subject from A to Z.

During the evening members were able to examine and discuss many examples of each other's model work that were brought along for display. This included a Gauge o layout (centre rail system), with vignoles section rail and wooden sleepers in their natural colour. The locomotives were fitted with overhead pantograph contact, working at 20 volts A.C. The train I saw running before the meeting commenced, consisted of locomotive, three passenger coaches, one baggage van, one petrol, and one beer wagon.

Some of the individual models brought by members were of outstanding quality. Mr. Buhlimann, of Zurich, showed me a unique range of his own handiwork. He specialises in historic locomotive models made by hand and mostly in brass. These included an American steam locomotive of the period 1865, *S minole*, a 2-4-0 type for Gauge O, to the scale of ¼in. to 1ft.

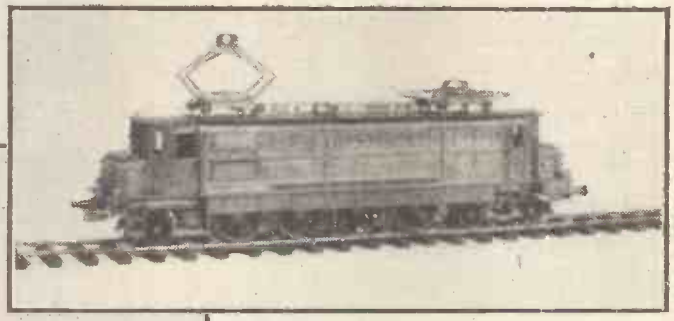


Fig. 6.—A Gauge O Swiss express locomotive model made by Mr. H. Muggli, a member of the Swiss Model Railway Club of Zurich. Mr. Muggli achieves an amazing amount of detail in his models, despite the fact that he works only with simple bench tools.

Also an American postal car of the year 1857, as used on the Pennsylvania Railway. Mr. Buhlimann is now engaged in making a model of the *Rapide*, an American locomotive of 1816, also in Gauge O. Next on his list is a French P.M.L. locomotive of 1815, *La Petite Bourbonnet*, for which he has already obtained drawings from Mr. J. Fournereau, of Montchauvet, France. In addition to the models I saw that evening Mr. Buhlimann has 25 other locomotives he has built from time to time. Unfortunately, I have not been able to obtain any illustrations of these quaint old-time models.

I very much enjoyed examining the model work of Mr. H. Muggli, of Monchaltorf, another member of the club. Mr. Muggli is not a professional craftsman, and his models are all made with simple bench tools, yet include excellent detail in their construction.

Mr. Muggli's Gauge O railway models are all exactly to Swiss Federal Railway standards (Figs. 6 and 7). They included a group of "Shell" oil wagons and an express type Swiss locomotive with pantograph collector; also a specimen works' crocodile car, as used in the works of Messrs. Brown Boveri, of Baden, near Zurich. This is a two six-wheeled bogie car with a central well, and the illustration, Fig. 8, shows the model wagon transporting two large model transformers.

Some of the junior members of the club were present and produced some promising work for inspection. I especially remember examining with pleasure some model Gauge O wagons and passenger cars with pantographs and centre rail contact, all made in metal by one of these young enthusiasts, Mr. Hürlimann.

The evening was a most pleasant one. Club members turned up in good force and were pleased to welcome some distinguished visitors from other parts of Switzerland. Two old friends I recognised were Mr. R. Marescot, of Lausanne, an experimentalist and model-maker, and Mr. Karl von Speyr, of Hergiswil, near Lucerne, who is keen on small and large-scale railway models. The whole proceedings were conducted with an air of quiet conviviality, light refreshments being passed round and consumed during the meeting.

A Fine Scenic Model Railway

What is claimed to be the most comprehensive Gauge O and HO (OO) working model railway layout in Europe (Fig. 9), is one designed and built by the firm of Franz Carl Weber, A.G., at the principal shop in Zurich. This has been constructed as a permanent working railway in order to demonstrate the latest locomotives, rolling stock, signal and point devices. The railway has two separate layouts: one in Gauge O (35mm. or 1¼in.) and the other in Gauge HO (16½mm. or §in.).

The Gauge O is a double track of about 320ft. and as can be seen from the control

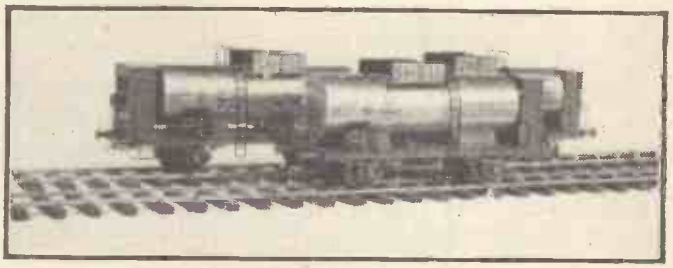


Fig. 7.—A group of Mr. Muggli's Gauge O "Shell" oil wagons.

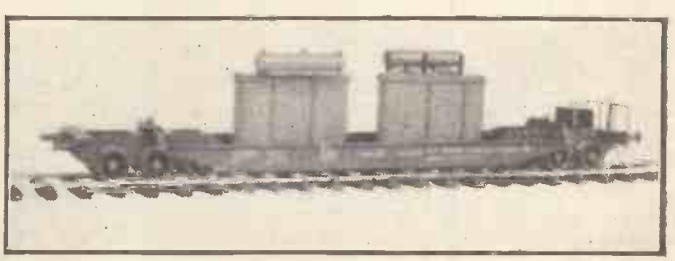


Fig. 8.—An unusual Gauge O model, also by Mr. Muggli. A "crocodile" car, as used in the extensive works of Messrs. Brown Boveri, A.G., of Baden, Switzerland, well known electrical engineers. The wagon is shown with two model transformers being carried.

diagram reproduced here, there is a loop at each end. Starting from a large station, it runs over three bridges and through six tunnels, passing a smaller station and over a dozen points, surrounded all the way by "dreamland" Swiss scenery including mountains, valleys, alpine pastures with cattle and chalets and even a large pond. Eight different trains can be run simultaneously, one following another. Two of these are of the express type, with exact scale models of the latest electric locomotives on the Swiss Federal Railways: they haul the required number of steel, bogie passenger and baggage coaches. In addition, there are two ordinary express passenger trains and two ordinary goods trains. Most of the rolling stock is of Swiss manufacture.

Elaborate Train Control

The special technical feature of the whole Gauge O exhibit is without doubt the elaborate system of train control installation (Fig. 10). This is housed in a glass case, so that it can be clearly viewed by all visitors.

Fig. 9.—A general view of Messrs. Weber's Gauge O and HO railways, showing several trains on the tracks and glimpses of the varied and characteristic scenic effects.

It includes a complete plan of the track layout, on which coloured lights indicate the position of all signals and all trains, whether stationary or running. The installation demonstrates in miniature all the safety devices of the modern railway block signalling system.

So many precautions are necessary for the purpose of guaranteeing absolute safety for trains travelling at speed. First, the "distant" and "home" signals along the line: then the blocking devices in the stations, which are operated by the station master or, on some routes now, automatically operated by the trains themselves. The "brain" of this model railway lies in the glass-fronted signal box, which contains 36 relays with their respective contacts and locking devices.

The whole Gauge O layout is sub-divided into 10 block sections which allow a maximum of nine trains travelling simultaneously, one after another. The trains follow one another so quickly that the signal rarely shows a green light, for the trains may continue their journey with reduced speed as soon as the amber light shows. If, however, there are only six or seven trains operating, the green light shows as soon as the line is clear, since two block sections have become clear between two trains following one another. The eight points are locked and made safe in such a way that they cannot be changed as long as a train is travelling across. Furthermore, the whole journey must be carried through once the starting signal is given: only when the last wheels of the last wagon of a train have passed over all points in a particular block section, can these points be changed again. If the point is not fully switched over (e.g., because of an obstruction between the switch blades and stock rails), the block signal in front of the point will show a red light until the point has been correctly switched. At the same time, the track inside the station must also be clear: the point may be in order, but even if only one single wagon remains in the station and is on the track to be used, it is impossible for the approach signal to show "Line clear." So no collision can occur, even through the overlooking of small details. Even if a coach or wagon becomes uncoupled from a train on the line, the section where it stops will remain blocked until the wagon is removed. In other words, the safety device reports the insulated rail as "occupied" for as long as a wheel is on it.

Since this model railway opened on November 9th, 1948, and up to Easter, 1949, an electrical counting instrument has recorded more than 70,000 trains passing one point on the track. If worked out mathematically, it would be found that each train has covered a distance equal to that from Zurich to Paris and back!

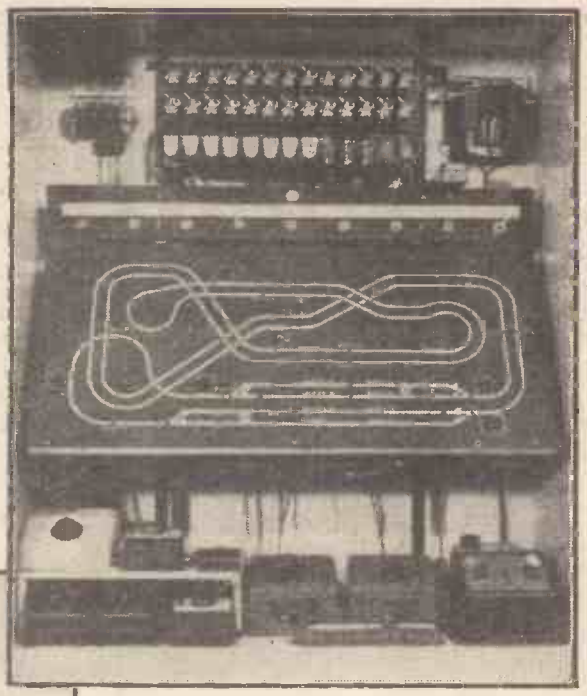


Fig. 10.—The train control installation for the operation of the wonderful Gauge O model railway of Messrs. Weber. The track plan can be clearly seen.

At a higher level and placed well to the back of the general exhibit, lies the Gauge HO layout. On this six different trains run simultaneously, including trains of the Swiss "Junior" make, and also some of Maerklins, of Goeppingen, Germany. Being smaller in size, this layout gives a sense of distance and perspective when viewed from the front of the Gauge O railway. Eight bridges and six tunnels are among the interests of the HO line, which is approximately the same length as the Gauge O track.

Apart from being a great attraction for customers and visitors to Mr. Weber's shop, this model railway has a certain appeal for any model enthusiast interested in the complicated operation of such an elaborate working model railway as this, as well as to railway students, because of its faithful reproduction of many modern railway signalling operations and other features.

The whole installation was designed and planned by specially trained experts of the firm of Franz Carl Weber, A.G., most of them also being members of the Swiss Model Railway Club of Zurich. They are certainly to be congratulated on a splendid achievement.

The Editor does not necessarily agree with opinions expressed herein

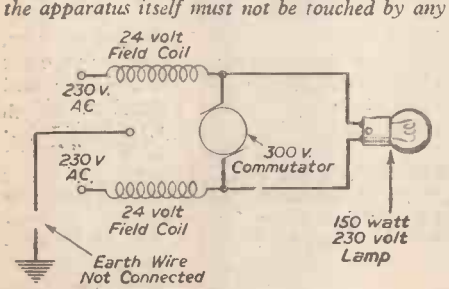
Converting Ex-aircraft Generators

SIR,—With reference to the article by H. H. Ward, in the July issue of PRACTICAL MECHANICS, on converting Ex-Aircraft Generators to A.C. motors, I experienced racing in my generator as explained in the article, so I tried out the scheme as suggested. I obtained a steady speed but overheating, hot coils, etc., were observed, so I switched off right away and tried various lamps in series up to 100 watts. The result was no better. I would be glad of some help in this matter, and the following is a description of my rotary generator. Ex-R.A.F. marked "V", 24 volts input D.C., output 300 v.—150 v.—14.5 v. (three outputs).

I put 24 volts D.C. in series with 300 volts and a 60-watt lamp. This ran well but overheated, so I tried a 100-watt lamp, which still overheated. Finally, I tried 150 volts and this blew the fuses. In each case I removed brushes not required.—J. CRAMB (Newbury).

SIR,—The now prevalent practice of running 24-volt apparatus on the 230-volt mains is bad electrical technique as the insulation value of the wire covering and coil bindings may not be high enough to withstand the new voltage. Owing to the very rigid specifications laid down for Government electrical contracts, these windings do withstand the new voltage in most cases, but there are cases where, due to damp storage, etc., this insulation value has decreased to a point where it will break down under load but will remain intact when only a few milliamps are flowing. It would appear that Mr. Cramp's apparatus has this fault and a megger test, made by a local electrical contractor, would be advisable before using the generator again.

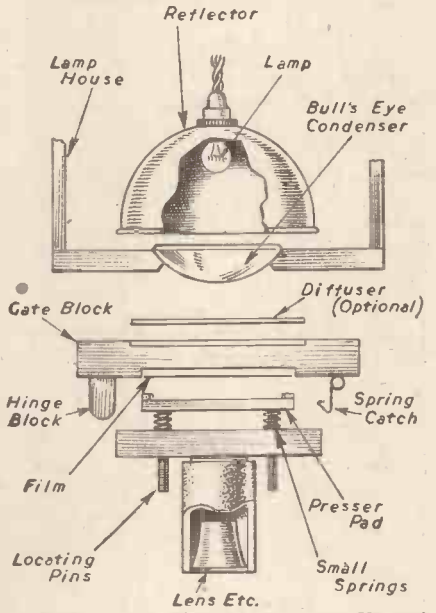
The effect of putting in lamps of 60 watts, 100 watts and 150 watts was to increase the almost negligible field current by approximately 0.25 amps., 0.4 amps. and 0.6 amps., respectively. Taking the vendor's rating of one eighth h.p. for even the largest of these machines and allowing for much inefficiency, their consumption should not exceed 1 amp. Thus the machine with 150-watt lamp in parallel should not consume more than 1.6 amps., which should not blow the fuse. If the apparatus is earthed, as it should be, a breakdown in insulation can send a heavy flow of current through the insulation and so blow the fuse. Merely as a test, Mr. Cramp might try rigging up the apparatus with 150-watt lamp and *no earth wire, as shown in the diagram. The current should be switched on from a switch remote from the apparatus and the apparatus itself must not be touched by any part of the operator's body.* If it fails to blow the fuse, this is proof of faulty insulation which might be rectified by rewinding the field coils with more turns of finer wire. Under these circumstances (i.e., without being earthed), the machine may appear to run satisfactorily but even so, it should not be used until the leak has been found and rectified owing to danger of shock.—H. H. WARD (Wallasey).



Test diagram for insulation test.

Film Strip Projector

SIR,—I read with interest Mr. Kay's article on a home-built film strip projector, but why does he use a bottle of water as a condenser-cum-diffuser? Any multiple stores would supply him (for 6d.) with a bullseye of sufficient optical correctness to give a flat white screen or, if desired, a frosted glass plate placed between film and bullseye would give even better results. By using this method his lamp-power would be cut down so much that such a large lamp-house would not be necessary. Indeed, a cycle headlamp (torpedo-type) would yield all the space required, and a bell-transformer all the current for this size picture. Using the same powered lamp as your contributor, and a reasonably good condenser, I can project a brilliant picture 6ft. by 6ft. up to 35ft. or 40ft. Mr. Kay will also find that if he fits a pressure feed (as shown in the accompanying sketch) and hinges his gate, the loading of film will be greatly facilitated.—F. W. MARKHAM (Darlington).



Details of suggested improvement to a film strip projector.

Cycle Lighting

SIR,—Having read with interest the various suggestions by readers regarding cycle lighting, I would like to submit a system which I have used for about three years with great success.

It comprises both lighting and bell running from a battery in the saddlebag. My idea in using this method was to eliminate the "drag" of a dynamo and also, with regard to the bell, to make it far easier to sound a warning and apply "both" the brakes at the same time (a feat, almost impossible with an ordinary bell).

I used ordinary dynamo head- and rear-light fittings, the headlamp originally having a single terminal on the underside which was internally connected to the "pip" of the bulb. I drilled a small hole about an inch away from this terminal and fitted another, insulated from the lamp case, which was to be my "live" supply. I also fixed a small toggle switch, of the type used in radio sets, into the top of the lamp. From one side of this switch I then connected a short piece of wire to my new terminal, and from the other side of the switch another short lead to the existing terminal. By then connecting the positive supply from the battery to the external end of my new terminal it was possible to control the light by means of the switch. The rear-light was then connected as shown in the circuit diagram (Fig. 1), the negative return being through the frame to the battery negative, which I joined by means of a copper earth clip to the saddle stem. Both front and rear lights are therefore controlled by the switch on the front lamp. It would be quite a simple matter to place another "indicator" lamp, in series with the rear lamp, as suggested by R. Verlander (August issue), but I feel that it would be safer to construct a small indicator fitting and not to use the front lamp for this purpose, otherwise, if the rear bulb should fail, we are left in darkness without front lamp either. This indicator could be fixed to the handlebars and, of course, the bulbs then used in the indicator and rear-lights should be rated at half the battery supply voltage, as stated.

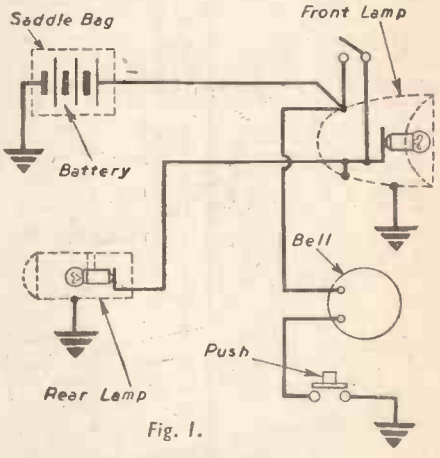


Fig. 1.

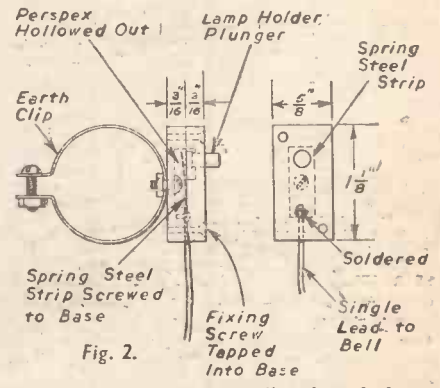


Fig. 2.

Circuit diagram, and details of push button for a cycle-lighting system.

The bell is of the enclosed type, which I mounted on a piece of ⅛in. sheet paxolin and fitted to the handlebar stem by means of the clip from an old bell. For the switch I made a push from perspex and an earth clip of the type used on electrical conduit, the button part of the push being the plunger from an old B.C. lamp-holder. This push has a very fine action, and I have it in such a position that it is quite an easy matter for my right hand to apply the front brake and my right thumb to ring the bell at the same time.

I use a battery of the Ever Ready 126 type (4.5 v.), with a pair of terminals which facilitates easy connection.—CYRIL D. BLAKE (Ilford).

Electrified Fence

SIR,—My attention has been drawn to an article appearing in the August issue of PRACTICAL MECHANICS on electrified fence construction.

In view of the increasing popularity of this type of fence, I understand that the I.E.E. will shortly be issuing a directive covering the design and operation of controllers for this purpose. In the meantime, this is covered by B.S.S. 1222, which gives details of magnitude of impulse and rate at which these impulses may be applied to the line. It also states that such controllers must not be operated from the mains, although at present this point is under discussion.

In view of the considerable danger, not only to cattle but to human beings, that can exist by improper control on electric fences, I suggest that home constructors should be discouraged from making controllers.—K. E. EVERETT (Electrical Engineering Dept., Woolwich Polytechnic).

Small Telescope Construction

SIR,—In the September issue of PRACTICAL MECHANICS you published a reply to querist F. C. Coppen, of Reading, in which it is stated there are no in-print books dealing with the making of small telescopes. Your inquirer will be pleased to know that there is a very good publication dealing with the construction, etc., of small telescopes. It is published by Percival Marshall and Co., and is called, "How to Make a Telescope," by Ernest F. Carter, price 3s.—A. W. NEILD (Harrogate).

Electric Gas-Lighter

SIR,—Regarding the electric gas-lighter described in PRACTICAL MECHANICS for September by E. S. Brown, may I point out that the circuit is only suitable if the coil used is of the insulated-return type, having the secondary winding connected to the case. As these coils are not new, it is more than likely that a coil of the earth-return type will be obtained by your readers, either of the ordinary or auto-transformer type. In the former the secondary is connected to the S.W. terminal of the coil, in the latter to the C.B. terminal, the object being that when the contact breaker points are open both windings are in series, and both contribute to the generation of the E.M.F. necessary to break down the spark gap.

To render the circuit suitable for either type of coil, I would therefore suggest that the S.W. terminal of the coil, to which the supply wire should be connected, should also be connected to the case of the coil. This will then ensure that that H.T. circuit will be completed, irrespective of the type of coil used. Also, if a coil designed for use with a ballast resistance is used, the ballast resistance must be connected between S.W. terminal of coil and supply, or, alternatively, the buzzer windings could be rewound to provide the necessary resistance.—B. J. WARREN (Marnhull).

Screwdriver Theory

SIR,—With reference to the screwdriver theory, surely the answer lies in the fact that the larger the handle of the driver the greater the leverage which can be obtained.

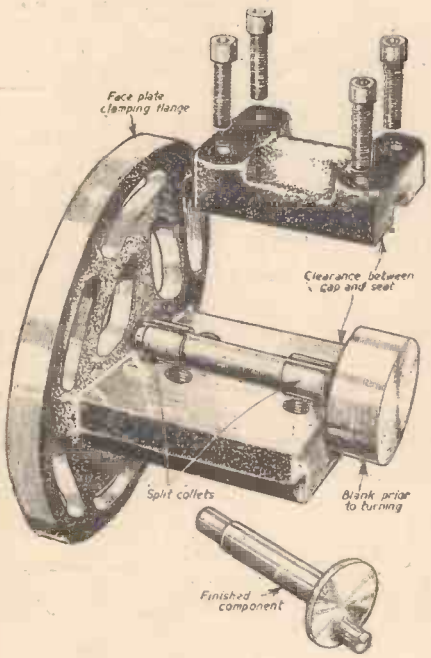
In reply to C. Francis (Heston), the driver he remembers seeing with the gimlet-like handle is still extensively used in the Royal and Merchant Navies. These drivers are usually called "keys," and are used in removing and replacing sounding-tube caps, etc., which are fitted flush with the deck.

Another type incorporates a driver, box-spanner and tommy-bar, the main use of the tool being to remove or secure bunker lids.—W. J. WALL (Birmingham).

Trade Notes

Eccentric Turning Fixture

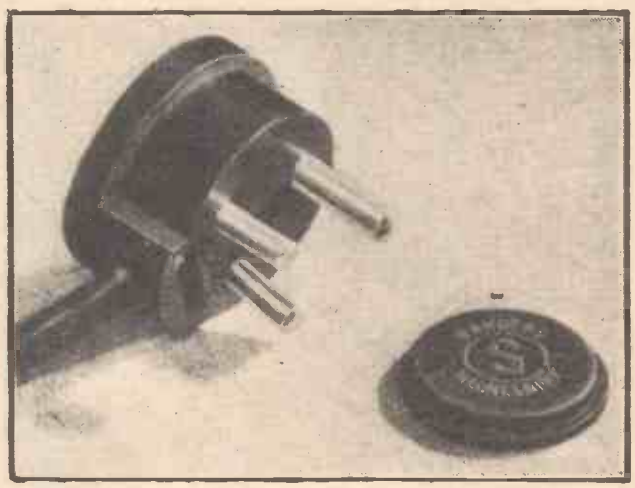
THIS sturdy fixture for eccentric turning has been designed by Mr. Thomas J. Trainer, 25, Valley Road, Anfield, Liverpool 4. The horizontal bracket can be used as a small angle plate. The necessary set over is made by clamping a steel square to face-plate, the blade and stock touching the flange of the fixture, and inserting the appropriate gauge between stock and flange. Close-fitting split parallel collets are provided which afford an easy method of holding shafts to good limits without the complications of taper collets. Castings for the fixture can be machined on a 3½in. lathe. Further particulars can be obtained from the address given.



A fixture for eccentric turning.

Sanders Unbreakable Plug

THIS unbreakable plug was first introduced in 1937 after an exhaustive series of experiments and tests extending over 18 months. A recent demonstration of the unbreakable qualities of this plug was carried out at a Walsall transport depot when a sample plug was run over by a bus weighing 7 tons 5 cwts. The plug emerged undamaged and satisfactory for use after the test. The plug, which is designed for use with any make of socket to B.S.546, should prove invaluable in industrial works and other places where portable tools and apparatus are extensively used, and where there is a high percentage of breakages with the ordinary moulded plug. Prices and further particulars are obtained from Wm. Sanders and Co., Ltd., Falcon Electrical Works, Wednesbury, Staffs.



A Sanders unbreakable plug after being run over by a bus.

"Fifty Years of Model Making"

THE story of Bassett-Lowke, Ltd., from the turn of the century to the present day, is told in an interesting booklet recently issued by this well-known Northampton firm of model makers. The booklet commences with a few introductive notes concerning the executive personnel, and goes on to describe the start of the firm 50 years ago and its progress from the simple models of 1899 to the fine scale models of to-day which bear the name of Bassett-Lowke. As an example of the advance made in model locomotive construction during this period there are the various scale models of the "Royal Scot," constructed in recent years, compared with the model, "Lady of the Lake," locomotive with outside oscillating cylinders, constructed by Bassett-Lowke and Co. in 1901. In addition to the smaller gauge model locomotives the firm has also made considerable progress in the design and construction of larger scale locomotives for garden railways, passenger hauling, etc. Among the other activities of the firm described and illustrated are various types of architectural modelling, model railway layouts, ship modelling (including the 21ft. model of the "Queen Elizabeth"), and exhibition scale models for various trade firms. The booklet is profusely illustrated, and any further information concerning it can be obtained from Bassett-Lowke, Ltd., St. Andrew's Street, Northampton.

HIGHSTONE UTILITIES

Crystal Sets. Our latest Model is a real radio receiver, which is fitted with a permanent crystal detector. Why not have a set in your own room? 9/6, post 6d. De Luxe Receiver in polished oak cabinet, 18/6, post 1/-. Spare Permanent Detectors, 2/- each. When ordered separately, 2/6. With clips and screws, 2/10, post 3d. **Headphones,** brand new, S. G. Brown, G.E.C., etc., 15/-, 23/-, and super-sensitive, 30/- a pair, post 8d.

New Headphones, 10/- a pair. Balanced armature type (very sensitive), 12/6 a pair. Both post 6d. New **Single Earpieces,** 3/6. Bal. armature type, 4/6; ex-R.A.F. earpiece, 2/-, post 4d. **Headphones,** in good order, 4/6 and 5/6 (better quality, 7/6), all post 6d. **Headphones** with moving coil mike, 15/-. Similar phones with throat mikes, 12/6, post 8d. **Headphone Cords,** 1/3 a pair, post 3d. **Replacement Bands,** 1/3, post 4d. **Wire Bands,** 6d. (All **Headphones listed are suitable for use with our Crystal Sets.**)

Bell Transformers. These guaranteed transformers work from any A.C. Mains, giving 3, 5, or 8 volts output at 1 amp., operate bulb, buzzer or bell. Will supply light in bedroom or larder, etc. PRICE 8/-, post 6d. BELLS for use with either the above or batteries, 6/-, post 6d.

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Hand Microphones, with switch in handle and lead, 4/-. Similar instrument, moving coil, 7/6, post 6d.

Sparking Plug Neon Testers, with vest-pocket clip, 2/3, and with gauge, 3/6, post 3d.

S.B.C. Neon Indicator Lamps, for use on mains, showing "live" side of switches, etc., 3/6, post 4d.

Soldering Irons. - Our new streamlined Iron is supplied with two interchangeable bits, one each straight and curved; 200/250 v. 50 watts, 9/-, post 6d. **Standard Iron** with adjustable bit, 200/250 V., 60 watts, 9/6, post 6d. **Heavy Duty Iron,** 150 watts, 12/6, post 8d. All parts replaceable and fully guaranteed. **Small Soldering Irons,** for use on gas, 1/4, post 4d. Resin-cored solder for easy soldering, 1d. packets, or 1lb. reels, 6/-, postage extra.

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Rotary Transformers, 12 v. D.C. input, in soundproof cabinet, for Car Radio, etc.; will also light two 230 v. 25 w. lamps in series, or as a motor, 22/6 each, carriage 2/6. 24v. input; Output 1,230 v. .2 amp. in case with suppressors, etc., easily converted to run as a high voltage motor, 25/-, carr. 3/6. Also 12v. input; Output, 6v. 5 amp., 150v. 10 mA., and 300v. 20/240 mA., 22/6, carriage 3/6.

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Meters. 15v., 2¼in., m/c, 9/6; 150v., 2in., m/c, 10/-; 300v., 2¼in., m/i., 13/6; 3,500v., 3¼in., m/c, 20/-; 6,000v., 3¼in., m/c, 57/6; 15/600v., 2in., m/c, double reading, 8/-; 100 mA., 2in., m/c, 7/6; 40/120 mA., 2in., m/c, double reading, 8/-; 3.5 amp, 2in. T.C., 5/-; 4 amp., 2¼in., T.C. in case with switch, 7/3; 20 amp., 2¼ in., m/i 9/6. Meter Movements, 2in. size with magnet and case (500 microamp.), 2/6. Units containing two movements, 5/-, or with one 100 microamp, and one 500 microamp, 5/6. All meters post extra. Money refunded if not completely satisfied.

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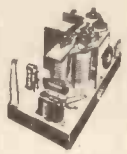
ALL MAINS TWO VALVER just right for your bedroom or den or for friend or relation. Parcel contains R.A.F. UNIT 22—two valves, rectifier and wiring diagram. Price 20/- post free.



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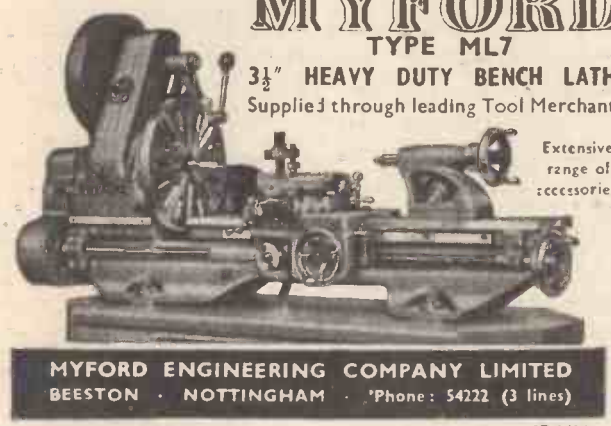

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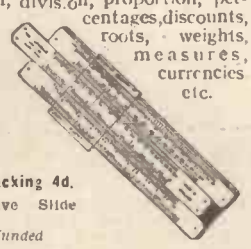

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QUERIES and ENQUIRIES

A stamped addressed envelope, three penny stamps, and the query coupon from the current issue, which appears on page 16 (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.

Figured Dials

COULD you please inform me upon the process employed to produce figured dials such as used on barometers.

I have in mind: (1) Black lettering on a silvered base or what appears to be matt silver finish; (2) Raised bright finish lettering on a black base.

This lettering is required on small dials about 2½in. diameter serving as indicator dials of a new calculating device something like a pocket slide rule of circular type.

I would be glad to have the name of any firm producing this class of work.—W. M. Worman (Newcastle).

TO produce black lettering on a silvered base, the necessary characters are first of all engraved on the metal (usually brass) either by hand or by one of the usual photographic methods. The surface of the metal is then given a coat of black lacquer. Immediately, it is wiped with a rag, which removes the lacquer from the surface but leaves it in the grooves, representing the lettering. After the lacquer in the lettering has dried, the plate is carefully cleaned and then it is rubbed over gently with a pad of soft cloth which has been dipped in a moistened mixture of equal parts of silver chloride, cream of tartar and common salt. This at once precipitates metallic silver in the well-known "white" or non-lustrous form on the brass. You will find it most convenient to purchase this silvering powder ready made. It can be obtained from Messrs. Wm. Canning and Co., Ltd., Great Hampton Street, Birmingham. Usually, for the sake of protection, the silvered surface is finally given a light coating of a clear lacquer, which should, preferably, be sprayed on to obviate brush marks.

In the raised type of lettering, the characters are stamped on the metal plate from the back. Afterwards the whole of the surface is black enamelled or lacquered and then rubbed gently, face side downwards, over a soft pad. This removes the lacquer from the letter faces but not from the background.

Any good firm of nameplate makers should be able to undertake either type of work for you in reasonable quantity. Suggested firms are: Messrs. W. G. Macnamara, Ltd., Aston Brook Street, Birmingham; Messrs. Done, Cleave and Burden, Ltd., 34, Woodcock Street, Birmingham; Caxton Nameplate Mfg., Co., Ltd., 11, 13 and 15, Rochester Row, London, S.W.1; Messrs. J. Morris and Co., Ltd., South Street, Portobello, Willenhall, Staffs; London Nameplate Mfg., Co., Ltd., 72-75, Turnmill Street, London, E.C.1.

Rhodium Plating

I AM interested in coating a telescope reflector with a metal surface that has a greater "life" than a silver surface, even if this means a slight reduction in reflection. The metal I intend to use is rhodium about which could you give me the following information:

1. The comparison of the reflective powers of rhodium and silver.

2. Can rhodium be deposited directly on to a polished glass surface or would it be necessary to deposite a thin layer of copper or silver to act as a "base" and then coat this with the rhodium?

3. What would the process of depositing consist of and where could the rhodium salts, etc., be obtained?—A. C. Large (Chichester).

METALLIC rhodium has about 90 per cent. the reflectivity of silver. After silver, it is easily the whitest metal known, and the one with the highest reflectivity.

Rhodium cannot be deposited directly on to glass. You would have to copper-plate the glass first. Although rhodium can be deposited on copper, it would be advisable to silver-plate the copper and then to polish the silver layer before depositing rhodium over it. Indeed, it is essential to polish the surface before rhodium deposition, for the rhodium will deposit dull on a dull surface and with a high polish on a polished surface.

Rhodium is heat resistant, very hard and entirely resistant to all forms of tarnishing and corrosion. You can obtain rhodium-plating salts and instructions from Messrs. Johnson, Matthey and Co., Ltd., 73-83, Hatton Garden, London, E.C.1. The process is a fairly straightforward one, so far as electroplating processes go, but we think you would be better advised to let this firm do your rhodium plating for you, since it would cost you less and would also avoid mistakes being made. It should be remembered that if you got a faulty deposition of rhodium on a surface you could not remove it for a rhodium-plated surface will resist even the action of boiling *aqua regia* (i.e., a mixture of strong nitric and hydrochloric acids).

Waterproofing Maps

AS I frequently use maps for cycling and walking I should be grateful if you could help me with a problem. I wish to waterproof the maps I use but do not know of a formula that would not dissolve the colour of the actual map. The maps are of paper, cloth backed. Can you suggest a solution that would not affect the map?

Also, could you explain why different books on photographic formula give the order for dissolving each chemical in the same formula—e.g., a developer—differently?—D. A. Waugh (Chingford).

MELT together equal parts of candle wax and beeswax, and allow the mixture to solidify. Cut the solid mixed waxes into shreds and dissolve one part (by weight) of these shreds in about 10 to 12 parts of high grade petrol or benzene. You should do this by enclosing the ingredients in a bottle and by vigorously shaking the latter. Solution is quickened by warming the liquid, but here, of course, there is always danger of fire.

Place the map in a warm oven overnight (for several hours), so that it becomes thoroughly dry. Then place it flat down on several sheets of paper, rear side upwards. With a wad of dry cotton wool, swab the wax solution over this rear surface. After the surface has dried off, go over it with a warm (not hot) iron. The temperature of the iron should be such that it just melts the wax. Thus the wax is consolidated and forced into the fibres. Complete waterproofing is attained by this method.

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.

For treatment of the face of the map, proceed in just the same way, but have the wax solution further diluted, say one part of the mixed waxes in 20 parts of the solvent.

If you want to use the most volatile solvent, you can do so by employing ligroin or "petroleum ether." This is a water-white liquid, procurable from pharmacists. It is of great volatility. Hence, it is excessively inflammable.

We are afraid that we cannot give you a reasoned answer to your quite justifiable query concerning the order of the ingredients in photographic formulæ as given in textbooks. Many textbooks copy one another. Perhaps that may be one reason for the variance in the order of formulæ ingredients. In many instances, of course, it is quite immaterial as to the order of dissolving the ingredients in a formula, but, on the other hand, in other formula the "order of solution" may be of great importance. It is just here that we are unable to penetrate the mentalitics of these textbook compilers who so often err in the above manner. You can, however, always place reliance on the formulæ (and mode of working same), which are published by the actual makers of sensitive materials, and, whenever you are in doubt, these are the formulæ which should be followed.

Thermit Welding: Crucibles and Refractories

I AM hoping to use a combination of thermit welding and "lost-wax" casting to produce small accurate castings for models. In connection with this I shall be glad if you will supply me with the following information:

(1) Suppliers of thermit welding powder and the ignition powder used with it.

(2) Suppliers of crucibles for use with thermit (i.e., with plugged pouring hole in bottom).

(3) Suppliers of hydrolysed ethyl silicate solution.

(4) Suppliers of refractories such as silica, alumina, flint powder, etc.

(5) Sources of detailed information on thermit.

Some indication of cost of materials mentioned above would be helpful.

Can you also state whether the metal formed by the thermit reaction is machinable?—F. Francis (Maple Cross).

(1) In small quantities, thermit mixture is best obtainable from a wholesale chemical dealer, such as Messrs. Griffin and Tatlock, Ltd., Kemble Street, Kingsway, London, W.C.2, or Messrs. Baird and Tatlock, Ltd., 14-17, St. Cross Street, Hatton Garden, London, E.C.1. Its price will be about 3s. lb., whilst that of the special thermit ignition powder will be about 8s. lb.

In larger quantities, these materials can be obtained from Messrs. Geo. Blackwell, Sons and Co., Ltd., Speke Road Works, Garston, Liverpool.

(2) For your purpose you require plumbago crucibles. These are supplied by The Morgan Crucible Co., Ltd., 7 and 8, Cambridge Street, Birmingham. You may also possibly be able to obtain them from the following firms: Smith's Glasgow Crucible Co., Ltd., 101, Fauldhouse Street, Glasgow; Messrs. James Waterhouse, Ltd., Soho Works, Henry Street, Wakefield, Yorks.

The prices of such articles vary according to their nature, size and shape. Prices range from 5s. each.

(3) Hydrolysed ethyl silicate is not supplied commercially, since the hydrolysed material only keeps in good condition for a few weeks, and sometimes even less. However, you can obtain ethyl silicate and hydrolyse it as and when you require it by following the maker's instructions. The non-hydrolysed ethyl silicate, costing about 12s. lb., will keep indefinitely. It is obtainable from Messrs. Albright and Wilson, Ltd., 49, Park Lane, London, W.1, from which firm you can obtain a booklet descriptive of the liquid and its hydrolysis.

(4) In small amounts, the refractories which you need would be best obtained from any who'esale chemical dealer and laboratory furnisher, or from Mr. A.M. MacCarthy, 37, Sandford Road, Moseley, Birmingham, 13. In larger amounts, alumina of varying grades is obtainable from Messrs. Peter Spence and Co., Ltd., Widnes. Sand, silica and flint are obtainable from Messrs. J. E. Garbett and Co., Ltd., 39, Union Passage, Birmingham.

(5) To obtain details of thermit welding, you will have to consult some modern text-books devoted to welding in general. These are often obtainable second-hand, and we advise you to contact technical booksellers to this end. Suitable booksellers are: Messrs. Heffer and Sons, Ltd., Petty Curry, Cambridge; Messrs. H. K. Lewis and Co., Ltd., 136, Gower Street, London, W.C.1; Messrs. Wm. Bryce, Ltd., 54, Lothian Street, Edinburgh.

Iron produced by the thermit reaction is machinable for ordinary purposes.

Transferring Newspaper Illustrations: Dry Cleaning

I UNDERSTAND there is a process by which photographs from newspapers and magazines can be transferred to materials such as silk, linen, etc. Can you please tell me how this is done? Also, is it possible to dry-clean small articles of clothing at home?—T. W. Morgan (London, W.).

TO transfer newspaper matter to any smooth surface, use the following solution:

Strong soap solution (i.e., soap jelly) ..	6oz.
Potassium carbonate	1oz.
Turkey Red oil	½oz.
Water	2 pints

It is advantageous for the soap solution to contain a little glycerine.

To transfer the newspaper matter, moisten the face of the newspaper with the above solution. Put it moistened side downwards on to a sheet of unglazed paper or other material, which is placed on a hard, smooth surface, such as a sheet of plate glass. Rub the newspaper into firm contact by means of the back of a

heavy spoon, or, better still, with a photographer's roller squeegee. Then strip off the newspaper carefully.

The smoother the surface, the better will be the transfer. Shiny surfaces must be avoided. Usually, the best results are obtained on drawing-paper.

Provided that you can take effective precautions against the risk of fire, it is easily possible to dry-clean small articles of clothing at home. The articles are merely immersed in a vessel containing the solvent and are stirred about therein for an hour or more. They are then put through a mangle to remove excess of solvent. After this, they should be immersed in a fresh bath of clean solvent, stirred about for a few minutes, and again mangled. Finally, they are hung up to dry. They will then, of course, require the usual hot pressing to remove creases, etc.

Common solvents are petrol, white spirit and naphtha. These are all HIGHLY INFLAMMABLE.

Non-inflammable solvents are carbon tetrachloride and trichlorethylene. The latter is being used increasingly for dry-cleaning. It is made by I.C.I., Ltd., but is not sold retail. Both these non-inflammable solvents are anæsthetic. Hence care must be taken not to breathe their vapours too much.

In commercial dry-cleaning, the dirty solvent is carefully collected and re-distilled, thereby reducing the cost of the materials.

Activated Carbon

CAN you please tell me what is activated carbon, and how can it be produced ?

Could wood charcoal be substituted for it where it is used to collect odours, etc., from dirty white spirit ?—J. Doherty (Carron).

THE specialised forms of activated carbon are now being manufactured by secret methods. In general, however, activated carbon consists of an animal or vegetable charcoal which, owing to its nature, has a large surface area, being of a cellular texture.

Ordinary wood charcoal is not much good as an "activated" material. Much better in this respect is the "bone black" which is made by calcining (i.e., strongly heating) bones in a closed iron pot until all fumes cease to be evolved, leaving nothing but the carbonised bones. This material is then broken up into small pieces. Such material could be used quite well for the purpose you mention. Charcoal made from hazel nut and beech nut shells can also be used with success as an absorbent, but not ordinary wood charcoal.

Commercial activated charcoal can be obtained from Messrs. Sutcliffe, Speakman & Co., Ltd., Leigh, Lancs.

Modelling Wax

CAN you please give me a formula for a fine modelling wax ? Also, what dyes are used for colouring ?—A. Lester (Birmingham).

YOU will be able to make a good modelling wax from either of the following formulæ. The waxes can be coloured by adding to them (when molten) a small amount of any oil or wax-soluble dye, such as the "Waxoline" dyes which are manufactured by I.C.I., Ltd., and which you should be able to obtain through a firm of laboratory suppliers, such as Messrs. Philip Harris & Co., Ltd., of Birmingham.

Formula I :		
Beeswax	10	parts (by weight)
Gum mastic	10	,, ,,
Ceresin	7.5	,, ,,
Paraffin wax	15	,, ,,
Sulphur (flowers)	20	,, ,,
Tallow	90	,, ,,
Formula II :		
Bleached beeswax	10	parts (by weight)
Paraffin wax .. .. (M.P. 40-42 deg. C.)	20	,, ,,
Vaseline (white)	2	,, ,,
Wool fat (lanoline) ..	15	,, ,,

If this wax is too soft for your purpose, cut down the wool fat content or, alternatively, increase the wax content.

Both the above waxes may be given additional "body" by incorporating with them up to 50 parts of china clay, the clay being added to the waxes whilst molten, and the mass being stirred continually until cold.

Test for Detection of Beryllium

I SHALL be grateful if you will suggest a method by which I can detect beryllium in fluorescent powders. Also, any further information you can give me regarding beryllium will be much appreciated.—C. W. Bartholomew (New Cross).

THE Parsons test (due to C. L. Parsons) for the detection of beryllium is about the simplest. Dissolve a portion of the material in hydrochloric, sulphuric or nitric acid, dilute or concentrated. Filter the solution. Evaporate it to dryness. Re-dissolve the product in water, and to the resulting solution add ammonium sulphide. Filter. Concentrate the filtrate. Add about 2 grams of solid sodium carbonate. Boil the liquid for 1 minute and filter it. Acidify the filtrate with nitric acid and then add ammonia in excess. If there is no precipitate, *beryllium is absent.*

If, however, a precipitate is produced, filter it and add to it 2 or 3 grams of sodium bicarbonate in a test tube. Boil with a little water for 1 minute. Filter to remove the remaining insoluble aluminium hydroxide. Dilute the filtrate with about 10 volumes of water and then boil the liquid. Beryllium hydroxide (containing a very little beryllium carbonate) will then be precipitated.

In the course of a short reply, we cannot give you very much information regarding beryllium, since we are not aware of the exact nature of the information which you require about this metal. You will find ample information in any chemical textbook.

In general, however, beryllium is a metal which is very like magnesium in its properties and appearance. It has a silvery-white lustre, and a specific gravity of 1.64, thus being even lighter than magnesium, which has a S.G. of 1.75. It has a melting point of over 960 deg. C., compared with magnesium's melting-point of 632 deg. C. It is prepared by the electrolysis of beryllium chloride (fused). It dissolves in sulphuric and hydrochloric acids, but is not very readily attacked by nitric acid.

Beryllium is very slowly coming into commercial usage, mainly in America. Its chief alloy is with copper —beryllium copper, which is used in various bearing parts, and also for non-sparking safety-tools. Some beryllium bronzes are also used, but metallic beryllium has no commercial usage.

Gyro Compass

I AM attempting to make a gyro compass, using parts obtained from Air Ministry surplus instruments, so far without success. Am I right in believing that a gyro, balanced against the action of gravity, but free to tilt around a horizontal axis and to rotate in its gimbal around a vertical axis will tend to take up a particular compass direction, or is there some other essential requirement ? I enclose a diagram of the apparatus.

In one "gyro" compass that I have bought, the spindle of the gyro unit, thus pivoted, is drawn into the magnetic east-west direction by electromagnets actuated by a simple magnetic compass in the base of the machine. Is there not a true gyro-compass entirely independent of the earth's

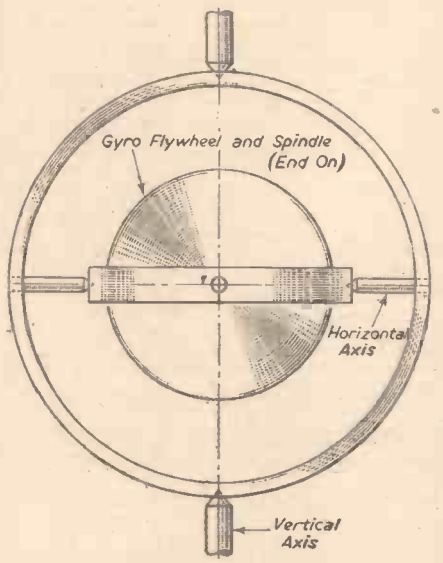

Diagram of a gyroscope.

or other magnetic field, e.g., the marine type ? If so, this is the type I wish to construct.

Possibly you could refer me to some text-book on the subject. Such guidance would be equally appreciated.—L. M. Ramsden (London, S.W.).

ONE of the basic properties of the gyroscope is that it will maintain its axis. This, however, is not enough to convert it into a north-pointer. If force is applied to the axis-line of a gyroscope, the instrument reacts by moving at right-angles to the line of the applied force. Because of this, the gyroscope is used to utilise the movement of the earth to retain it in a north-south direction. Thus, it becomes the only machine known which makes direct use of the earth's rotation.

From this very brief explanation you will see that your statements are quite correct, although they need detail amplification.

There is a very simple explanation of gyro-compass action in "Miracles of Invention and Discovery" (Odhams Press, Ltd.), but for your more specialised purpose you will, we think, require such a work as A. L. Rawlings's "Theory of the Gyroscope Compass and its Deviations."

Other volumes which might interest you are: "Compasses and How to Know Them," and "New Navigation," by F. Cross; "Lectures on Compass Adjustment," by W. R. Martin; "Methods of Modern Navigation," by E. J. Willis; "The Deviascope Explained," by H. M. Wood.

There is no work extant of the type "How to Make a Gyro Compass," but we believe that Messrs. W. & G. Foyle, Ltd., Charing Cross Road, W.C.2, have issued a special catalogue (No. 6a) dealing with the special subject of navigation, in which matters pertaining to the gyroscope will be found.

Removing Stains from a Bath

COULD you give me any advice about removing the following stains from my bath, which is an iron one with an enamel surface ?

(1) Brown stain, caused by the geyser dripping.

(2) Blue stain caused by a rubber mat which had been standing while wet on the blue linoleum and then put back into the bath.—G. Boothroyd (Ealing).

THE great trouble about stain removal from porcelain enamelled baths is that the porcelain surface tends to become porous and to absorb the stain, in which case it often becomes most difficult to "get at" the stain. In your case, the brown stain is due to a deposit of iron oxide and/or hydroxide, the blue stain being caused by some dye or pigment picked up from the rubber.

It is just possible that you might be able to dissolve away these stains by the application of strong ammonia, followed by a plentiful washing down with water. Also, a solution of caustic soda in water (1 in 5) might do the trick, although such a solution should be well rinsed away, since it appears to cause some softening of the enamel. But if you are careful over the job this softening will not be set up.

The most radical treatment is actually to bleach the stains away with a hypochlorite solution made by grinding up bleaching powder (chloride of lime) to a paste with water. Spread this paste over the stains, and when it is semi-dry apply either hot vinegar or, better still, dilute acetic acid (1 in 4). Effervescence will take place, and chlorine gas will be disengaged. Breathing small amounts of this gas will not cause any harm, although it may make you cough and splutter. The point is that one or two of these treatments will completely get rid of the stains, unless, perchance, they have penetrated right through the enamel surface, in which case the treatment will have to be repeated again and again until the stains are finally conquered. If the stains have penetrated the enamel of the bath it is a sign that the enamel has attained some type of porous condition, in which case care will have to be taken on future occasions not to allow the bath to become stained again.

Microscope Objectives and Telescope Eyepieces

COULD you please tell me what is the difference between a microscope objective and an astronomical telescope eyepiece of the same focal length (say, ¼in.), in so far as it affects their interchangeability ? For example, is the aperture of the microscope objective or its field too small for it to be used as a telescope eyepiece ? I have what appears to be a microscope objective of about ⅞in. focal length mounted for use as an eyepiece, but I am uncertain whether this is possible with a higher power.

I would be glad if you could also give me addresses of firms dealing in second-hand optical equipment such as telescopes, projector lenses, etc.—C. T. Geeson (Durham).

THERE is a great deal of difference between a microscope objective and the eyepiece of an astronomical telescope. In the first place, their construction is vastly different, and, again, they are not made in the same or equivalent focal lengths.

The present type of telescope eyepiece is of the "Huyghenian" pattern, being the invention of C. Huyghens, the celebrated Dutch optician at the close of the 17th century. It consists, essentially, of two plano-convex lenses of different focal length, which are mounted in a short tube at a distance apart, which is approximately equal to half the sum of their focal lengths. Their convex surfaces both face the same way —towards the object glass or "business end" of the telescope. The same type of eyepiece can be used as an eyepiece of a microscope.

The microscope objective of modern times, however, is a highly complex system of separate lenses, cemented and uncemented, which, as a whole, acts as a compound lens of very short focal length. Upwards of half-a-dozen lenses of various types and glasses may be required to make a microscope objective. In formation, the construction of the objective is totally different from that of the eyepiece, and if you are trying to use an objective as a telescope eyepiece you are certainly not getting good results, and you would get still poorer results with objectives of higher powers.

Secondhand optical goods of the various types which you mention may all be obtained from the following firms: Messrs. Broadhurst, Clarkson & Co., Ltd., Farringdon Road, London, E.C.4; Messrs. C. Baker, 244, High Holborn, London, W.C.1; Messrs. Flatters & Garnet, Ltd., Oxford Road, Manchester, 13.

Wax Solution for Spraying

WOULD you please give me a formula for a wax in a solvent which can be sprayed on to a car and then polished, in order to avoid hand application of the usual wax polishes?—W. H. Lloyd (Brighton).

WAX solutions do not spray well. Wax emulsions (which are only made with difficulty) spray better, and for this purpose we would recommend "Sposs," which is a hard wax emulsion manufactured by Simmonds Products, Ltd., Trading Estate, Slough.

If, however, you wish to experiment with a true wax solution, gently fuse together two parts of beeswax (or Candililla wax) and one part of prime yellow Carnauba wax. Dissolve the mixed waxes in about 20 times their bulk of white spirit. It is best to add the white spirit slowly to the molten waxes, rather than to attempt to dissolve the solid waxes in hot, white spirit. The resulting product will be a clear solution, but, as previously indicated, its spraying properties will not be good, since, on a smooth surface, the minute droplets will tend to coalesce together unevenly giving rise to "islands" of good polish surface interspersed with patches of dullness. The emulsified wax preparations of the "Sposs" type will, we think, give you a much greater chance of success, since they are "dry-bright" polishes and do not ordinarily require rubbing when the surface to which they are applied is perfectly clean and uncontaminated.

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Comments of the Month

By F. J. C.

Stolen Bicycles

THE Metropolitan Police are gravely concerned at the large numbers of bicycles, running into many thousands, which are stolen each year in the Metropolitan area. The total figure for the whole country is probably in the neighbourhood of over thirty thousand annually. A large number of stolen bicycles are recovered by the police, and their concern is that they are unable to trace the owners or, alternatively, when they do, they are unable to identify their machines. Every bicycle has a frame number and even though a thief may file this away, the police have methods of identifying the number by photo-micrographs which reveal the deformation caused by the numerical impression. The police therefore, issue yet another appeal to cyclists to record the frame numbers of their bicycles either in a pocket book or diary.

It must be remembered that a high proportion of the bicycles recovered by the police have not been taken by thieves. They are ridden away by those who have missed a bus and who wish to get home without walking, and by boys who wish to have a joy ride. They have, in legal parlance, "taken the machine away without the owner's consent." The owners naturally report the loss to the police, but few owners are able to quote the frame numbers or any special features of the machine beyond the name of the manufacturer. This is insufficient, as dozens of a particular make may be recovered each day.

The manufacturers could help here. They could issue with every bicycle a small book somewhat like a driving licence giving the frame number, the specification, the model number, the date of purchase, name of the agent supplying, and the name and address of the owner. Thus, in the unfortunate circumstance of the machine being stolen, a complete description can be handed over to the police; and in the lucky event of the machine being recovered, identification becomes easy. Very many cyclists when asked to pick their machine out of a number recovered have failed to do so. It is important to inform the police at the earliest moment, giving not only the information mentioned above, but also full information concerning the time at which it was missed, and the place from which it was taken.

There are many thief-proof devices on the market. One of the best is the Resilion Thief-Proof Brake Lever. In the fulcrum of each brake lever is a yale lock which will lock the brake in the "on" position; thus the bicycle cannot be ridden away. There is no device which can prevent it being carried away unless it is chained to a lamp-post or similar object. But the bicycle thief does not go for the machine which is going to give him a large amount of trouble. To force a lock or to break a chain would attract too much attention. He usually selects the machine propped against a kerb or a wall and left unattended. Will you immediately make a note of the frame number of your bicycle and record it in a place where it may be readily consulted? The police go to a lot of trouble in recovering bicycles, and they merely ask that you should help them to return them to their rightful owners.

Agents should similarly keep a record of the frame numbers and the names of the corresponding purchasers.

Whilst we are dealing with this matter, we would advise readers to be particularly cautious when offered second-hand machines by strangers. In a high percentage of cases these are stolen and the purchaser might have some difficulty in proving that he had purchased the machine in good faith, if he does not know the name and address of the person from whom he bought it. Deal only with reputable cycle dealers and agents, and you will be safe.

Best British All-rounder

CONGRATULATIONS to Kenneth Joy on his success as the winner of the British Best All-rounder Competition, organised by the Road Time Trials Council. His time of 2h. 1m. 5s. represents the fastest fifty of 1949. He also did the hundred mile in 4h. 17m. 43s. His average speed of 22.808 m.p.h. is the second fastest to be recorded in this event.

By his win Joy has brought renown to the Medway Wheelers of which he is a member, a club which in a comparatively short time has risen from obscurity to a high position in clubdom. Riders under the Medway Wheelers badge have during the year added considerable lustre to the club escutcheon; the Medway Wheelers also collected the team honours.

We do not necessarily imply that we support the method of finding the best all-rounder. In fact, the rules of the competition are open to severe criticism. They do not, in fact, find the best all-rounder. No competition that ignores a 24 hour event can claim to do that. It will be remembered that some time ago we gave a hypothetical set of results showing that the second or even the third according to the B.B.A.R. formula was really the first. Could not the R.T.T.C., now that they have had a few years of running this paper contest (for it is on results of a number of events that the winner is found), modify their rules and bring them more in conformity with the title of the contest?

The Triple Rear Warning

A REPRESENTATIVE of the National Cyclists' Union was recently delegated to meet representatives of the Ministry of Transport in order, once again, to put the cyclists' point of view against the enforcement of the order, which comes into force on January 1st, 1950, compelling them to fit a rear light and to carry a red reflector and white patch. We understand that the Ministry do not propose to make a variation of the order; as usual the N.C.U. made a mess of it. Certainly this body is not the one to represent the viewpoint of cyclists for they are only one of the Three Tailors of Tooley Street.

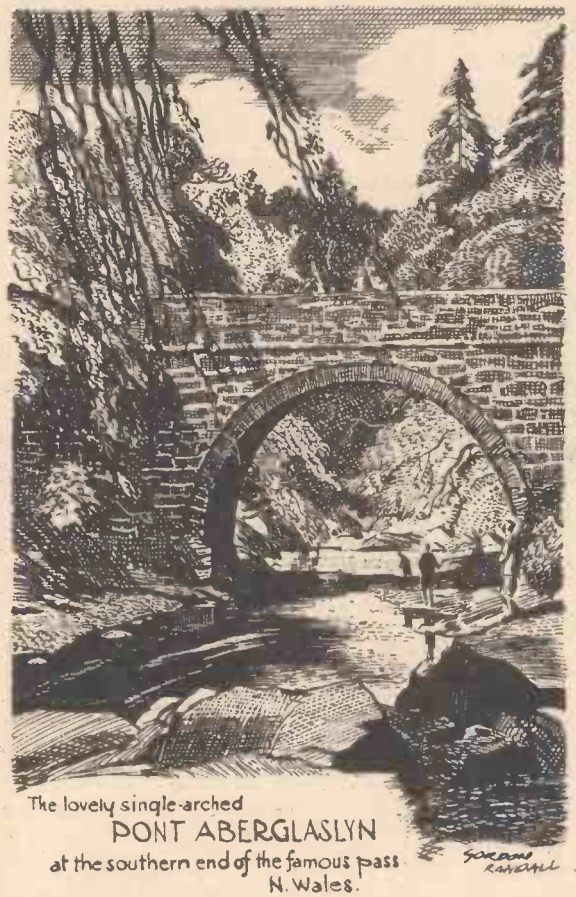
Why should the N.C.U. waste the time of the M.O.T. as well as the time of their delegate protesting against something which had already become law? Before it became law all of the arguments advanced had been taken into consideration were turned down. Cyclists can, of course, continue to write letters to their M.P.s or to their local papers. Our own view is that if rear lights are necessary, pedestrians should be made to carry them when they walk on the highway; for, everything which moves along the road is in effect a vehicle, and likely to be involved in, or to cause an accident. If they are not necessary, and weighty arguments can be advanced to support this, they are unnecessary on any vehicle.

In the course of the year we have to make many business journeys at night by car. We have not yet found the slightest difficulty in seeing cyclists, even when they have not been carrying a rear light. Motorists who say that they cannot see cyclists should not be driving cars at night; their eyesight needs testing.

July Accidents

DURING July, 415 persons were killed on the roads of Great Britain and 17,046 injured.

Paragrams



The lovely single-arched
PONT ABERGLASLYN
at the southern end of the famous pass
N. Wales.

Took Their Own Grandstand

A GROUP of cyclists who went along to Filton aerodrome, with hundreds of other riders, to see the taxying tests and the first flight of the 130-ton Brabazon I, the world's largest civil land 'plane, built their own grandstand when they arrived. They put their machines together in the form of a pyramid and took it in turns to watch the tests through binoculars; the one on top giving a running commentary to his friends below until it was time for him to change over.

On To Macduff!

SANDY KEITH, of Shepshed, Leics., who is not yet 15 years old, has completed a ride of over 450 miles from his home to Macduff, in Banffshire, Scotland, where his grandmother lives. After a short stay with his grandmother his plans were then to carry on to John o' Groats and ride back to Shepshed again. Armed with a list of the principal towns through which he would pass, and details of the road route numbers, Sandy set off from home at 6 o'clock one morning, and by nightfall he was in Corbridge, Northumberland. Next morning the weather was bad, so he did not set off until midday, and that night he was in Lauder, at the foot of the Lammermuir Hills. The following morning he was away early, through Edinburgh, Cupar, Dundee, Arbroath, Montrose, Stonehaven and Aberdeen, to reach Macduff that evening, 2¼ days after leaving home.

Big Business!

A GRIMSBY man, charged before the borough magistrates with stealing two cycles, asked for 12 similar offences to be taken into consideration. A police witness, who estimated the value of the 14 stolen bicycles at £174 11s., said it was "a very lucrative form of income," and that if the astuteness of the detective-constable had not matched the cunning of the accused many more people might have suffered from such thefts. The man was sentenced to six months' imprisonment on each of the two charges; the sentences to run consecutively.

Kerbside Bicycles

COMPLAINTS are being made regarding the manner in which the 20,000 or so cyclists in Scunthorpe park their machines. The kerbside is the favourite parking place, but the cycles have a habit of falling into the roadway or on to the pavement, and there have been several narrow escapes from serious accidents. The other day a police patrol car was using its loudspeaker to give a safety first talk as it moved slowly past a long row of parked cycles when one fell down and forced the police driver to make a sudden swerve. The complaints continue, but there seems little interest in providing proper cycle parks.

Tandem-riding at 83

WHEN Mr. George Jowitt, 83-year-old retired Sheffield engineer, riding a tandem with 61-year-old Mr. Gordon Shaw, also of Sheffield, up in front, set off on August 14 from Land's End to John o' Groats in convoy with Mr. Tom White, of Manchester, aged 63, on his bicycle, the plan was to complete the trip of 870 miles in 15 days. They reached their destination with a day to spare. The riders decided they could manage an average of 58 miles a day, but when they crossed the Border their average was 60½ miles a day. Mr. Jowitt actually celebrated his 83rd birthday at Kendal, Westmorland, but rode on as if it was just his 23rd birthday.

For the Family

WISHING to go cycling with his wife and baby son, but not anxious to do all the work of propelling the offspring in an ordinary cycle sidecar, Roy Herrick, of St. Louis (famous for its "Blues") set the old brain-box working. Eventually he decided to weld cross members between the cycles of himself and his wife, and on these supports to fasten a torpedo-shaped sidecar for the child. This idea has proved very successful, but if the family increases he will have to think up something else for the later arrivals.

Record-breaking Woman Tricyclist

PETERBOROUGH Cycling Club's leading woman tricyclist, Mrs. Mona Hollowell, well upheld the honour of the club in a recent ride, and broke two records. She set off to beat the lowest 12-hours "standard" of 150 miles and the Peterborough to King's Lynn and back lowest of 4 hours. She broke the 4-hours King's Lynn record with a time of 3hrs. 49mins. 56secs., and she carried on to complete 173 miles 25 yards in the 12 hours. Her new record is only 13 miles less than the Peterborough Club's men's tricycle record and 12 miles below the lowest standard for the British competition record.

Economical

TWO young Dutch girls, Miss Cocq Groeneveld and Miss Doerga van der Kemp, who have arrived in this country on a six weeks' cycling tour, will not have to be very rash with their spending money. They have brought with them only £16 to cover all their expenses while in this country. Whenever possible they will get accommodation at youth hostels.

One Brake—No Bell

A SYKEHOUSE (Yorks) cyclist, who knocked down and fatally injured an elderly woman in the dark as she was walking with her husband, admitted to the coroner at the subsequent inquest that he was riding with only one brake and no bell. He said he was blinded by the lights of an approaching car. The coroner, who said there was no evidence to suggest the cyclist was riding fast or recklessly, suggested there had been a certain amount of negligence and told him: "That is what happens in the country. You go riding along without any lights, without any bell and with only one brake, and you become just a nuisance. There is no excuse for going around the countryside like this."

Degenerate!

IF those tough old Vikings of long ago, from their home in Valhalla, can keep in touch with modern affairs they must be feeling more than somewhat annoyed with the Danes of to-day. It seems that the descendants of those men who once sailed across the world in their long ships now find ordinary cycling in winter a little too tough for them, for it is now possible to buy in Denmark a gadget for warming up cycle frames. A dynamo driven from the cycle provides current for heating elements which are attached to the cycle frame and provide a little warmth in chilly weather.

Crashed—But Won

IN spite of a crash on the fourth lap, Harvey Page, Leicester Pegasus Club and East Midland section junior champion, carried on to win the National road race title at Derby on August 14. His chief opponent, Eric Furriss (Woodville) had his chain come off a quarter of a mile from the winning post. Page's time was 2 hrs. 27mins. 25 secs. and next came O. Stevenson (Tyne Velo) with 2 hrs. 27 mins. 26 secs., followed by R. Holliday (Wolverhampton) with a time of 2 hrs. 27 mins. 27secs.

Taking No Chances

DETERMINED that no accident shall happen to his racing cycle, an Italian competitor in the cycling championship events held in Copenhagen insisted that the hotel at which he stayed should give him a double room and that his companion in this double room should be his bicycle. So it was a case of bed for two and rations for one.

Comfort, Not Speed

THE cycle which Paul Bayrad, a French mechanic, has built for himself, is no speedster's model. Altogether the machine weighs some 50lb. It has sprung front forks and various other refinements, and a four-valve radio and speaker mounted on the handlebars with a rod aerial on the left-hand side. The radio batteries are contained in a bag at the rear, while also over the rear wheel is a lightweight petrol motor to assist the rider's muscles.

Around the Wheelworld

By ICARUS

Massed Start at Weston-super-Mare

CRACK road cyclists from London, Wolverhampton, Polhill (Kent), Cheltenham, Southampton, Bristol, Bath, Salisbury, Dundee and Weston-super-Mare entered for the first of Weston-super-Mare's speed events—the road cycle races which were held on the sea-front on Saturday, 24th September.

The British League of Racing Cyclists, who were organisers of the event, have, up to now, confined their activities to races over open country, although in one town they have staged a "round the houses race." At Weston-super-Mare, for the first time in England, they were able to introduce Continental racing in the form of a Criterium. Criteriums, which are long-distance races, up one side of a road and down the other, always in full view of the spectators, are the most popular events on the Continent and attract thousands of sightseers.

The events arranged were a one-mile scratch race and a team omnium which included lap time trials, a team pursuit race and a five-mile point-to-point race. Finally, there was the 50-kilometre Criterium in which 35 riders—the cream of the English cycling world—took part.

An Indoor Velodrome?

AT a recent reception given by the Raleigh Cycle Co. to Harris, world sprint champion, he expressed the view that this country needed an indoor velodrome, so that cyclists during the winter could continue their sport as on the Continent. It would, he thought, provide an excellent training school. I do not, however, think that this form of sport would take on over here. An attempt was made before the war to revive six-day racing in this country on an indoor track, but it was not a financial success and it failed to attract the crowds. This form of cycling, in my view, merely encourages the get-rich-quick style of promoter and rackets.

The early days of sport in this country provide a good example of the dirty work which can go on when the trade and promoters get together. The trade in this country has set its face against those old rackets, when riders were bought off and one firm would vie with another. Without trade support indoor meetings could not succeed. The N.C.U. could not afford to back them and I do not think that cyclists generally would provide a big enough gate during the autumn and winter to provide the money to keep premises going the whole year round. Our way of life, and certainly our cycling way of life, differs from that of Continental people. If we tend to take our pleasures sadly, at least we try to keep our sport clean—although strangers, from the hole-and-corner methods we adopt in our time trials, may think otherwise.

On Colds

I NOTE that a paragraphist in a contemporary has been descanting on the common cold, and he expresses the view that he never catches cold whilst riding a bicycle, even when soaked to the skin, but only when sitting in a train for a few hours or attending a meeting. He draws the moral that as long as we maintain bodily heat by cycling we shall not be attacked by colds. Unlike the lunatic, who gave as his reason for knocking his head against a wall that it was nice when he left off, apparently once we take up cycling we must continue to pedal away for the rest of our lives to escape virulent attacks from micro-organisms. In other words it is bad for us if we leave off. My own experience is that I have caught just as many colds through riding a bicycle as through not riding a bicycle. I think that this is the experience, too, of most cyclists. A cold is due to a condition of the system. You do not "catch" a cold. A number of people whose vitality has dropped below a certain point will all respond to certain changes in temperature at the same time, and because of this they loosely say that they have caught so and so's cold. Quite absurd. I do not think that cycling prevents the development of those conditions any more than I think that it encourages them, nor do I think that cycling will cure a cold. Cycling, like any other form of gentle exercise, is beneficial; it is not necessarily a panacea for bodily ills.

Devaluation

IN order to earn the same amount of sterling we shall have to export a greater number of bicycles. The alternative was to reduce costs of production, but that was found to be impossible because of the burdens in the form of social security, health services and other overheads which have been saddled on to industry since the war. So we have been compelled to cut our costs by devaluing the pound. For a time, therefore, we shall be able to sell our bicycles in greater numbers in America and other countries. Not for long, however. No country is going to stand idly by and see its own industries hit and its workers thrown out of employment because of the lower prices of British goods. These countries are bound to take protective measures, and already America is threatening to do so. This will mean that in the not too distant future another financial crisis will arise. In other words the devaluation of the pound is but a temporary expedient. In the meantime, however, British cycle manufacturers have a splendid opportunity of enlarging their markets abroad—if they can get the materials to make more bicycles. The cycle trade is one of the few that has exceeded its export target.

A Wooden Bicycle

NECESSITY may be the mother of invention, but in the case of the new wooden cycle now being made in Italy it is a case of necessity becoming the offspring of an older invention, for, of course, wooden bicycles are by no means new. As my colleague Frank Urry states in a contemporary, he has actually ridden one, about fifty years ago, that was of bamboo. Most of our early boneshakers, of course, had wooden wheels, and some of the earliest a wooden backbone also. The Italian machine is not freakish to look at. It has a one-piece wooden diamond frame, wooden handlebars and forks, but alloy crown and ends. The machine is known as the Vianzone, and it was exhibited at the Milan Cycle and Motor Cycle Fair. A fair number of them are already in use in Italy, and the riders report that the wooden frame makes riding much less fatiguing, not only on account of the lightness, but also because of the natural springiness of the wood. Information is not available as to whether the machine warps, or whether the rider spends some of his energy bending the frame when pedalling.

The wood employed is ash, acacia and beech, timbers which are also used for the manufacture of skis. The manufacturers claim that these timbers are unaffected by atmospheric conditions.

The frame is laminated and formed from one continuous strip, the laminations being alternate beech and ash. There are no lugs, and the laminated strip commences at the seat stays and follows round the top tube, so to speak, the down tube to the bottom bracket, where it bifurcates in order to accommodate the rear wheel. There are spliced strengtheners. The only round members of the frame are the seat tube and the seat pillar. The few metal parts consist of the fork ends, which are alloy castings, as are the fork crown, pedals, etc.

Mr. F. J. Camm being presented with the gold badge of The Roadfarers' Club (at the Club luncheon at the Savoy Hotel) in recognition of his services. In the picture are Lord Brabazon, Marquis of Donegall and E. Coles-Webb.

Wayside Thoughts

By F. J. URRY

Festiniog, N. Wales.

The lovely Vale of Festiniog seen from near Teilau, with a distant glimpse of Afon Dwyryd.

Practise What You Preach

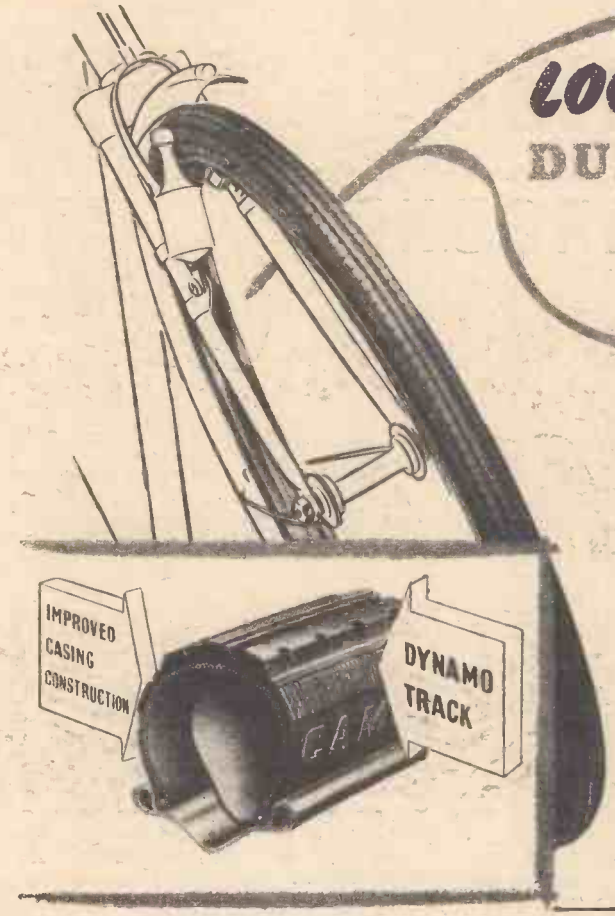
IT is not an easy matter to persuade people that the finest way to see the countryside is by the way of riding a bicycle. It is not easy because so many people concerned with cycling—don't. Some of my friends are in that category, give the excuse of being too busy with making and selling the article, or legislating for the sport and pastime. They are cycle-minded, but they forget to be cyclists; and occasionally when I tell the truth about the pastime as I see it, my listener retorts by asking me why such people talk so much about cycling, and do so little. It gives a nasty jolt, and unfortunately there is a modicum of truth in the query. That is why I am so keen on persuading the active individuals in the late forties to keep a lively interest in cycling, because I am sure they will be happier and healthier people and an example to the younger folk never to give up the game. For it is a game, one that can be played during every odd hour and exactly suitable to the mood of the moment. And no other game can equal such catholicity, and no other game is so cheap and satisfying, with that internal and mental satisfaction of playing it yourself, knowing it is good for you, body and soul, without the faintest shadow of ostentation. The world is a whirr of grind and noise, and the only silence in machinery left to us is the well-found bicycle. And what of it? you will say. Just this—it has presented man with at least three times his natural speed afoot, he sits down to the business of travel in a restful posture, moves fast enough to be pleasantly observant, unconsciously uses every muscle in his body, breathes the freshest air in long, easy intakes and becomes an individualist endowed with the performance of a demi-god. You cannot have such precious possessions by way of the motor-car; all you can get is the speed and ease, and if these things satisfy you, then the taste of athleticism has departed, or your crave for urgency has upset the balance of living. Profoundly, I believe this to be true as cyclist and motorist, and indeed as a player of most of the games that interest man until the passing of years make one lag superfluous. Cycling, however, never does that; the pace slows down in you and the miles need a trifle more time to complete, but that adds rather than subtracts joy from the journeys. Yet people will tell me I am an exception, and that is the point I want to make; I oughtn't to be an exception, for I feel selfish in the enjoyment of these things when so many thousands of other people could join in. Cycling is good for the very young, better for the youth, better still for the grown man or woman, and best of all (if only the wisdom to remain in it is perpetuated) for the elderly. I shall never give it up, it is far too precious; it may give me up, but that time is not yet.

Are We Deteriorating?

AS a daily rider to work and home again I see many things occur which cause me regrets. Road conduct has not improved since the highways have carried more traffic, and risks are taken by all types of traveller which the simple rules of courtesy should forbid. The cyclist who pushes inside me at traffic signals, or travelling faster fails to register distances before he cuts across my front wheel, are two common incidents I meet along the road. They are not dangerous, merely discourteous, but such discourtesies may ultimately lead to risky conduct. The car driver who cuts in front too soon after passing is a danger, for this is usually done to sneak through the traffic stream without generally improving his position more than the length of the car. The tram driver who tries to bell me out of the way of his track when I am passing a stationary vehicle is just rude and vulgar, and if he were aware of that degrading conduct would surely not try to frighten people, for that appears to be his objective. Generally, I find bus drivers decent except near stopping places when they overtake and pull up sharply, and either make you do the same (which is wise) or swerve into the opposing traffic stream which is usually hidden by the bulk of the bus. How easily these annoyances could be altered by the application of a little courtesy which would add so much to the dignity of life. We are in danger of destroying all sense of chivalry by an urgency that intimates bad manners and gets us nowhere. A few evenings ago when I was taking the long way home, I changed the wheel of a light car for a lady. It was obvious she knew little about the job and was duly grateful for the assistance. Indeed, she tried to pay me. "Do you know," she said, "a dozen cars went by before you came along and not one of them stopped to enquire if assistance was needed." A terrible comment on our loss of road manners; for I remember the time when no one would dream of "passing by on the other side" without proffering aid, and I suppose in my time I have repaired more punctures for other people than for myself, and can remember the incidents now with pleasure. If this plea for greater courtesy among road travellers is sentiment, then I plead guilty to the charge, and as far as I am concerned would not have it otherwise, believing that it is part of the joy of the road to be a useful wanderer when occasion demands.

Windy Weather

IT was a windy morning, the kind of weather when cycling with the breeze was an undiluted joy and against it "hard work" if you were unwise enough to make it such. But how can you help it? I can hear someone say. Well, if it is to work or home you are riding, go more slowly than your normal speed, and if you have change gears, use them. So many people I see don't; they go slamming along on tall ratios, often enough swaying their bodies from side to side, and making heavy weather of their progress. True enough they go faster than I do, perhaps a mile or two miles an hour; otherwise I should not see these efforts to fight the wind. In any case that is a silly game, for the wind is sure to win, for it can last a good deal longer than you can. If you are going for a ride on a windy day, ride into the breeze but select a lane route and take the shelter of the hedges on the narrower way. Yes, some fellows say, and the wind will turn round when you come back. As a matter of fact that very seldom occurs; it may drop, but only on very rare occasions have I faced a wind going and returning on the same day. If you are touring and an unfavourable wind is using the road you want to go, then cut your mileage, take it easily, walk the hills, rest more frequently, and do not allow the conditions to worry you. As often as not personal pride makes a fellow flog his energies beyond the point of pleasant travel; but there is no need to do this thing. If cycling, like every other game, did not present difficulties occasionally, call for an effort and the application of the art of pedalling, it would not be worth playing, for a game to be worthy must have a risk, a desire to win through, a satisfaction in accomplishment, and finally, from the viewpoint of three score and ten, an aptitude to conserve and to use energy so that joy shall never depart from the journey.



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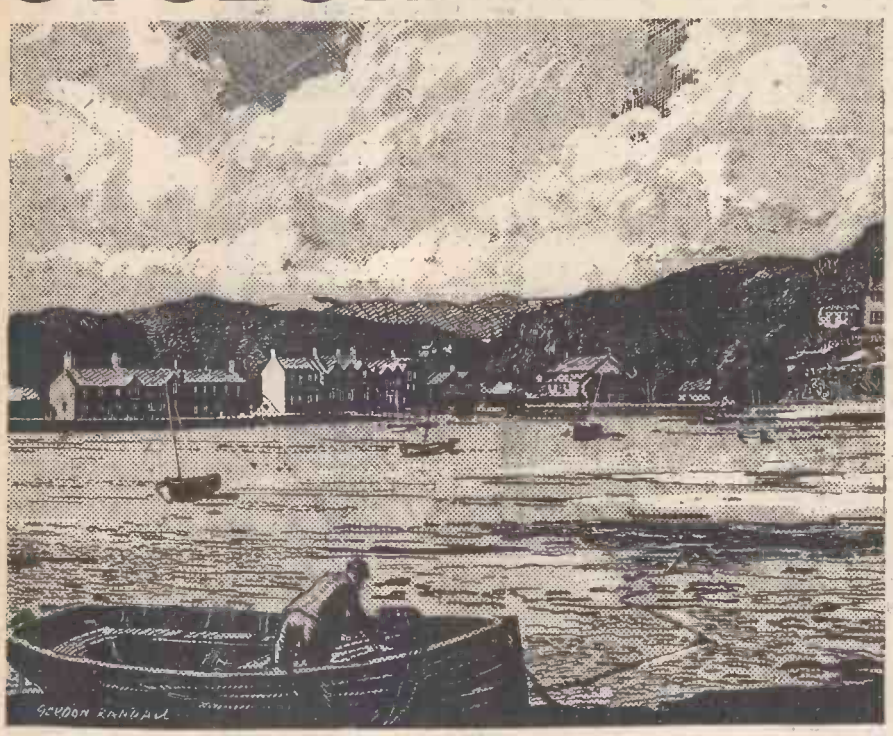
CYCLORAMA

By H. W. ELEY



Looking towards Moel-y-Gest and the Vale of Penmorfa from the little harbour at Borth-y-Gest, Carnarvonshire.

Campaign to Advertise Cycling

I WAS most interested to read, in one of the trade journals dealing with the business of advertising, that plans were being formulated to launch a national advertising campaign with the object of popularising still further the great "game" of cycling. Long ago I advocated this, and still believe that, despite the popularity of cycling in this country, much could be done to widen its appeal and recruit many more thousands to the ranks of those who ride bicycles. In the advertising business such campaigns are called "group" campaigns, and whilst it may be difficult to assess the actual value of such publicity to any one manufacturer, it goes without saying that *all* must benefit. Everyone knows of the big successes achieved by various "group" advertising campaigns . . . such as "Drink more Milk" and "Eat more Fruit." Properly planned, and put over in an effective manner, a campaign could help the British cycle industry enormously. The "field to be tilled" is large, and the story to be put over is a fascinating one . . . cycling has so many facets, so many advantages, that a modern advertising agency entrusted with the task could, I am sure, make many more riders and sell a big number of machines. I shall hope to see more of this plan.

What Do Cyclists Read?

RECENTLY I was privileged to be among a party of ardent cyclists on tour, and I was intrigued to note their choice of reading matter. The party included boys and girls . . . youths, and one or two "old stagers." To provide themselves with something to read when, cycles put away, they relaxed in inns and hostels, some had put "thrillers" into their haversacks; in fact, the "thriller" was the most popular choice . . . Agatha Christie, Dorothy Sayers, Peter Cheyney . . . these were the authors most favoured, and I am not surprised. I plead to being a "thriller fan" myself, and I find the sleuth and the criminal fine companions when, pipe alight, I sit back and have a quiet hour before going to bed. But not all the riders loved to "wallow in murder"! One girl in the party had a copy of "Wuthering Heights," another was enthusiastic over Lord Baldwin's "On England" and one of the older men had armed himself with a copy of Trollope's "Barchester Towers."

Visitors from London

ONE quiet August afternoon, when in the country home where I now dwell the only sound was the distant whirring of a corn-cutting machine, I had two surprise visitors from London Town . . . a father and his son, both keen cyclists. They appeared, hot but happy, at my door, and informed me that they had had a grand ride from Town, via Kings Langley, Berkhamsted, Tring, Aylesbury, Bicester, Banbury, Kenilworth and Lichfield . . . and thence, through narrow winding lanes, to "my village." How glad I was to see these good riders! They were making for a youth hostel at Ilam, in the Peak district, and from thence back to London. The father, with whom I was long associated in business, gave me all the news, and we talked of cycling, and counties, and the merits of varying youth hostels. Together we watched a field of oats being cut; leaning over a gate, we saw scared rabbits darting from out of the corn, to fall to the guns of two farmers out for an afternoon's sport. All very pleasant . . . but the visit gave me no nostalgia for London, and I am still content with my lot, and happy to be far from the madding crowd.

"Old Cycles Never Die"

I DON'T know whether they even "fade away"—or whether, like Tennyson's brook, they go on for ever. Last week I was shown an old B.S.A., which the lady who owns and rides it told me was twenty-seven years old. A bit heavy . . . but then bikes were heavier in those old days. But what a tribute to British manufacturing craftsmanship! It is small wonder that the British bicycle has a world reputation for quality and sound construction . . . and I trust that this priceless asset will never be lost. There must be many "veterans" on our roads, and it would be interesting to know who claims to be riding, daily, the oldest cycle in use.

Good Harvest

LIVING in a countryside, where the land and its produce is the vital thing, I have naturally been interested to hear the comments of farmers on the hay and corn harvests. It is a trite saying that the English farmer is always grumbling and never satisfied, either with the weather or his crops . . . but this year even the farmer has been unstinting in his gratitude for good harvests. The hay was cut astonishingly early, and so was the corn. The extraordinary spell of fine, sunny weather enabled the work to be done without interruption. Around here the yields were good, and it is a grand sight to see the stacks. Over the stubble the little brown partridges now roam, and the countryside seems to be taking a rest after much labour. The grey mist rolls over the fields in the early morning, and the urge comes to be out good and early in the hope of finding mushrooms. The brambles are smothered with blackberries, fast ripening in the September sun . . . and altogether the countryside is full of charm. Already some of the trees are taking on autumn hues and tints . . . but summer has not gone, and the swallows still whirl around the roofs and flash by like little jet-propelled machines; soon, they will gather on the telegraph wires, and hold their conferences prior to leaving for sunnier climes. . . .

Cycle Exports

MR. DOUGLAS TERRY, the president of the British Cycle and Motor Cycle Manufacturers' and Traders' Union, had some very heartening figures to give when he spoke at a dinner recently given by the Ministry of Supply Midland Region, in Birmingham. Last year, he stated, the total value of British cycles and cycle parts exported had gone up from £3,250,000, in 1938, to £18,000,000, and included nearly 2,000,000 bicycles. Here is good news . . . and evidence of the continuing high quality of British machines. During the last three years the total value of cycles, motor cycles and parts sold abroad was no less than £58,000,000. It is well to remember these impressive figures when we feel inclined to be depressed at doleful news about our trading position and our ability to compete in the markets of the world.

Note From an Old Diary

SOME folks scrap their diaries as soon as a year ends and another dawns. Others, like myself, have a habit of keeping them. Searching among some old books and papers the other day, I came across a very old diary . . . for the year 1908! The entries made me long to be young again! Amid a variety of notes and engagements, I came across an entry about a cycle ride from Burton-on-Trent to the pleasant little town of Alsager, in Cheshire, where, at the time, I had a relative living. "Rode the 'Campion' machine to Alsager, and had tea at Trentham." What memories came flooding back as I looked at that somewhat faded entry! I recalled the tea at Trentham . . . the fresh butter, the lavish supply of jam, the great pot of tea. And . . . I wondered when it was that I saw a "Campion" machine last? I have an idea that this bike was made in Nottingham, but I am not sure. So many old brand names have disappeared . . . but memories remain.

My Point of View

By "WAYFARER"

The famous Burford Bridge Hotel beneath the wooded slopes of Box Hill, Surrey.

Outmoded

ONE of those entertaining leading articles which appear almost daily in *The Times* was entitled "The Truth About Rabbits" (not the four-legged specimen which, stripped of its fur, has been known to find a place in that delectable dish known as rabbit-pie, and, alternatively, has been suspected of deputising for more expensive dishes such as chicken) and contained the following little passage concerning cyclists: "Almost as soon as we could walk we tackled and triumphed over the dangerous art of balancing a bicycle. Before that is dismissed as nothing, picture what would happen if we could go back a few centuries and pedal down a medieval village street. Our incredible power over the forces of gravity would be counted black magic, and we should be burnt as witches." The world has progressed to some extent since the Middle Ages and the process of burning people as witches has been outmoded. Outmoded, too, is the pleasant practice (popular some 60 or 70 years ago) of greeting pioneer cyclists with: "Here's a stranger; heave a brick at him!", and the no less genial habit of thrusting a stick into the wheel of the unfortunate cyclist or of "tickling" him with a whip, the latter being a favourite trick of horse-drivers. Nowadays, so far has civilisation advanced, we get off lightly, and have to submit to nothing more serious than loud guffaws proceeding from yokels loitering at the roadside. On the principle of the empty vessel making the most sound, the loudest noise comes from the least intelligent of the loiterers. Possibly that form of ignorance, too, may soon be outmoded.

No Motor Roads

IN one of the daily newspapers I read there is raging at present (at the moment of writing) a controversy concerning the respective merits of tram and bus. With unusual forbearness I regarded this as a "private fight" and took no part in the argument. When, however, one of the protagonists spoke of those local cases where the trams were segregated, running along an exclusive central track, "thus freeing the motor roads for private traffic," I felt that the time had come for me to speak. As yet, there are no motor roads in this country. Regrettable—and reactionary—though the position may appear in this age of progress (this era featuring the verbal deprivation of other people's rights), the "motor roads" to which our friend refers are actually all-traffic roads. They are open to the free use of cyclists, horse-drawn vehicles, farm tractors, hand-carts, wheelbarrows, steam-rollers, and motor vehicles of every class and type. Some day, doubtless, we shall have motor roads, but that day is not yet—and any attempt even at the mental appropriation for one purpose of our present all-purpose roads must be firmly scotched.

False Start

I SUPPOSE it is true to say that most of us begin our cycling activities in the wrong manner. How soon—and to what extent—we depart from the error of our ways depends on the guidance we can obtain, and on the receptivity of our minds—and the adaptability of our plans. A friend with whom I was discussing this matter a few evenings ago said that he started off as a cyclist carrying no fewer than three national flags on his heavy-weight bicycle, he (apparently) being under the impression that the more bicycle you had the better, and that the prime function of a bicycle was to hang things on. Fortunately, he came under the influence of a writer who knew better. He (my friend) was out to learn: he was open to conviction, and he very quickly made good as a cyclist.

The Joy that Abides

THE other day I chanced across a cycling acquaintance who was obviously—very obviously—on the final stage of a cycle tour. The luggage on his bicycle proclaimed that fact: his personal appearance shouted from the housetops that he had been having a holiday. I paused on my way home from business and had a few words with my acquaintance. He, like myself, is no chicken, for he has many years of cycling experience behind him. But his mental outlook was that of a schoolboy. He was aggressively cheerful and happy. He was overflowing with enthusiasm. He spoke with youthful glee of the "best-ever" holiday which was just drawing to a close—though, of course, the memory of it would endure for many a day. He was the picture of health, July's normally wayward sun having "burnt him to a cinder."

Cycle touring contains the joy that abides. Its attraction has been the same all through those yesterdays in which so many of us have revelled: it is the same to-day: it will be the same to-morrow. It changes, but for the better. This game of games—the best phase of our pastime—will give us all we ask, and more. It will give us "bags" of fresh air and exercise, physical and mental fitness, constant change of scene, mild adventures, optimism, philosophy, contentment, happiness and knowledge. And at what a price! Indulgence in cycle touring may not be always easy. There may be adverse weather conditions: there may be a succession of wearisome hills (though all hills go down as well as up, and the down-grades are anything but wearisome!); there may be tiredness; there may be difficulties over meals and "digs." But all these things—like the joy of speeding in silence along a fine main road or of meandering through a series of crooked lanes—are an intregal part of the cycle touring game, and are accepted as such by every true tourist.

Yes! in this grand phase of the pastime will be found the joy that abides. And the pity of it is that so few cyclists, relatively, have ever sampled the infinite delight of this form of holiday, with its sense of complete freedom and unalloyed happiness.

Petrol's "Lure"

I WENT for a run the other evening in the infantile car of an old cycling friend who has turned—or partly turned—motorist. In the course of the journey he disclosed that he had three new cars on order and proposed to take delivery of the first that materialised, then cancelling the other two and selling his old crock. Despite this news, which astounded me, my friend remains, and will remain, a loyal and enthusiastic cyclist. He has no loyalty to or enthusiasm for motoring, which he views from the purely utilitarian point of view—and it was solely from that point of view that I (having business calls to make) was riding with him. He came to a speedy realisation of the need, from the motoring standpoint, of nice, wide, straight and properly cambered roads, but we deliberately spent as much time as possible in narrow, winding, and deserted lanes, which it was a real joy to traverse. Yes! we were in a motor-car! I, who have consistently declined to possess a car, or to learn to drive, was interested to have an old cycling comrade's reaction to the lure of petrol.

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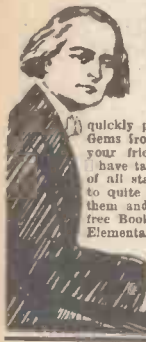

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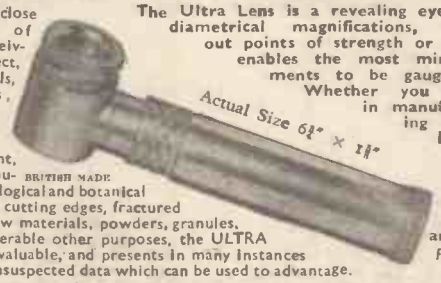

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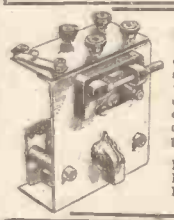

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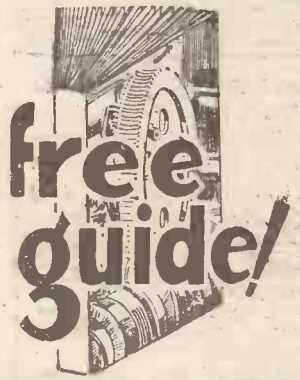

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