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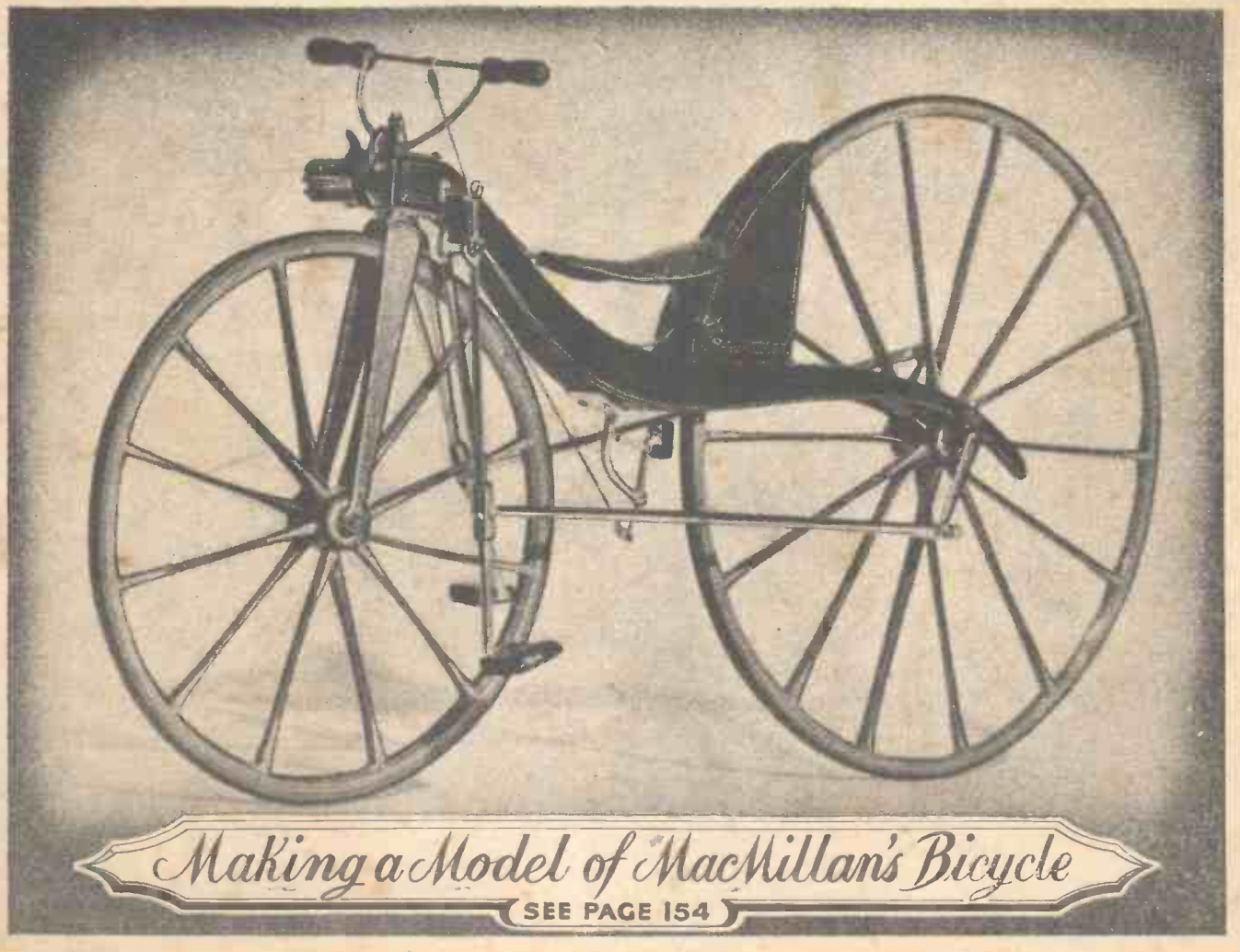
NEWNES

PRACTICAL MECHANICS

EDITOR: F. J. CAMM

FEBRUARY 1952



Making a Model of MacMillan's Bicycle

SEE PAGE 154

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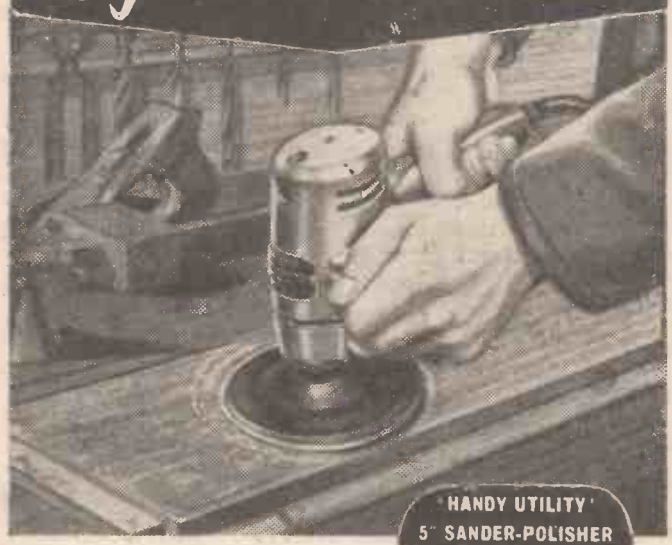

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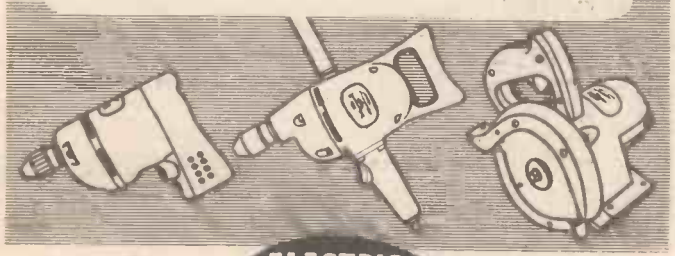

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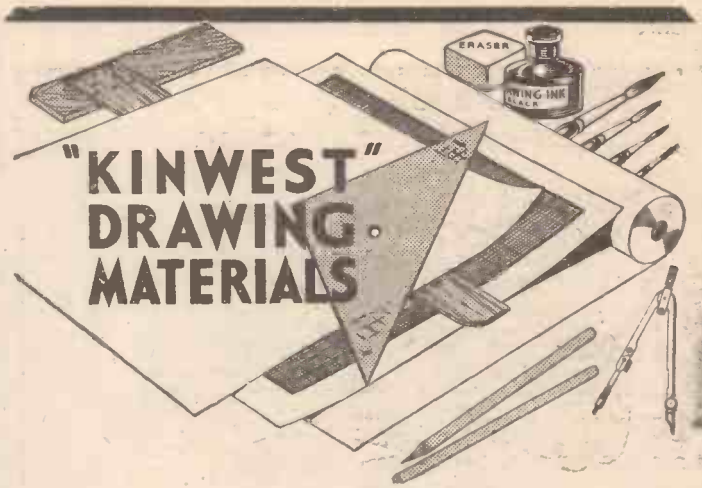

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PRACTICAL MECHANICS

EDITOR F. J. CAMM

FEBRUARY, 1952
VOL. XIX. No. 218

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

FAIR COMMENT — By The Editor

The Artificial Satellite

THE possibility of establishing an artificial satellite in space for research purposes was discussed by a member of the Scientific Staff of the Ministry of Supply, Rocket Propulsion Department, at Westcott, in a recent lecture.

He said that it was quite possible for an artificial satellite to be put into position about 500 miles from the earth, and to be used for research into the upper atmosphere, and into cosmic rays. The rockets launched by U.S. scientists into the upper region have always returned to earth, but with a satellite centrifugal force and gravity would hold it in position.

As I pointed out in a recent article, this would be a very expensive undertaking, although I agree that it may be possible in about 15 years' time. It seems clear that planetary flights to Mars and the Moon will only be possible when atomic energy can be applied to rockets.

We seem in the past year to have made considerable progress towards that end. It was recently announced by the U.S.A. that their scientists had been able to develop electrical power from atomic energy, and to put such power to useful work.

The economic position of this country to-day is a severe handicap to our own scientists. All work on atomic energy is directed towards the production of atomic bombs, although it is known that a large number of nuclear physicists believe that a review of Government policy is called for in the uses of atomic energy in view of American developments.

Present policy is dictated by our financial resources and the supply of uranium, and the need for rearmament which must be our first consideration. But the recent announcement by the United States Navy that a contract has been placed for the construction of a nuclear-powered submarine invites the question whether we should not with our greater knowledge of shipbuilding direct our attention to a similar project.

Certainly in view of the coal position something must be done to provide an alternative source of energy. Intensive effort would be bound eventually to produce nuclear reactors for the production of power for industrial and domestic use.

INTEREST IN SPACE FLIGHT

MY recent article on the subject of interplanetary travel in which I touched upon this problem prompted nearly 1,000 readers to write to me, and this is indicative of public interest in this latest revelation from science's Pandora's box.

Sir John Cockcroft recently stated that Britain's requirements for electrical power have increased by 50 per cent. since 1940, and are expected to increase by about 45 per cent. by 1960. This alone would require an additional 13 million tons of coal by 1960 in the United Kingdom.

Britain does not expect, he said, to be able to produce power more cheaply than from coal. What we are aiming at is to produce more power at a cost which is not too much higher than that of power from coal. The only method in sight of utilising nuclear energy is to use the nuclear reactor as a source of heat in place of the fuel burners of conventional power stations. The cost of the output from natural uranium power producers would not be very much more than the cost of power from coal.

THE STEAM CAR

GREAT interest was evinced in my article, "Will the Steam Car Return?" Readers from all over the world asked for further information, and in view of the position in relation to the supply of liquid fuel our motor-car manufacturers might once again turn their thoughts to the production of a steam car. With modern steels and our improved knowledge of high pressure reciprocating engines it should be possible to produce a car cheaper even than a petrol engine. There is no valid reason why, however, we should tie ourselves to a piston engine. A turbo-jet engine would be quite satisfactory.

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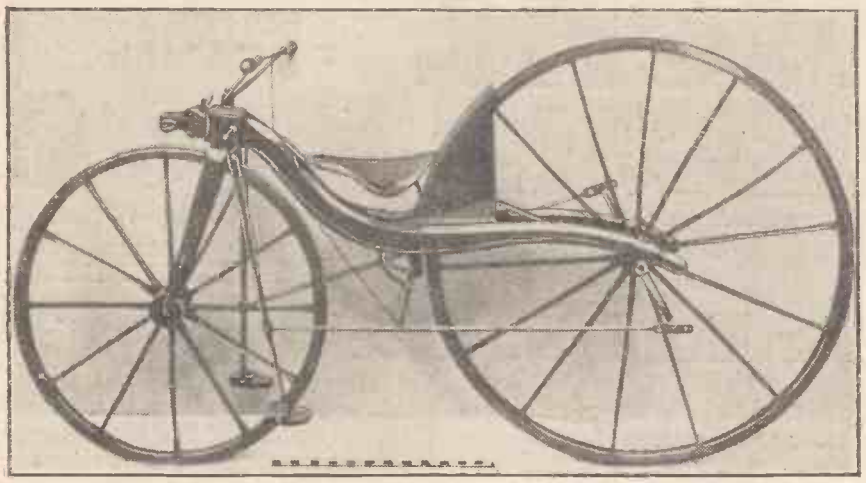
COMMENCING with issue dated February 29th, and continuing for eight weeks, our companion journal, *Practical Engineering*, published at 6d. every Friday, will contain a valuable 16-page pocket book of engineering data, particularly suitable for apprentices, fitters, turners and mechanics. This leading weekly engineering journal teaches engineering principles and practice week by week, and no one engaged in engineering should be without it.

FREE BLUEPRINTS IN "P.W.," "P.T." and "P.M."

THE March issue of our companion journals, *Practical Wireless* and *Practical Television*, will each contain a free gift blueprint, the former for a Midget Battery Portable of the "Personal" type, and the latter for the "Argus Television Receiver." Owing to power cuts, personal battery portables are in great demand. It is a four-valve all-dry battery set with four-station pre-set tuning—three medium stations and one long-wave. It measures 6½in. by 5in. by 3½in. It can be assembled in an evening.

The *Practical Television* blueprint is for a 21-valve unit-constructed television receiver employing a 6in. tube. Both of these receivers can be cheaply constructed. To secure copies containing these free blueprints it is necessary for readers to order now, in view of the recently announced paper cuts.

Next month I shall announce details of the blueprint which is to be given with every copy of the April issue of PRACTICAL MECHANICS.—F. J. C.



Photograph of the only Macmillan bicycle in existence. It is a copy probably made about 1860, and it may be seen at the Science Museum, South Kensington. For reasons explained in the text it is necessary to point out that this photograph is Crown copyright.

A 1/8th Scale Macmillan's

Details of the One-eighth Scale Bicycle, Built by Mr. F. J. Camm Copy of Macmillan's Bicycle in the

By F. J. CAMM

READERS of this journal are aware of the fact that I have constructed hundreds of models in my time, but none has given me greater pleasure than the making of the one-eighth scale model of Macmillan's bicycle illustrated here. Nor will my cyclist readers need to be told that it is a famous machine, because it was the very first to employ a drive to the rear wheel. Thus it marked an important stage in the development of the bicycle and paved the way for the invention of the Safety bicycle.

It is not known with accuracy who first discovered that a rider could maintain equilibrium on a two-wheeled vehicle, but there is a stained glass window in Stoke Poges Church showing a cherub, blowing a trumpet, astride a two-wheeled hobby-horse. This window was made in 1642, but if velocipedes did exist in those days no textual references were made. The hobby-horse, or velocipede, was propelled by sitting astride and "walking" until a sufficient speed was obtained to maintain equilibrium.

Crank and Pedals

The next development was to fit crank and pedals to the front wheel, but this made pedalling awkward when turning a corner.

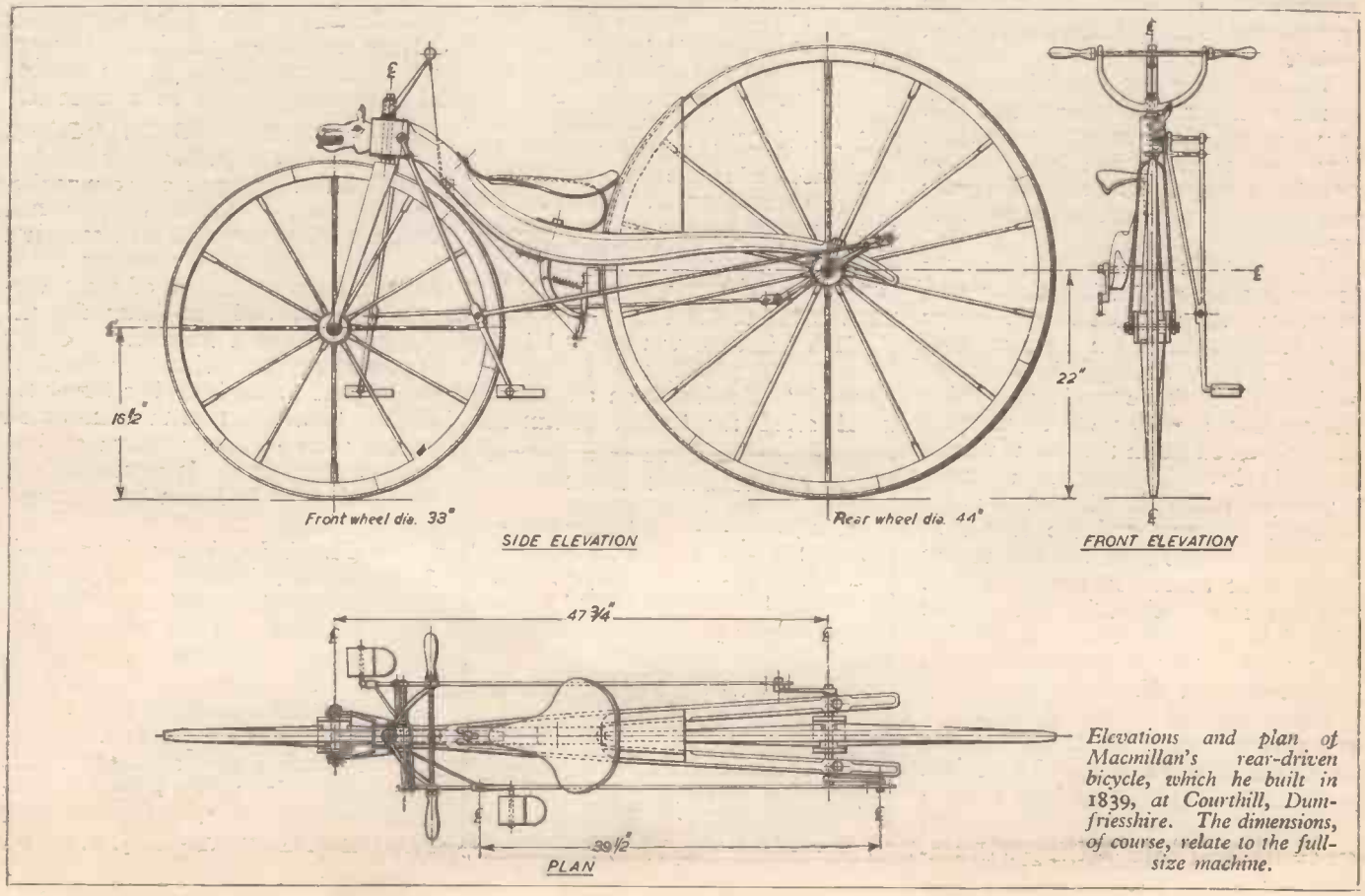
Considerable researches by the late H. H. Griffin during the early part of the present century, when it became a matter of importance to discover who really did invent the first pedal-driven bicycle, led him at first to give the credit to Gavin Dalzell, but further investigation proved that Kirkpatrick Macmillan, a blacksmith residing at Courthill, in Dumfriesshire, was the first and true inventor, and that he built it at his smithy in 1839. He was thus the first cyclist.

In 1939 the Centenary Road Club, whose members are mostly bicycle manufacturers, was formed to celebrate Macmillan's invention, and in 1946 they, in conjunction with the National Committee on Cycling, conducted a cycling pilgrimage to Macmillan's birthplace and unveiled a plaque to his memory bearing the following inscription:

1939
THE CENTENARY OF
THE BICYCLE
The National Committee on Cycling
Honours the Memory of
KIRKPATRICK MACMILLAN
The Inventor of the Bicycle.
He builded better than he knew.

This is the first time that scale drawings of the machine have been prepared and published. The Science Museum merely possess the copy of the machine and the photograph which appears at the top of this page.

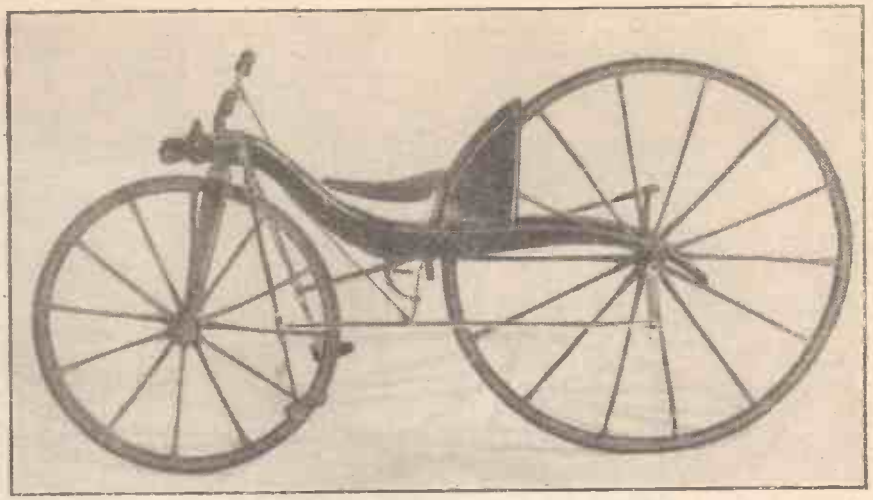
In the interests of historical accuracy it is necessary to state here that this photograph is Crown copyright, because a cycling paragraphist, who claimed to be the "cycling historian" on the strength of the possession of a copy of Griffin's famous book on "The History of the Bicycle," stated that the copyright was his. Moreover, in an interesting book entitled "The Devil on Wheels," which tells the story of Macmillan and his



Elevations and plan of Macmillan's rear-driven bicycle, which he built in 1839, at Courthill, Dumfriesshire. The dimensions, of course, relate to the full-size machine.

Model of Bicycle

Model of the First Pedal-driven from Drawings Prepared from the Science Museum, Kensington



Photograph of the one-eighth scale model of Macmillan's bicycle built by Mr. F. J. Camm. It is to scale in every detail, both as to size and method of construction.

bicycle, published in 1946 to synchronise with the unveiling of the plaque, this same photograph is used and credited to a cycling journal.

Certainly Macmillan, in building his machine, would not have prepared drawings. He would probably have chalked out a rough design on the floor and designed the details as he went along. The machine shows signs of having been altered, particularly the front forks, to gain wheel clearance. It will be agreed, however, that he had an eye for nice curves, for the backbone gives a pleasing impression of a speeding race-horse, although the representation of a horse's head at the front is more reminiscent of a dragon rampant with bar sinister!

The machine is, of course, a clumsy and cumbersome contraption, and perhaps altogether too much fuss has been made of its "invention," for the plain fact is that there is no invention in it. Wheels had been turned by cranks, rods and pedals in other mechanisms, notably lathes, years before, although Macmillan was the first to apply it to a bicycle.

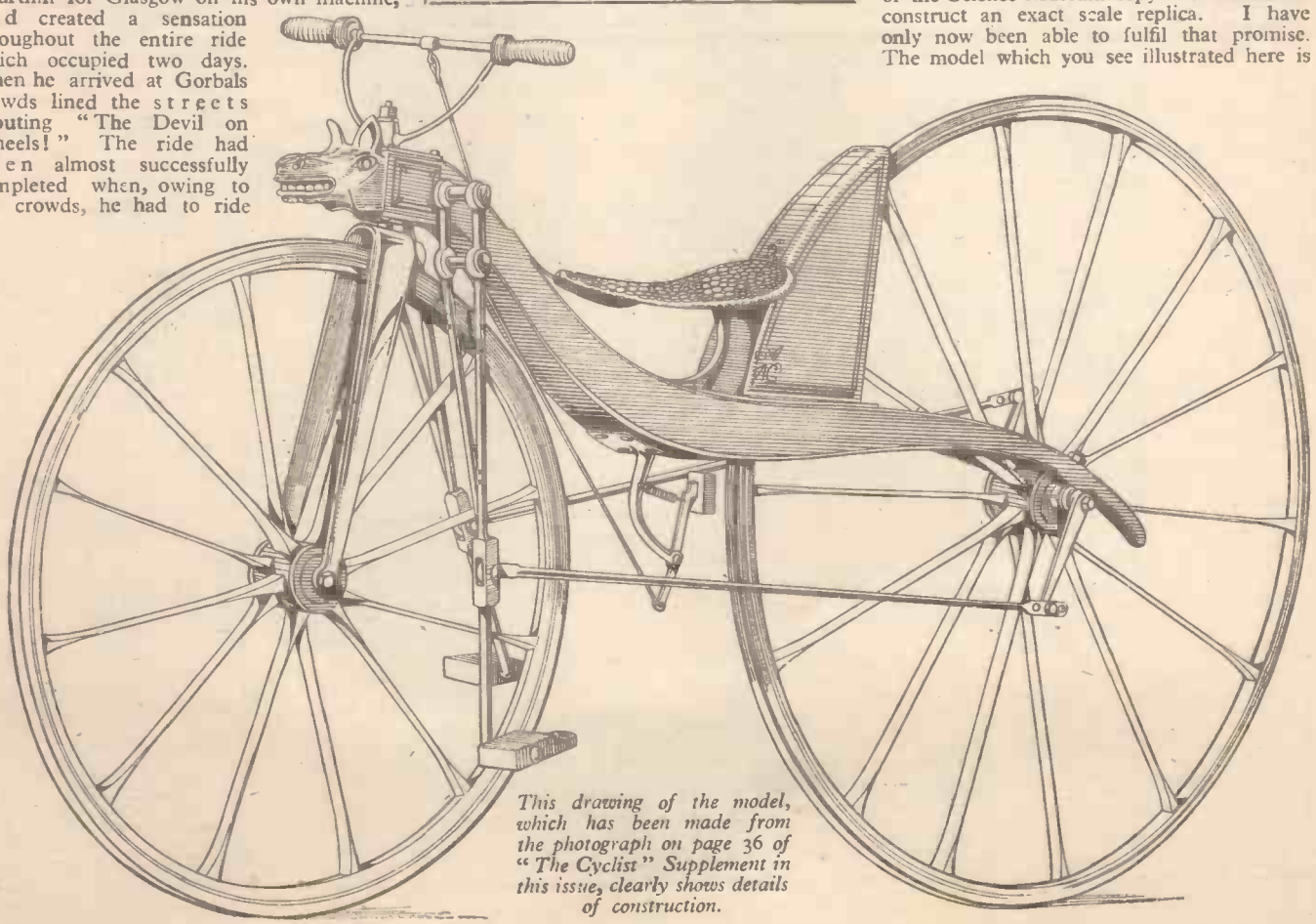
The First Pedal Cyclist

If he deserves fame it is on the score that he rode it at all! As the first cyclist he achieved fame also by being the first one to be fined, for on June 6th, 1842, he set off from Courthill for Glasgow on his own machine, and created a sensation throughout the entire ride which occupied two days. When he arrived at Gorbals crowds lined the streets shouting "The Devil on Wheels!" The ride had been almost successfully completed when, owing to the crowds, he had to ride along the pavement for a short distance. A five-year-old girl ran into the machine, just grazing her legs. The hostile crowd mobbed him. His machine was taken into custody and he was put in a cell. He was charged with causing obstruction and injuring the child. During the evidence it was disclosed that he had covered 40 miles in five hours—not bad on a machine weighing 57lb. with iron tyres, wooden wheels, and over the rough cart-tracks which passed as roads at that time. The magistrate referred to "this modern craving for speed," and clearly did not believe that any machine could travel faster than a horse-drawn vehicle. Macmillan was fined 5s. after he had demonstrated his machine to the magistrate.

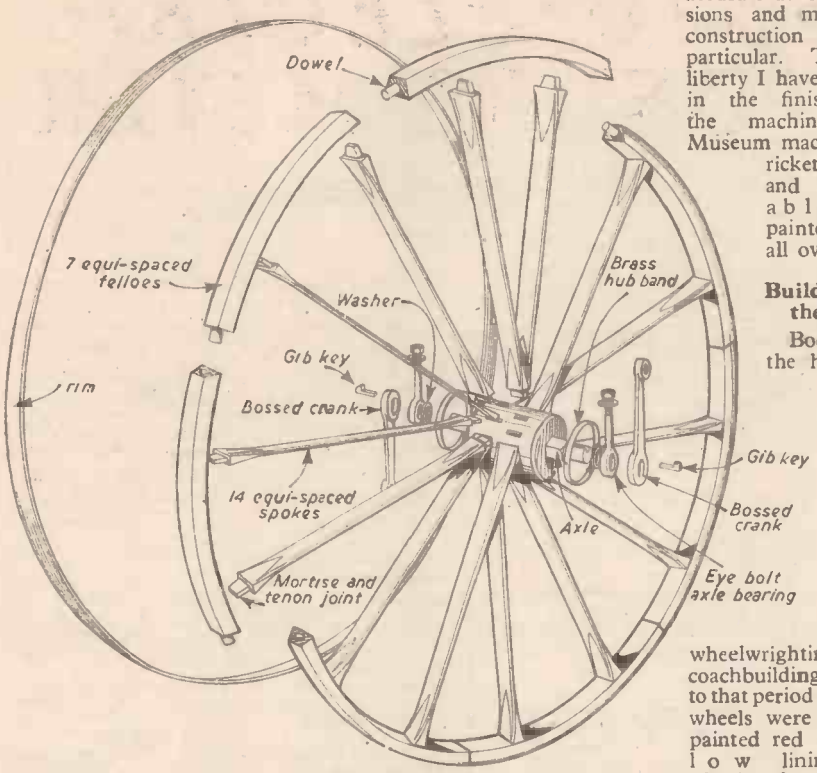
SPECIFICATION OF MACMILLAN'S BICYCLE

Weight	57lb.
Wheelbase	47¾in.
Front wheel (12 spokes) diameter	33in.
Rear wheel (14 spokes) diameter	44in.
Cranks	6⅛in.
Live axles to both wheels.	
Plain bearings.	
Twist-grip handlebar control to shoe brake acting on rear wheel.	
Tyres	Iron, shrunk on.
Pedals	Wood.
Saddle	Metal Pan type, cloth covered. (Sprung with fore and aft adjustment.)
Adjustable stroke to connecting rods.	

When I founded THE CYCLIST, then a weekly publication, in 1936 I promised myself that I would one day make drawings of the Science Museum copy and from them construct an exact scale replica. I have only now been able to fulfil that promise. The model which you see illustrated here is



This drawing of the model, which has been made from the photograph on page 36 of "The Cyclist" Supplement in this issue, clearly shows details of construction.



Method of building the wheel. It will be seen that separate felloes are used, 7 in the rear wheel, and 6 in the front.

accurate as to dimensions and method of construction in every particular. The only liberty I have taken is in the finishing of the machine. The Museum machine is a rickety affair and presumably was painted black all over.

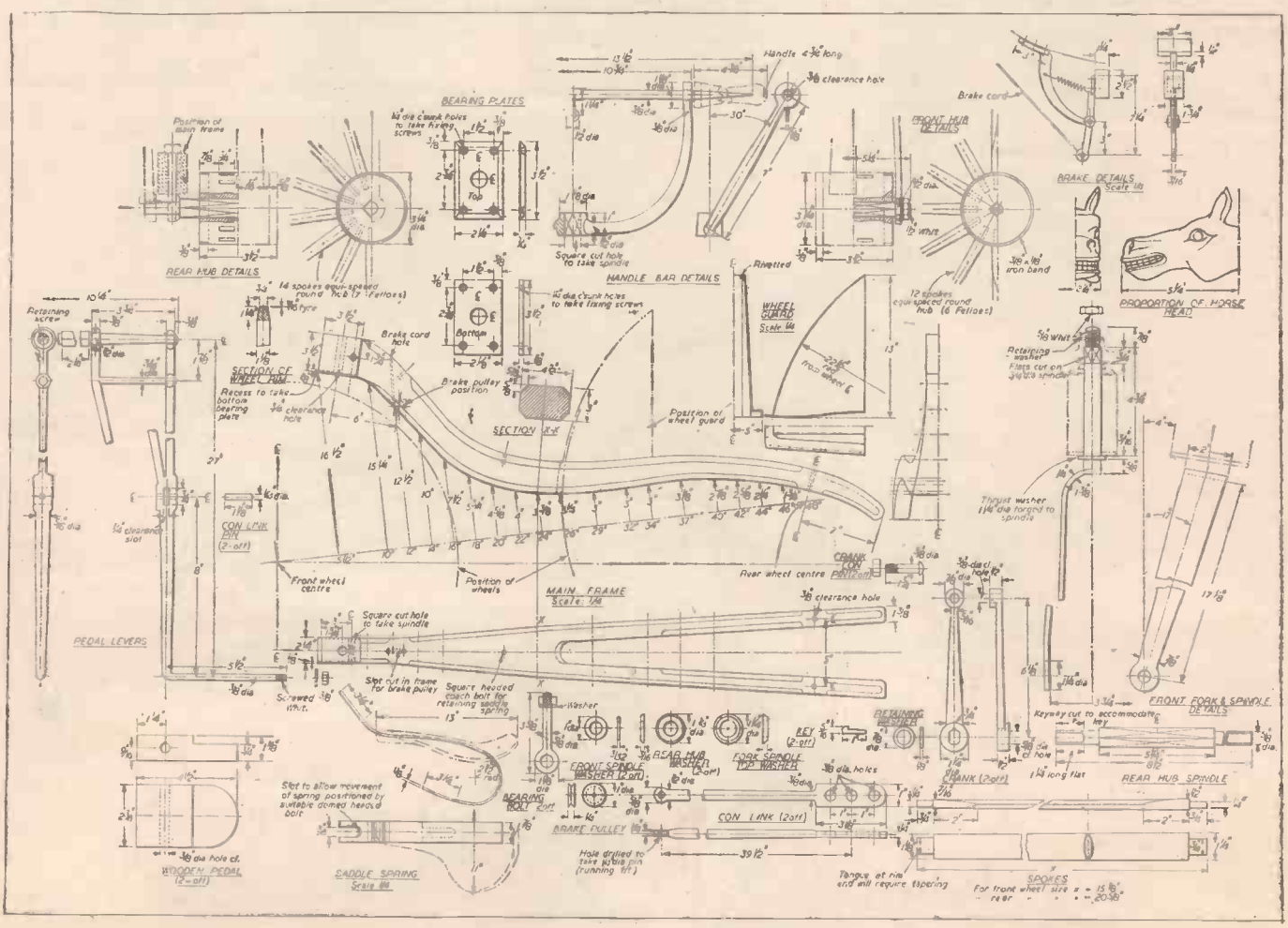
Building the Wheels

Books on the history of wheelwrighting and coachbuilding relating to that period show that wheels were normally painted red with yellow lining. My wheels, therefore, are finished in that style, the backbone being painted black. I built my wheels as a wheelwright would build them, using turned boxwood hubs, with metal bands at each end, spokes which are faired off from oblong section to oval section, separate felloes dowelled together and metal tyres which were shrunk on. The exploded view of the wheel construction on this page clearly shows how I built the wheels. I used boxwood throughout for the wooden parts. For the felloes I used parallel pieces cut to the correct angle and glued them on to a wooden face-plate symmetrically around a circle representative of the wheel diameter. When the glue was dry I turned away the unwanted wood, leaving on the face-plate a ring of wood forming the rim of the wheel.

The wooden face-plate had a piece of paper glued to it before the pieces of wood were applied to make removal easy. When the wood was removed from the face-plate I thus had seven separate felloes for the rear wheel and six for the front. The spokes, it will be seen, have tenons formed on each end fitting into slots in the felloes and hubs. It is important that the spokes should be of exact length between the shoulders, otherwise the wheels will not go together correctly. When the spokes are assembled on the hub, the felloes dowelled, and the outer ends of the spokes are entered into their mortices, a little gentle pressure will close the wheel, and if dimensions have been adhered to there will be no gaps at the felloe joints. Glue, of course, is used and I made a circular cramp to pull the wheel together and to hold it true until the glue was set.

For the tyres I used pieces of strip brass,

(Continued on page 36 of "The Cyclist" Supplement).



The component parts of Macmillan's bicycle.

The completed exposure meter.

A PHOTO-ELECTRIC EXPOSURE METER

Constructional Details of a Serviceable and Inexpensive Unit

By F. G. RAYER

READY-made photo-electric meters cost several pounds, but the one described here was constructed at a cost of approximately 12s. It is sufficiently sensitive for use when taking interior photographs, and has proved quite trouble free. Some difficulty frequently arises in calibrating a home-constructed exposure meter, unless a ready-made meter can be borrowed as a guide. This difficulty has, however, been completely overcome by screening the photo electric cell by a perforated grille. The perforations are increased in number until the meter gives a specific reading for certain lighting conditions, as will be explained, and it will then be correct for other scale readings.

Two ranges are provided. With the grille in position, the meter will deal with light values ranging from full midsummer sunshine to dull evening light. With the grille slid back, the full sensitivity of the cell is employed so that poorly-illuminated interiors and artificial light values may be read. To facilitate using the meter, it is calibrated directly in seconds, from 1/1,000th second, the camera shutter being set accordingly.

Photo Cell and Meter

The cell is the selenium barrier layer type, 22mm. by 40mm. in size. (This is obtainable from Megatron Limited, 115a, Fonthill Road, London, N.4, the price being 6s.) The cell consists of a flat steel plate upon which selenium is deposited. The plate is positive, and this should be remembered when connecting the two leads, or the meter pointer will endeavour to move backwards. A narrow metallic ring on the selenium forms the negative connection.

The meter is an ex-Government one, with a full-scale deflection of 50 microamperes. (That actually used was obtained from Sussex Electronics, Princes Works, Brighton, for 5s.) Under a strong light, the cell mentioned will give out over 300 microamperes, with a 100 ohm external circuit, so ample sensitivity on the "dim light" scale is obtained with the 50 microamp movement.

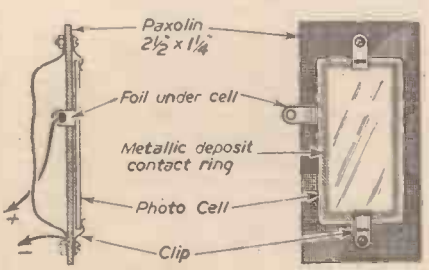


Fig. 2.—Method of mounting the photo cell.

Constructing the Case

This is shown in Fig. 1 and was made throughout with ¼in. wood. All the dimensions are included in the diagram. The panel rests on a ¼in.-wide ledge formed by cutting this width away to a depth of about 3/16th in. The lid is similarly treated, the edge being a trifle undercut so that the tinplate grille is held in place. A long hinge (two small ones would do equally well) secures the lid to the case itself. When the lid is closed both meter and cell are protected, and the cell kept in darkness. The lid is opened to about 90 deg. when a reading is required.

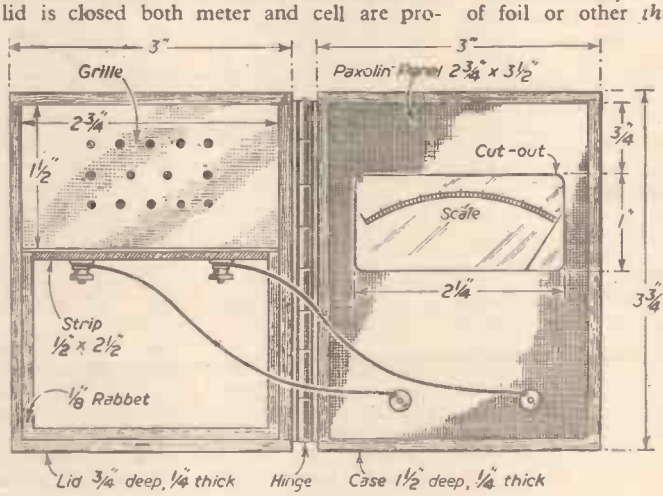


Fig. 1.—The meter completely open, showing the leading dimensions.

The meter is fixed in position as in Fig. 3. That used was a very tight fit in the case, so that a trifle needed to be shaved off inside to accommodate the magnet. Blocks glued in position hold the meter slightly away from the bottom of the case, while small brackets hold it down in place. The existing scale should be removed or covered up with card, upon which an arc has been drawn to correspond to the movement of the pointer.

The panel was cut from thin paxolin, with celluloid glued in place behind the cut-out through which the scale is seen. Two small terminals provide easy connections to the meter. A little space must be left so that the pointer does not foul the underside of the panel.

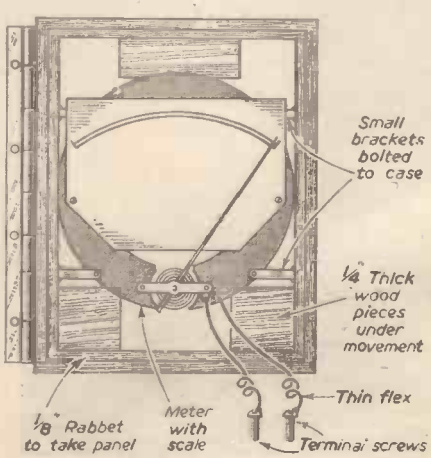


Fig. 3.—Meter casing with panel removed.

Mounting the Cell

This is done, as shown in Fig. 2, a piece of foil or other *thin* metal being held by pressure between the rear of the cell and the strip of paxolin to form the rear connection. Contact with the metallic deposit ring is made by two small clips cut from brass and bolted in place. These are joined by wire, as shown, to help to assure proper contact is maintained.

The mounted cell, as shown in Fig. 2, goes under the grille, illustrated in Fig. 1, fitting between the 2¾in. by ½in. strip and the end of the box, where it is held by small screws or tacks. The leads marked positive and negative in Fig. 2 are taken to the two small terminals on the strip.

Two thin flexible leads join the cell to the meter, as shown. When these are connected the meter pointer will move according to the intensity of the light falling on the cell. If the weather is bright the meter should not be taken near the window, or outside, at this stage, or the output of the cell will endeavour to drive the pointer past its maximum.

Calibrating

To avoid having many small figures on the scale, this was calibrated for the type of film always used, with the maximum aperture of the camera, as depicted in Fig. 4. Many

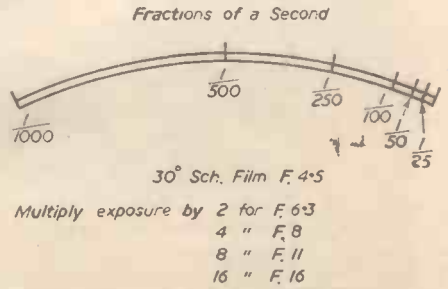


Fig. 4.—Method of calibrating the exposure scale.

Another view of the completed meter.

popular films have a speed of 30° Sch. If other films are used, the exposure may be doubled for each 3° lower the film-speed rating is, or halved for every 3° higher. (E.g., a 27° Sch. film requires twice as much exposure as does a 30° film.)

For other apertures, the well-known formula is used—*double* the exposure each time the lens is stopped down. For example, the exposure the meter indicates is for F.4.5. With F.6.3 double the exposure is required; with F.8, double again; with F.11, double that at F.8, and so on. This has been indicated in Fig. 4. It is only necessary to multiply by 2, 4, 8 or 16 for the smaller apertures, if these are used. (Photographers will already be familiar with this procedure, but it has been set out here to explain why the scale is so simplified.)

There is no reason why additional scales should not be provided for all the usual apertures and film-speeds, but the numbering will become rather cramped, and scarcely seems necessary.

The grille shown in Fig. 6 is cut from thin metal, and is a tight sliding fit in the ledge mentioned. It has a flange so that it can be drawn back. To begin with, drill a few small holes only in its centre, put the grille in position, and take the meter out of doors. This should be done between the hours of 11 a.m. and 1 p.m. with the sun shining unobscured by cloud. During the months of November, December and January, the meter should indicate 1/250th second. During the months of February, March, September and October, it should indicate 1/500th second. During the months from April to August, it should show 1/1,000th second. If the pointer does not move far enough, remove the grille and drill a further small hole in it. Keep on doing this until the reading is as above. Other readings for other light conditions will then be correct. In the meter made up, 14 holes 1/16in. in diameter were required, a few being very slightly enlarged to get the pointer up to the necessary reading.

During calibration, the meter should be pointed at some ordinary object of average tone, not at the sun.

For Artificial Light

If it is required to calibrate the meter for this, it is necessary to wait until darkness.

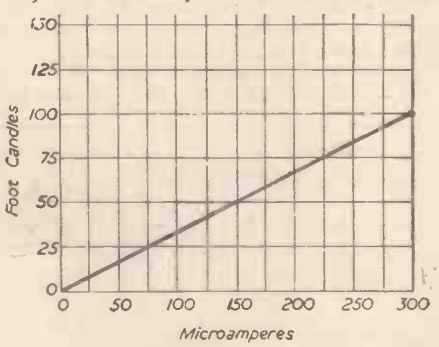


Fig. 5.—Graph indicating relationship between light and output.

A 100 watt pearl bulb is then taken as the light source, any reflector or shade being removed. Still adopting the 30° Sch. film and F. 4.5 aperture, exposures on medium toned objects positioned at definite measured distances from the bulb (which should be the only light in use during calibration) will be as follows: 1ft. 1/15th second; 2ft. 1/5th second; 3ft. 1/3rd second; 4ft. ¾ second; 6ft. 1½ seconds. The scale is accordingly marked with these figures, opposite the positions to which the pointer moves. This scale was marked on a small, separate card, cut to a semi-circular shape at the top to show the tip of the pointer. When used, it is merely held upon the panel over the window.

Accuracy to Expect

With the cell mentioned, and a meter of 100 ohms resistance, the cell makers give figures which are illustrated in simple graphical form in Fig. 5. This shows a straight line characteristic, output being directly proportional to the intensity of the light. It was thought that calibration should prove quite easy, and this was so, while actual use of the meter in conjunction with a camera, over several months, shows that the readings can be followed with confidence.

The ideal method of calibration would be to employ a ready made instrument, note its reading, and place this figure on the meter scale of the instrument being constructed. If circumstances permit, this may certainly be done. But in many cases it will not be possible to do this, and the method of calibrating the meter according to definite lighting conditions, as explained, can then be followed.

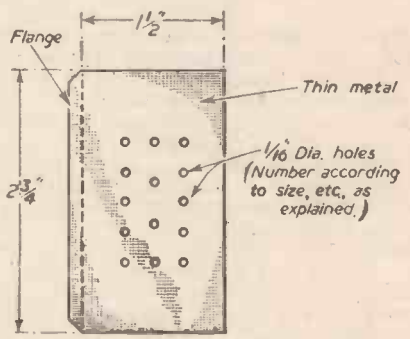


Fig. 6.—Details of grille perforations.

The Post Office Railway

A mail-bag container being unloaded from a train at Mount Pleasant Station.

SEVENTY feet below the streets of London, through 6½ miles of tunnels, run driverless and guardless trains carrying nothing but mail. Since December, 1927, the Post Office (London) Railway in achieving its first objects of relieving street congestion and speeding up the transit of mail across London, has run 42 million miles, has carried an annual traffic load which has grown from 7 million letter and parcel bags in 1928 to 11½ million last year and throughout its career the system has been totally immune from fatal accidents. The route of the railway, which is the only one of its kind in the world, is from Paddington in the west, to the Eastern District Office at Whitechapel, with six intermediate stations situated under large Distributing Offices and Liverpool Street Station. The train is scheduled on an even headway basis of three, four or five minutes, comprising one- or two-car trains arranged to meet mail requirements. The control is semi-automatic with standard track circuit relays, operating contactors which act as switches. All movement of trains in station areas is manually controlled by lever operation at a speed of eight miles per hour, but between stations the trains are under automatic control, and reach a speed of 35 miles per hour. The main supply of electric current is derived from two sources, with provision for an automatic change-over in the event of a supply failure.

A MODERN STANDARD LAMP

Constructional Details of an Attractive but Inexpensive Appliance

By R. W. HILL

I FOUND recently that a need had arisen for a standard lamp. The surrounding furniture called for a modern type of lamp as opposed to the more usual wooden style, but an investigation of the prices showed that the plainer lamp is very often dearer than its more ornate counterpart. The only alternative was to resort to construction. A promising start was made with the purchase of a length of aluminium tubing, which would polish up nicely for use as a column, but the problem of making a clean-looking round and smooth base to go with this proved rather acute until a happy inspiration came in the shape of a dustbin lid! Now before I am deafened by ribald laughter let me say that the average dustbin lid, which abounds in many gardens owing to its well-known propensity for outlasting the parent dustbin, is, due to the shape, of very strong construction, fairly accurately made, and if well chosen

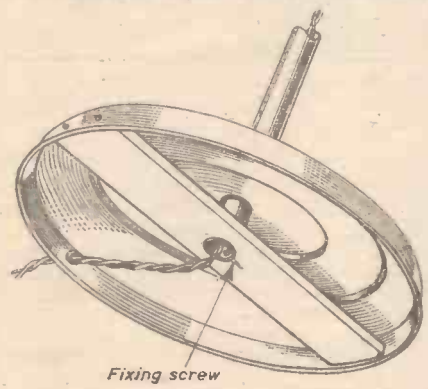


Fig. 1.—Underside of base, showing method of fixing to the column.

and finished will form part of a very handsome standard lamp, and will give the proud owner not a single qualm about its humble origin.

Construction

The chief advantage I found was ease of construction. Choose a fairly plain lid of about 17in. diameter and start with a good scrubbing to clean off some of the dirt; remove the handle and fill up the rivet holes by soldering pieces of tin on the inside, after first rubbing down to bare metal round the edges. Next remove any loose rust and dirt with a wire brush and file off or knock down any projections which would mar the appearance of the finished article. At this stage the application of one of the proprietary liquid rust removers would effectively remove the rest of the rust and dirt and prove an effective deterrent to any further rust formation.

The column, which is a 4ft. 6in. length of 1in. diam. aluminium tubing, can now be fitted to the base. Drill and file a hole in the centre of the base to fit the column. This is the only precision work required—a bad fit would ruin the appearance and allow the column to rattle loosely on the base. The column is fixed as shown in Fig. 1. A piece of wood about 3in. by 1in. is shaped to fit across the base and secured by four round-head screws from outside. The wood is marked and bored through to take the base of the column, a single screw through a hole ½in. from the bottom of the column into the wood holds the two together quite firmly. Final assembly can take place after painting. One further hole is made at the side of the base to take the wire; this is bushed with a rubber grommet from the radio spares box.

Painting

The finishing of the column is easy; a few minutes of brisk rubbing with metal polish will produce a good shine, after which clean off with cellulose thinners, brush on a coat of clear cellulose lacquer and the job is done. To match this, the base should be a nice glossy black, and to achieve this smoothness from our perhaps dented and rough base the filler or knife stopper used when cellulosing car bodies will prove invaluable as a ground for painting. A friendly garage or spray firm would supply a small quantity and this is applied liberally and smoothed over with a knife, covering up all irregularities. After 24 hours, rub down with wet abrasive paper (sometimes called "wet and dry") and plenty of water; this is a trifle messy, but it produces a very smooth and even surface which, after drying, forms an excellent base for painting.

Having just purchased a spray gun of the type which attaches to the vacuum cleaner I felt that I must needs try out its paces on this job, so a quantity of best black coach cellulose was obtained, and after many coats and a final polish a very high-grade surface was produced. For those without the equipment I am sure that a good synthetic enamel would produce as good a result, and certainly with less labour.

The Lamp Holder

The lamp fitting is made from a lamp holder with screw fitting, an adapter obtainable from any electrical supplier for about 6d., and a piece of 1in. dowel, as shown in Fig. 2. Drill a $\frac{1}{16}$in. hole right through the dowel for the wire. This hole should be just undersize for the adapter which, if screwed in, will cut its own thread and hold firmly. The outside of the dowel is cut or turned down to make a good push-fit into the top of the column, leaving a lip flush with the top. Fixing screws can be added if desired, but this fitment will be found quite strong enough in practice; more support might be necessary if the lamp holder contained a switch and was subject to continual handling, but I prefer the switching to be at the mains socket—a fastidious precaution, perhaps, but it avoids a permanently live lead trailing round the floor.

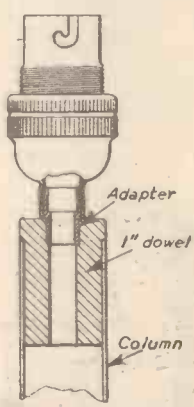


Fig. 2.—Sectional view of lampholder and top of column.

The completed standard lamp in a homely setting.

The Shade

The lamp can now be assembled and wired up. Having gone so far with construction I went the whole way and made the shade as well, from silk stretched on a framework of 12 s.w.g. galvanised wire. This was perhaps unnecessary enthusiasm, for frames or complete shades can be easily purchased; but whichever course is adopted remember to choose a wire framework and shade of fairly simple lines to be in keeping with the general idea of the lamp.

Colour and decoration will, of course, depend on the existing furnishing, and with good taste the completed standard lamp will make a pleasing and useful addition to any modern home.

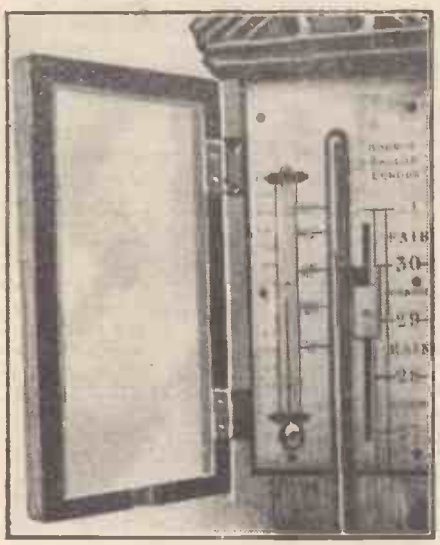
Restoring Mercurial Barometers

Practical Pointers for the Repairing and Refurbishing of a Common Household Article

By J. F. STIRLING

MORE, perhaps, than any other object of domestic convenience, the ordinary household barometer, as it hangs silently and uncomplainingly near the front door of the house, is liable to suffer from, and ultimately succumb to, the insidious ravages of time and of a long sequence of neglect. For, somehow or other, we are apt only to become aware of the hall barometer's presence when it ceases to function, much in the same way as we usually notice a household clock when we fail to hear its tick.

The ills which household barometers bear are mainly those which are due to dust, dirt



A close-up of the indicating plate of a "stick" barometer. As will be seen, the mercury-level is read off directly against the calibrated scale.

and rust, to corrosion and to excessive dampness, apart, of course, from the more severe ailments caused to such instruments by sudden and violent shocks, resulting in actual internal breakages of one kind or another.

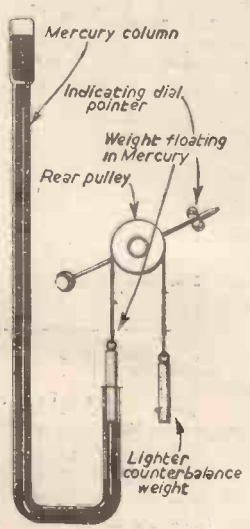
There are two types of barometer in common household use at the present day—the mercury type and the aneroid pattern. The mercury variety of barometer, with which this article is solely concerned, is to be found in two chief types: (a) the straight or "stick" barometer in which the level of the mercury column is read off by direct observation, and (b) the "wheel" or "banjo" type of barometer in which the mercury movement is manifested by the position of a pointer in front of a circular dial. For more than a century this has been the common type of household barometer, being, when carefully adjusted, more sensitive than the modern aneroid barometer, although not quite as accurate and sensitive as the still older "stick" type of instrument.

Operating Principles

A mere glance at the internal arrangements of the stick and of the wheel barometers will immediately indicate the principles on which these types operate. The stick type of barometer is entirely without working parts. It embodies nothing more than a barometric mercury column conveniently mounted, with a calibrated indicating scale placed behind the upper portion of the mercury tube so that the mercury level can be read off against the indications. In the wheel type of barometer, precisely the same pattern of mercury tube is used, but the rising and falling movement of the mercury is made to actuate the dial pointer by means of a small glass float which rests on the surface of the mercury in the lower end of the tube, being suspended thereon by means of a thread which is attached to one side of a small pulley mounted on the pointer spindle, and which is partially counterbalanced by a lighter glass float similarly secured to the opposite side of the pulley. Thus, as the mercury rises in the long tube, the indicating pointer moves clockwise against the dial and the counterbalance float descends, whilst, when the mercury falls in the tube, the counterbalance float rises and the dial needle moves anti-clockwise.

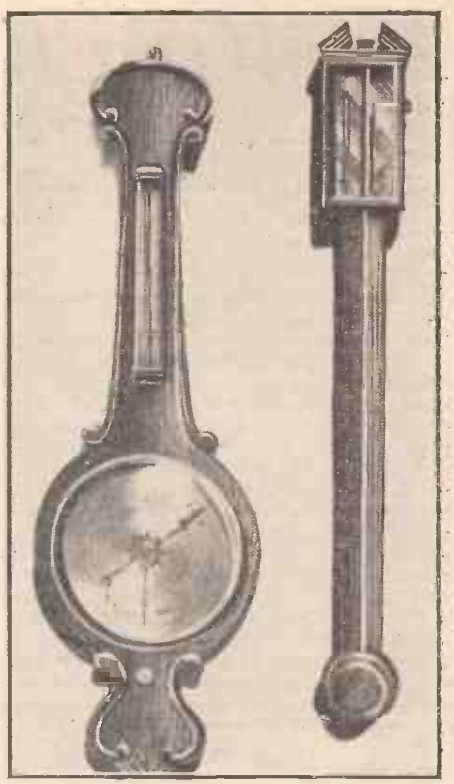
From a constructional viewpoint, nothing could be simpler than the operating principles of these two barometer types, and, often enough, a barometer which has been giving erratic readings or which has ceased to function altogether may at once be put into full working order by dint of a little care, cleaning and adjustment.

There are more serious cases, however, when the barometer tube has lost some of its mercury, or when, as a result of the instrument being turned upside down or knocked over in some way, air has attained access to the top of the mercury column. Similar instances occur also when the mercury has become badly contaminated with dust and dirt. In addition, there are small "mechanical" faults which are capable of bringing the needle movement of a wheel barometer to a standstill. Obvious faults these will be, such as the rusting of the central pointer spindle, the breakage of the thread holding the floats, the frictional contact of a bent indicating pointer against some part of the dial, and the more or less clogging up of the simple moving parts of the instrument with compacted, matted, damp-impregnated dust and fibrous debris of various kinds.



Schematic diagram of the operating principle of the wheel barometer.

For a mercury barometer of either

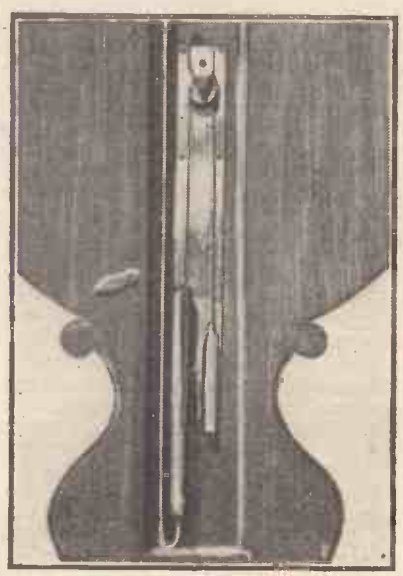


Two household mercury barometer types. The "wheel" barometer (left), and the "stick" or straight type of barometer (right).

wheel or stick type which has got into a really bad condition, there is no alternative but to detach the tube, remove the mercury and, after thoroughly cleaning it, replace it therein. This is a serious job, but it is by no means beyond the resources of any amateur who is prepared to work carefully and patiently.

Emptying the Tube

Removing the mercury from the tube is a fairly simple task. The tube is detached from its mounting and held vertically above a large non-metallic basin. The tube is now



The mechanical portion of a wheel barometer at the rear of the case. Note the glass float suspended in the lower mercury-tube limb, and also the free counterbalance weight whose relative movements actuate the pointer on the dial of the instrument.

slowly inverted so that a little of the mercury spills out into the waiting basin. The operation is repeated again and again (perhaps 15 or 20 times), until all the mercury has been removed from the tube.

Usually, the glass tube itself will require cleaning. Chemical methods are necessary here, because, as a rule, the inner sides of an old tube will be found to be filmed with a greyish mercury sludge. This film can be readily dissolved away by partially filling the tube with diluted nitric acid (about 1 in 5) and then by shaking the liquid within the tube. The tube should then be rinsed out with water and then recharged with a clear soap solution. A small soft-bristle brush attached to the end of a long flexible wire should be carefully worked up and down inside the tube in order to "scrub" the tube walls and to free them from any adhering matter. Incidentally, these narrow-bore "tube brushes" may be obtained from most dealers in laboratory supplies. It is most essential, however, that the bristles are firmly attached lest any should remain in the tube, from which they would be removed only with difficulty.

After cleaning, the barometer tube is rinsed out with plain water three times, and with distilled water twice. It may then be put away in a warm place for a week to dry out thoroughly (a hot cylinder cupboard, for instance). It may be dried more rapidly by the expensive method of filling it with absolute alcohol, which will absorb the residual water from within the tube, shaking out the alcohol and partially filling the tube with ether, and subsequently shaking this out. The tube will now be perfectly clean and it will dry rapidly when placed in a warm situation. Remember, of course, that ether is very highly inflammable, and that a barometer tube containing ether or even a trace of it must not be placed near an open fire to dry out.

Cleaning the Mercury

The mercury itself is readily cleaned by preparing a little chamois-leather bag in the bottom of which a few needle holes have been made. The mercury is poured into this bag a little at a time. The bag is then screwed up between the fingers and the mercury is thus forced through the needle holes, descending as a fine, silvery shower into a waiting non-metallic receptacle below. This operation should be repeated three times. Unless the mercury is very badly contaminated, it will be sufficiently clean for refilling into the tube; but if it still presents a dull surface, or if, when drawn across a surface of rough white paper, it leaves "tails," the metal is still contaminated, and it must be further purified by being squeezed through the chamois into a vessel of dilute nitric acid (1 in 5), this operation being repeated half a dozen times. The mercury is then shaken up with a large volume of water several times to rid it of the acid, after which it is poured into a clean, shallow basin or saucer and the surplus moisture mopped up from it with white blotting paper. Do not put the mercury away into a hot, dry place, because, at elevated temperatures, mercury is appreciably volatile and some loss of the metal may result from this method.

The lower end of a "stick" barometer showing the V-tube whose shorter limb has been formed into a bulbous shape to act as a mercury "cistern."

Before filling the mercury into the tube it is most essential to see that both tube and mercury are perfectly dry, for if the slightest trace of moisture is present it will ascend to the top of the tube above the mercury-level and will remain there in the form of water-vapour exerting a direct internal pressure on the mercury column and falsifying the reading of the barometer.

Cleaning mercury or quicksilver by squeezing it through a chamois leather bag which has been pierced with a few needle holes.

Recharging the mercury into the barometer tube is a critical and an exacting process. It depends more on knack than on skill. Hold the tube vertically with its closed end at the top and with its lower end facing upwards. Pour a little mercury into the lower end. Then place the thumb over the lower open end, completely closing it, and invert the whole tube with a rather sharp but not too violent a motion. This latter precaution is essential, because if the mercury is too vigorously shaken in the tube its heavy impact may fracture the glass.

In the above manner, some of the mercury will be jerked around the lower U-bend of the tube and will fall into the long limb of the latter. The operation is repeated until the long limb of the tube is completely filled with mercury. As the tube fills, the task of getting the mercury into it becomes more and more difficult since, in the later stages of the process, the very greatest care must be taken not to allow air bubbles to enter the tube above the mercury. The whole operation becomes one of getting mercury *into* the long tube and, at the same time, of getting air *out* of the tube.

There are several methods of effecting this. One of them is to lay the entire tube on a bed of gently heated sand contained in a long, shallow tray. By this method, the air, becoming heated, is expanded in part out of the tube, so that when mercury is poured into the lower end of the same it tends to be sucked therein when the tube cools down by virtue of the partial vacuum thus created. Another, and, perhaps, a simpler method, is to allow fairly hot water to run down the outside of the tube. This has the same effect of air expansion and subsequent partial vacuum creation within the tube. At each addition of mercury to the lower end of the tube the latter must be sharply inverted (the thumb closing the open end of the tube), so that some of the mercury is jerked around the bend and sucked downwards into the long tube, some of the air being thereby forced out of the tube as it is displaced by the mercury.

The Torricellian Vacuum

The long tube must be filled *completely* with mercury. When it is then reinverted to its normal position, the mercury will sink a little in the tube, leaving above it an almost completely vacuous space—the well-known Torricellian vacuum—and the mercury-level in the tube will be the barometric level in the district under the prevailing atmospheric conditions. It will now be a simple matter to replace the tube in the older type of "stick" barometer. Care must be taken to replace it so that the mercury-level coincides with that day's barometric reading on the engraved scale behind the tube, and this necessitates reference to another reliably working barometer.

Clean, uncontaminated mercury for barometer use breaks up into globules or "buttons" when spilled on to a level surface.

Mercury which is dirty and thus unsuitable for barometer use leaves "tails" when poured over a level surface, and it tends to mark the surface with a greyish film.

In the case of a "wheel" barometer, after replacing the tube, the pair of glass "floats" (they are frequently portions of broken thermometer stems) are secured to ends of stout linen thread or thin gut lines which are themselves tied to opposite sides of the central pulley mounted on the indicating-pointer spindle. It is essential that the spindle should revolve freely and truly, otherwise the pointer itself will stick and will not adequately register the rise and fall of the mercury. From this simple type of indicating mechanism all possible sources of friction should be eradicated.

The worker who is making a thoroughly good job of the restoration, repair and refurbishing of an old barometer will naturally wish to clean up the discoloured brass fittings and mountings of the instrument. They should all be boiled in weak caustic soda solution (1 in 12) in order to soften and remove the old, and now possibly encrusted, brass lacquer. After this, the parts may be rinsed, dried and re-lacquered, using a colour lacquer. But if the colour of the natural brass is preferred, the brass parts would best be immersed for a moment in the following bright dip:

Strong sulphuric acid	...	109 ccs.
„ nitric acid	...	19 „
„ hydrochloric acid	...	0.5 „
Water	...	123 „

This bath should be made up accurately. It will impart a bright surface to clean brass or copper within a matter of seconds, after which the article is swilled in cold water, dried and clear-lacquered.

Resilvering

Barometer dials and indicating plates are readily resilvered by means of the special silvering powders which are sold by dealers in horological materials. Alternatively, the amateur may make a good instrument-silvering compound for himself from the following formula:—

Common salt	...	2 parts (by bulk)
Cream of tartar	...	2 „ „
Silver nitrate	...	1 part „

The ingredients are dried and are powdered separately. They are then ground up together (in a non-metallic vessel) and stored until use in the dark in a well-corked amber bottle. For use, a little of the powder is taken up with a soft, wetted cloth and rubbed over the area to be silvered. The silvering appears at once, and when the whole area has been covered the newly-silvered surface is rinsed down with plain water and allowed to dry without heat. When dry, the surface should be given a thin coating of clear lacquer. The surface under treatment must necessarily have previously been thoroughly cleansed and rendered quite free from old lacquer.

If, by any chance, the tube of an old barometer is found to be broken, it can be replaced by a new one obtained from a firm of laboratory furnishers. It is best to take delivery of the new tube personally, even if it involves a journey to do so, in order to obviate the risk involved in the packing and transport of such a fragile article. Often enough the small thermometer, which is usually incorporated as part and parcel of a mercurial barometer instrument, will be found to be broken. Such an article cannot be repaired, but it can usually be replaced at a very reasonable cost from the stock of any laboratory dealer. Indeed, such a necessary replacement should never be omitted, for an accompanying small thermometer is one of the features which so strongly characterise an old-world barometer of the mercury type and which serve to "make" it not only in style and in all-round serviceability, but also in actual monetary value.

To function well and reliably, the barometer tube itself should be guarded as much as possible against the entry of dust. It is advisable to tie down a circle of cellophane tissue over the open end of the shorter limb of the mercury tube, and then to puncture the stretched tissue with one or two needle holes. These will help enormously in keeping out dust, but, at the same time, they will allow quite adequately the necessary admittance of air.

Vertical Position Necessary

When placed on a wall, any mercury barometer must be positioned perfectly upright, for if the tube deviates from the upright the mercury movement will not be free enough, nor will the mercury reach its highest barometric level. Furthermore, in the case of a wheel barometer, the moving parts may tend to bind and thus to interfere with the true pointer-indications.

It should not lean, either forwards or backwards, against the wall, and if the wall is out of true (as is, unsuspectedly, often the case) one or more thin packing blocks will be necessary behind the instrument at its upper or lower ends to ensure that it is vertical.

A good barometer should be attached to the wall at both its upper and lower ends by means of Rawlplug fittings. The instrument will thus be held rigidly and no movement will be possible. It should not be necessary to tap on the face of a wheel barometer in order to get an accurate reading from the instrument. If any such tapping is found to be necessary the inference is that there is a lack of freedom at some point or other of the moving parts, and the trouble should be investigated at once.

Never place a barometer in a draughty position. Draught, in the average house, means dust, and the latter is one of the worst enemies of barometer working. Nor should the instrument be fixed against a wall which is perpetually damp, because dampness makes for corrosion of the metal parts and, usually, for the general deterioration of the instrument as a whole.

The ideal position for any type of barometer is against a flat, level, perfectly vertical wall which is not unduly damp, draughty or dusty, and which is exposed to a fairly equable temperature and humidity. So fixed, and guarded against accidental mechanical injury caused by objects falling against it and thereby breaking the dial glass or even the mercury tube itself, a well-adjusted mercurial barometer of any type will go on working accurately and consistently for year after year, being, in point of fact, only rivalled in reliability by that other familiar work of the old-time craftsmanship, the old English clock.

Items of Interest

Johnson's Photographic Competition Results

MESSRS. JOHNSONS of Hendon, have recently issued a list of prizewinners in their Autumn Competition, which closed on October 31st, 1951. A very high standard of photographs were submitted, particularly in the novices' class. In each of the first three classes prizes of £10, £2 and £1 were awarded. In Class 4 (Novices' Section), three first prizes of £3, two second prizes of £2, six third prizes of £1, and eight fourth prizes of 10s. were awarded. There were also forty-two consolation prizes, taken from all classes. The next competition closes on April 30th, 1952, and leaflets giving the rules, classes, etc., are obtainable free on application to Johnsons of Hendon, Ltd., Hendon Way, Hendon, London, N.W.4.

The Blackburn Universal Freighter

THIS new Universal Freighter is the civil variant of the GAL.60 military transport, and is sufficiently spacious to accommodate a thirty-seater coach. This huge aircraft, designed for the air haulage of bulky cargoes, is powered by Bristol Centaurus 171 engines of 2,940 h.p. The main feature is, of course, the freight compartment, which has a level floor 36ft. long and 10ft. wide, with no obstructions, and a maximum head room of 10ft. The floor is designed to carry any load within the capacity of the aircraft without spreader beams. The floor panels and supporting structure are designed to take a maximum unit-distributed load of 325 lb./sq. ft. and a maximum axle load for vehicles of 9,000 lb.

New Union-Castle Liners

THE *Rhodesia Castle*, recently completed by Harland and Wolff in Belfast for the Union-Castle Line, is a twin-screw turbine vessel of 17,300 tons, and is at present on the "Round Africa" service. A sister ship, the *Kenya Castle*, is now being fitted out.

"Besides resting the feet it leaves the hands free!"

VISIBLE SPEECH

A Review of Some Interesting Research Work Carried Out in America

By F. W. COUSINS

THE title may sound rather paradoxical but the idea of enabling totally deaf persons to converse by visual aids was one of the objectives of Alexander Graham Bell's early researches. Many technical difficulties have hindered the progress of recording the visible patterns of sound, but recently certain war-time researches of the Bell Telephone Laboratories* of New York have been disclosed, and they have perfected and produced apparatus for carrying into effect the visual portrayal of sound phenomena by electrical means.

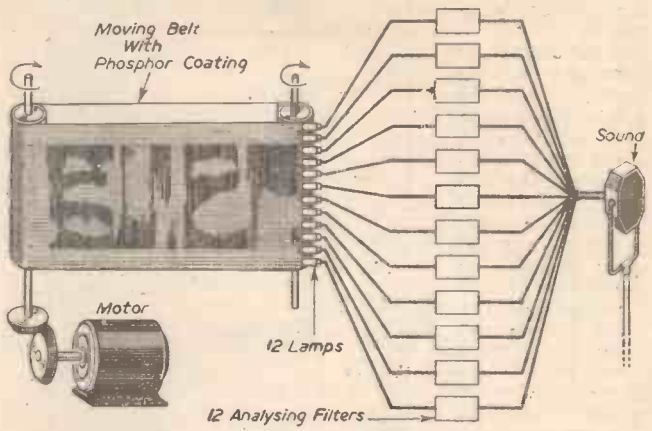


Fig. 4.—Schematic diagram of a visible speech translator.

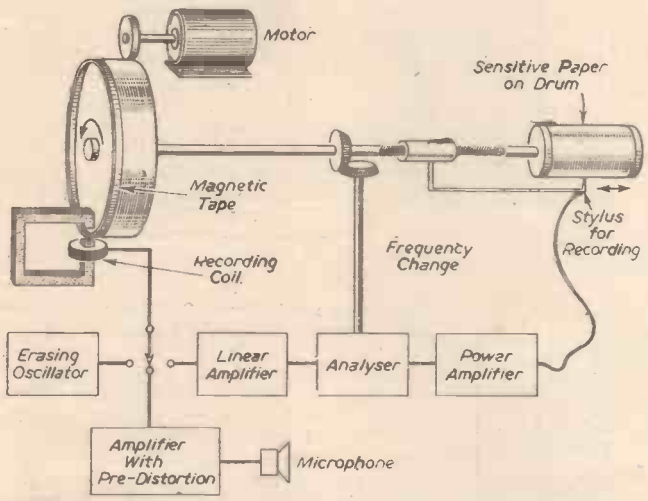


Fig. 2.—Diagram showing the layout of a sound spectrograph.

The Portrayal of Visible Speech

Ordinary oscillograph methods of portrayal are not satisfactory as the wave traces seen carry too much information. To portray sound in a form that the eye can encompass in a glance requires that some means be provided for selecting the essential information and displaying it in orderly fashion. The essential information for visual reception must not be dissimilar from the essential information which the ear analyses when fulfilling its normal function. The ear performs a time frequency intensity analysis of speech taking the complex sound waves and spreading them out in space patterns corresponding to the overtones present in the waves. Further, the high frequency and low frequency overtones are segregated, and strong overtones register more markedly than weaker ones.

Visible speech portrayal attempts to conform to the above noted analysis undertaken by the ear. In the Bell Telephone technique the visual pattern presents the overtones spread out vertically, high frequency at the top and low frequency at the bottom of the pattern.

Strong overtones are shown darker than the weaker ones. The time relationship is satisfied by linear spacing along the horizontal direction; and the visible patterns move from right to left as the words are spoken.

A spectrogram of the words "Visible Speech" and "We are due at about eight" appears in Figs. 1a and 1b. The spectrogram is made upon a sound spectrograph which essentially comprises a magnetic tape sound recording means which plays the sound back repeatedly into a scanning filter, the pass band of which is moved slowly across the frequency spectrum. The scanning filter output operates a stylus which makes a trace upon electrically sensitised paper. (Fig. 2.)

If words are spoken by different people having voices of varying characteristics the words have a similar basic appearance in the visual pattern. This is well illustrated in the comparative pictures of Figs. 3a and 3b, where different men and women have each uttered the same word "speech." The spectrogram diagrams give a visual representation of the varying accents of the recorded words.

Visual Speech Translators

A later development of the sound spectograph is shown in Fig. 4; it is called a visible speech translator since it converts speech intended for aural reception into a form suitable for visual perception.

The speech of the operator is received into a microphone and the impulses are conducted to a set of twelve adjacent filters which divide the speech band (about 100-3,600 cycles) into 12 groups of approximately 300 cycles wide. The output of energy from the individual filters excites twelve minute lamps which in turn excite a phosphor coating on the moving belt thereby producing visual patterns which move from right to left. The filters are so arranged and so connected with the lamps that the lowest lamp is excited by the lowest frequency, and the uppermost lamp by the highest frequency.

Applications

Primarily the portrayal of sound offers a great service to the deaf and the severely deafened. It offers a service to such unfortunate people in two ways; it enables them to read instantaneously (after appropriate training) the conversation of others; and it enables them to control the production of their own speech. This latter use is of great assistance in training children who are deaf at birth,

* Visible Patterns of Sound, R. K. Potter. Technical Aspects of Visible Speech, Bell Telephone Monograph, B1415.

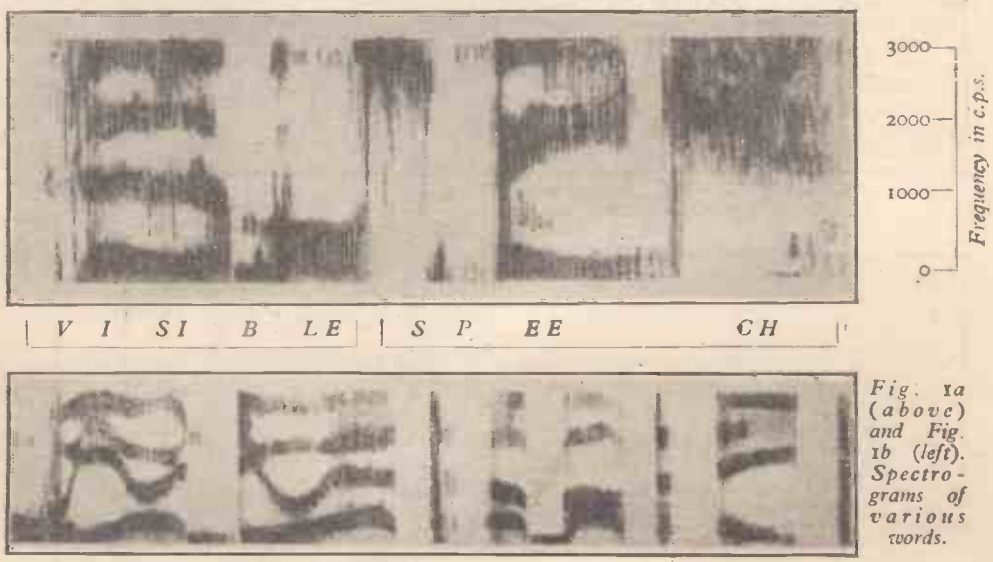
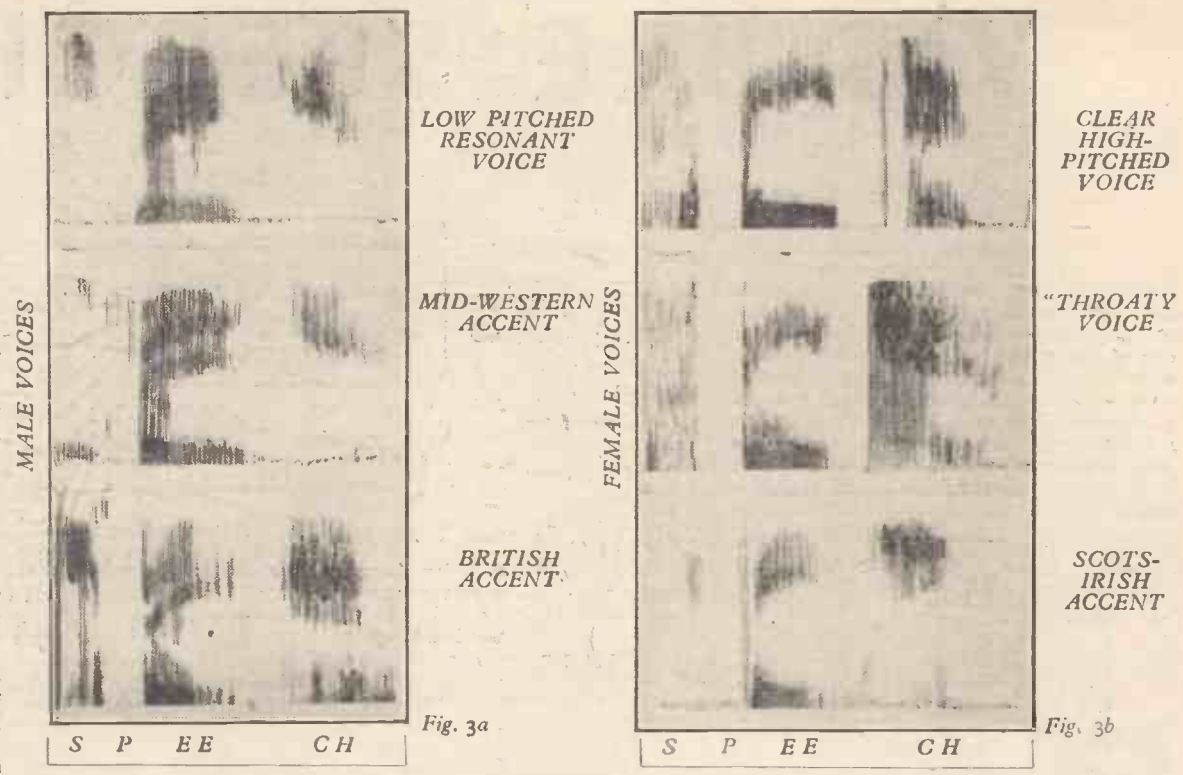


Fig. 1a (above) and Fig. 1b (left). Spectrograms of various words.

"We are due at about eight."

and who consequently cannot learn to speak by an imitation of their elders. Making sounds without ears to hear is just as difficult as drawing without eyes to see the results. The other uses are to some extent overshadowed by the first-mentioned use, but the visual patterns are of great interest to the phonetician in his dealings with the analysis of speech and speech correction. The method may be used to teach the correct pronunciation of foreign languages. Other applications come readily to mind such as detailed studies of the characteristics of sounds emitted from musical instruments, from animals, birds and even noisy and disturbing machinery. Some patterns representative of such sounds are shown in Fig. 5.



Figs. 3a. and 3b.—Spectrograms of words spoken by different people.

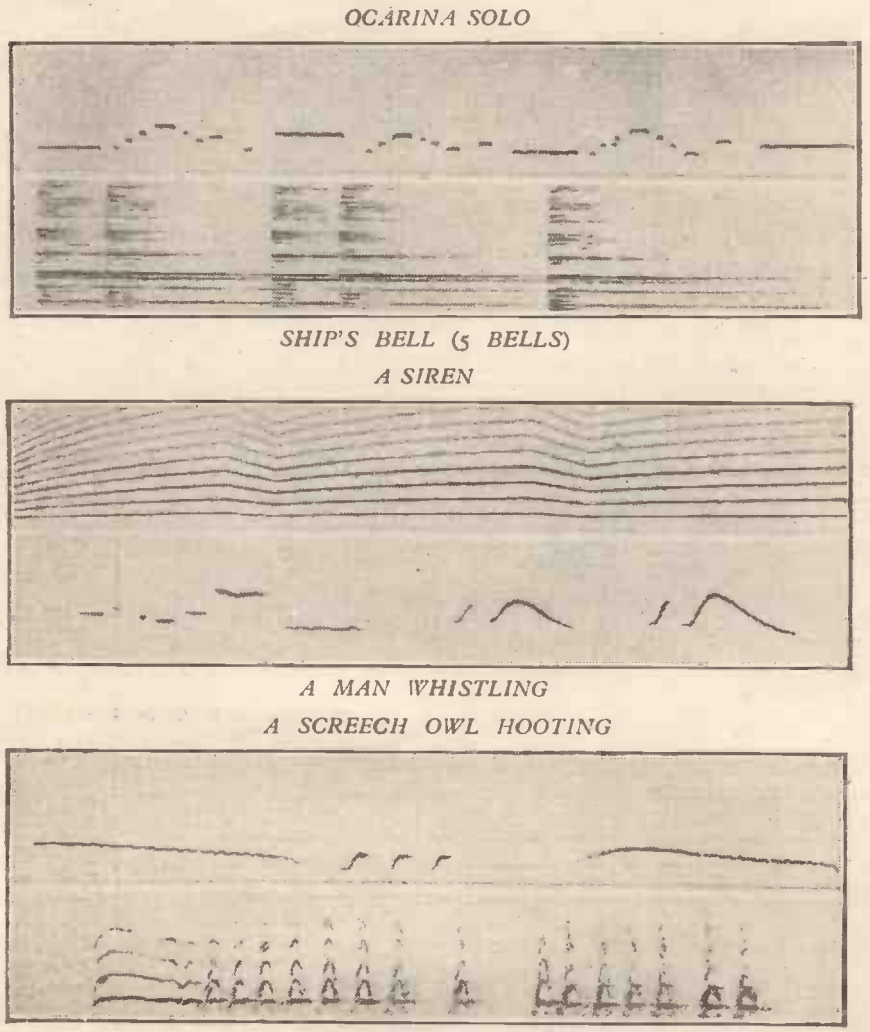


Fig. 5.—Visual patterns of various sounds.

Jet Planes Piloted by Periscope

EFFORTS are being made to increase the speed of jet planes, and high-speed fighters may soon be piloted by periscope. Experts are working on indirect-vision devices which will give pilots a wide view when flying in the prone position.

Experiments have been carried out for sometime to discover if pilots of these ultra-modern streamlined machines can fly them while lying on their stomachs to reduce the effects of gravity. In America, tests have already been made in a blacked-out conventional plane equipped with a small periscope. The plane was successfully flown with nothing to guide the pilot except an 8-in.-square TV-type picture of the view in front, projected on to a screen on the control panel. The test-pilots reported no greater difficulty in flight than with the conventional windshield.

One advantage is the large gun-sight type cross drawn on the screen which enables the pilot to "aim" his plane on to the runway when landing.

Making a Burglar Alarm

An Efficient Alarm Device Constructed from an A.M. Unit Control Camera, Type 48

By J. S. KENDALL

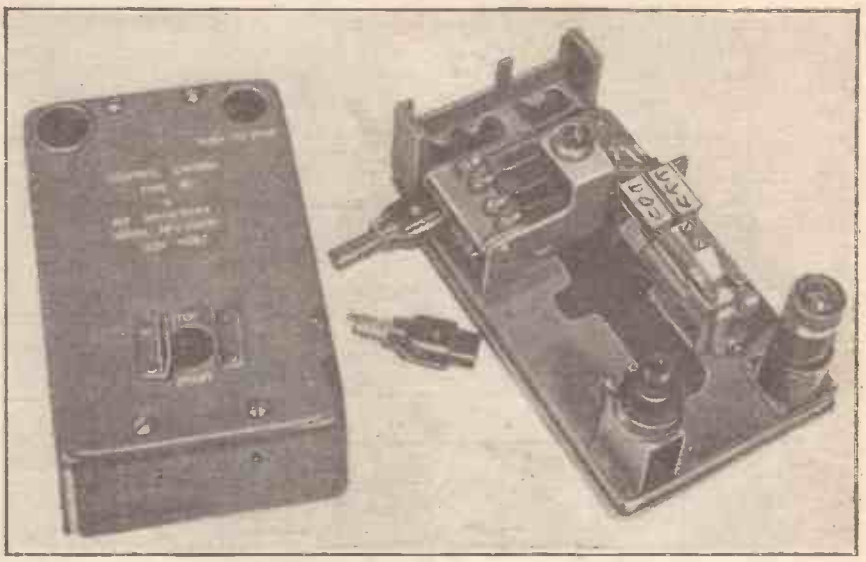


Fig. 1.—The completed alarm device with its cover removed.

THE unit used for this alarm, as purchased, has two relays, and when the cover is removed these can be seen. The wires should be carefully unsoldered from the one on the left-hand side (Fig. 1) and the relay removed, as it is not required. The next step is to modify the push switch at the bottom left-hand corner; it is of the break type and has to be modified to a push-to-make. The way this is done is shown in Fig. 2; the two fixing screws are removed and the push button taken to pieces; cut a piece of paper insulation to the same size as the bottom piece of the push button. This acts to stop the two contacts from earthing. Turn over the two contacts so that the pips are on the top; turn over the spacing piece and then reassemble the remaining parts in the same way as they were before being removed, and the button will then be modified.

Conversion

Some of the wires go to the original places in the unit as purchased, but others have to be altered. Some constructors may prefer to strip out all the wires and start over again, whilst others may prefer to leave as many as possible in situ.

The switch incorporated in the unit is of the double-pole type and only makes one circuit at a time; this is convenient, as the alarm circuit can be disconnected whilst the unit is being tested before leaving it at night.

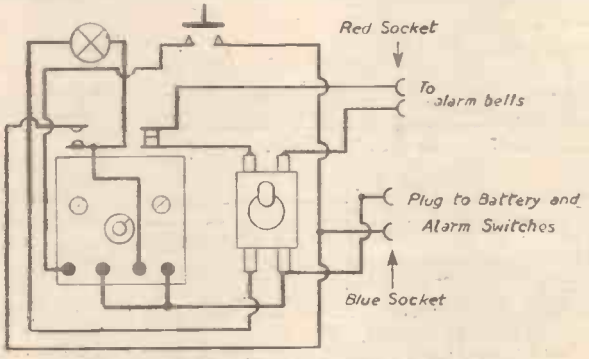


Fig. 3.—Wiring diagram of the alarm unit.

The actual wiring is shown in Fig. 3, in which the end view of the relay is shown.

The two heavy contacts are heavy enough for the 230-volt mains alarm bell to be used, and they close (make contact) when the relay is normal, so that the bell will ring when the relay is released, so that the switch is used to disconnect the bell when not in use. The other half of the switch is used to disconnect the test light. When the press switch is depressed the relay will operate over the 4-ohm coil, but only if the external circuit is continuous; the relay is then held over its own contacts, and the 200-ohm coil. The switch should be put in the up position and the alarm bell will be switched into circuit and the indicator lamp extinguished.

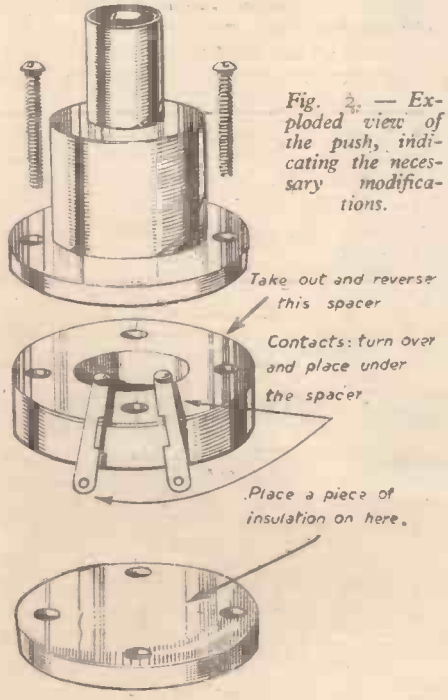


Fig. 2. — Exploded view of the push, indicating the necessary modifications.

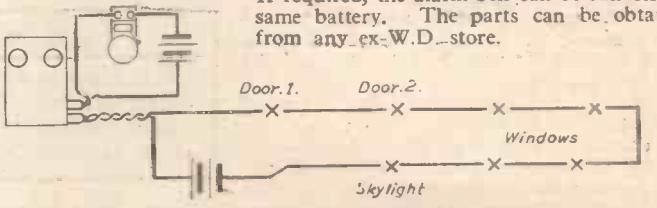


Fig. 4. — A typical alarm circuit, indicating how the door and window switches are connected in series.

External Circuit

So much for the conversion of the unit. The next thing to consider is the external circuit. For the protection of doors and windows the "Micro" switch, manufactured by Belling Lee, Ltd., is recommended. These switches are held closed by pressure, and if set into the door or window frame will operate as soon as it is opened, thereby disconnecting the circuit and releasing the relay in the alarm circuit. If the door is again closed the relay will not reoperate, but the alarm will ring until either reset or switched off.

The variety of things that can be protected by such a system are almost unlimited. Items of a few ounces or more at an exhibition can be placed on a micro switch, and lighter objects can be protected by a turn of fine wire, providing that it is wired in series with the alarm unit.

A typical alarm circuit is given in Fig. 4. One point to remember is that if the battery fails it sets off the alarm! So check the battery regularly and the alarm will give efficient service. The best type of battery is the wet accumulator type, as it can be charged regularly. It should give a very good service as the drain is only a few m/a. If required, the alarm bell can be run off the same battery. The parts can be obtained from any ex-W.D. store.

Miniature Scale

Constructional Details of a Novel System Utilisin

FROM letters which I have received from time to time it would appear that any scheme which renders it possible to run locomotives and trains which are really miniatures would be welcomed by the indoor model fraternity. In this country the smallest scale of which I have any knowledge is the standard H.O. gauge of 16½ millimetres, 3½ m.m. to 1ft., but I understand that in America there are a few models of one-tenth inch to the foot.

It is an unquestionable fact that no ordinary room is really adequate to the requirements of a model railway, because such room is too small and the scale of the railway too large. As I have pointed out elsewhere the H.O. scale requires a run of over 60ft. to represent one mile only; so that in a room measuring, say, 15ft. by 10ft., the greatest possible circuit of the railway can but represent a scale distance of about three-quarters of a mile. What, therefore, can be done to increase the scale effect?. Obviously if the space cannot be increased the scale must be reduced.

An ideal scale would be one-tenth of an inch to the foot, but there are limits in smallness beyond which it is not possible to go. By these limits I refer to the electric motors to be fitted in the locomotives, the boiler casings and platework generally, enclosing the motors and the mechanisms, not only of the engines and coaches but the rails as well, and particularly of switches, check rails and points, and their working. As regards the wheels running on rails the flanges would have to be turned to microscopic accuracy, and the frogs and switch tongues of the track made to the same high degree of skilled fitting, for it must be borne in mind that the weights of engines and coaches come down as the cube of the scale, and that derailments would therefore occur much more readily than in larger and heavier vehicles to bigger scales.

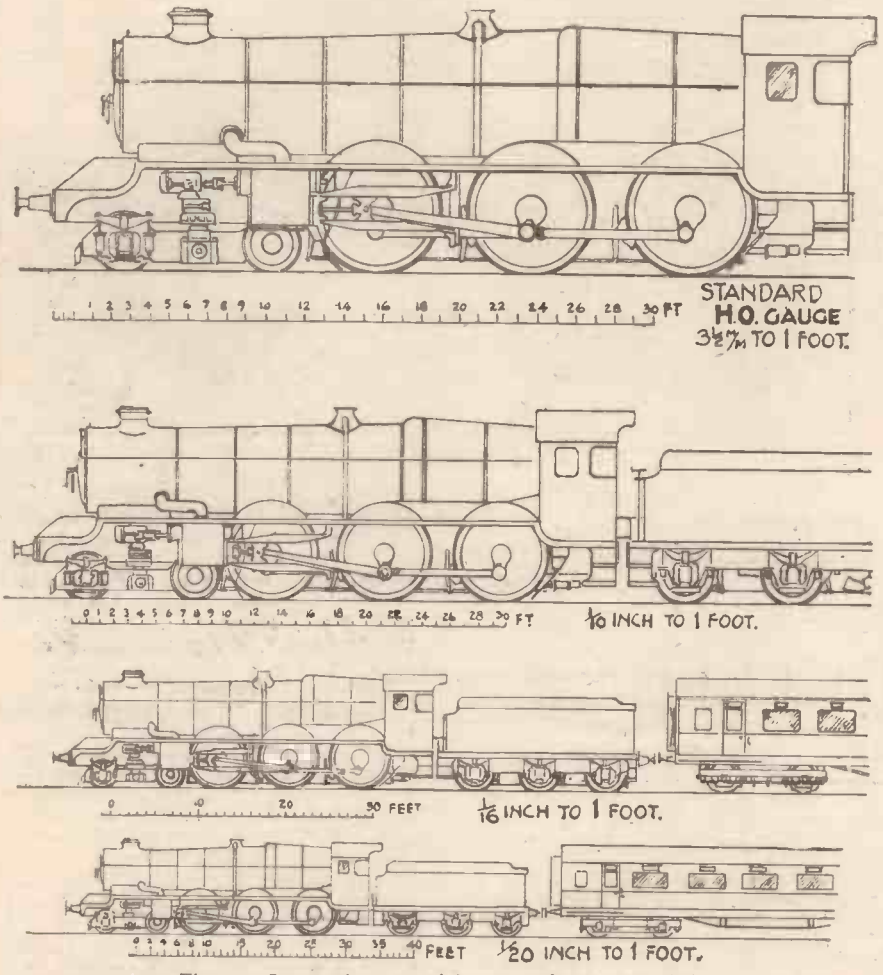


Fig. 1.—Locomotives to miniature scales (¾ full size).

During the year 1937 the germ of an idea occurred to me which might make it possible to have a railway and trains very much smaller than the H.O. scale; smaller than one-tenth inch, if desired; in fact, there need be scarcely any limit to the diminutive dimensions.

General Arrangement

The basic principle of the idea is this: that the trains which are seen running upon the model railway through cuttings and tunnels, under bridges and on embankments, are not moved under their own power, but by comparatively big loco-motors on wider gauge track underneath. This means that the biggest available oo, or even o gauge, permanent-magnet motors with appropriate gearing and wheels, can be used, and the rails on which they run need bear no resemblance to full-size permanent way.

The scheme also means that the visible rolling stock, including the locomotives, need not be made of metal, with the exception of engine frames and wheels and carriage bogies. Coach bodies can be of solid wood up to the seat level, faced with Bristol board pierced for windows and with Cellophane strips for glazing. Roofs and ends can be of Bristol board, as also tender sides, cabs and splashers. Boilers can be of tubing or turned in boxwood, with fireboxes carved from the same material. Boiler mountings would be best in metal if the prototypes are of bright brass; if painted they can be of boxwood or bone.

Now with regard to the scale to be adopted; the following table gives details of gauges and scale mileages in feet for the suggested and most suitable miniatures; from which table comparisons can be made with the existing H.O. standard.

As a means of further comparison of relative sizes as regards locomotives I give

Model to	Scale	Gauge	Scale distance = 1 mile
"H.O." Standard	1/87	16.5 m/m.	About 60½ feet.
1/10in. to 1 foot	1/120	.47in.	44 feet.
1/16in. to 1 foot	1/192	.29in.	27½ feet.
1/20in. to 1 foot	1/240	.235in.	22 feet.

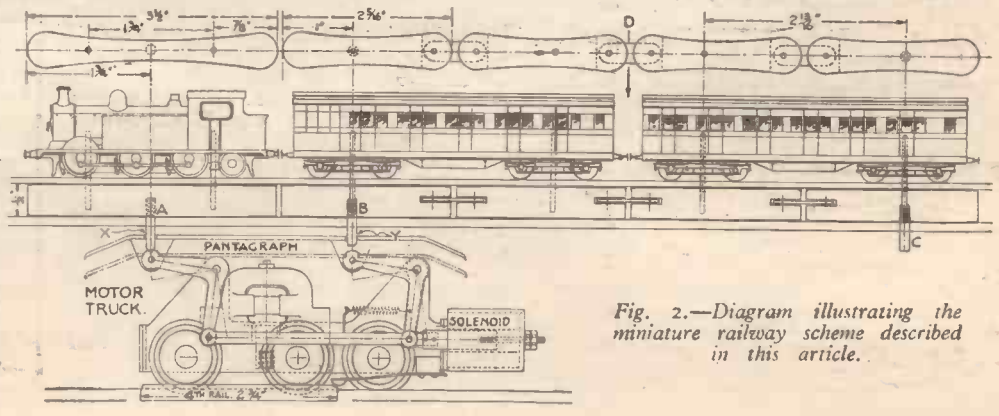


Fig. 2.—Diagram illustrating the miniature railway scheme described in this article.

Indoor Railways

Auxiliary Loco-motors

By E. W. TWINING

elevations, in Fig. 1, of each of the four scales in the table, reproduced ¾ full size.

The practical carrying out of the scheme is explained by the drawings which follow, and I commence with Figs. 2 and 3. Fig. 2 is a longitudinal section of straight track, and Fig. 3 a cross-section, taken in a station; double track for up and down lines. From these drawings it will be seen that the whole railway system is built up in three stages: first, the strong foundation shelving which carries the track on which the motor-truck runs, then a one-eighth inch plywood platform and, at half an inch above this latter the top surface of the model, which can be of either plywood, one-sixteenth inch thick, faced with cartridge paper, or hard strong cardboard of the same thickness.

Both of these upper plywoods are slotted throughout the length of the line, the lower slot being the wider to allow of the passage of the stout driving pins: A, B and C (Fig. 2). The upper slot need be only 3/32in. wide, or even less, to allow clearance for the thinner pins shown.

Channel and Slides

Between the upper and lower plywoods, and separating them, are half-inch deep lengths of stripwood and the space between these is also half an inch, with the slots in the centre between them. These strips, with the upper and lower plywoods, form channels in which the wooden sliding pieces, shown in plan at the top of Fig. 2, will run. The slides, shaped as shown, can be made from any suitable hard or semi-hard wood, such as mahogany, and must be slightly less than half an inch square.

In all the drawings the engines and coaches are shown one-tenth inch to the foot scale, but I recommend, for greater mileage effect, the one-sixteenth inch to the foot. I mention this matter of scale and mileage again because I want to point out that although the slides will be best made to run in half-an-inch-square channels, whatever the scale, their lengths will have to accord with the lengths of engines and coaches. I should here point out that all the slides which move the train are linked together by little metal plates, pinned into horizontal saw cuts, but the slide which drives the locomotive is not connected to the others. All the slides are hollowed at the sides, as shown in the plan view, in order to render possible free passage around curves.

Neither the locomotives nor coaches should be in any way fastened to the pins which project upwards from the slides; they should be quite free to rise and fall on the pins so as to ensure that they rest upon the wheels; the holes in the vehicles should therefore be a nice easy fit over the pins.

The train depicted in Fig. 2 shows two coaches only, this number being drawn merely to avoid excessive length in the illustration. At least one more coach and pair of slides should be added.

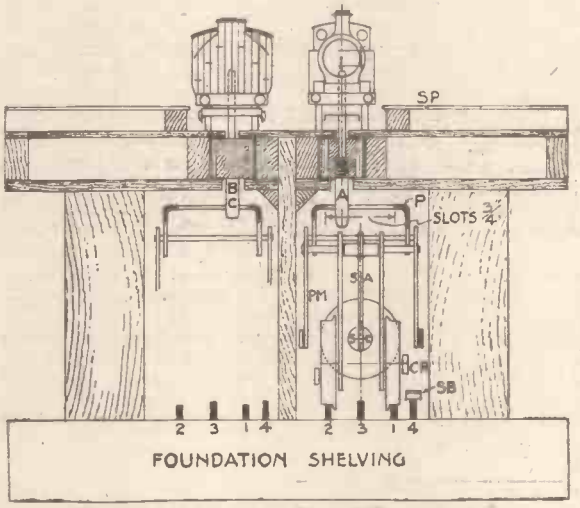


Fig. 3.—A cross-section through the model railway.

The Propelling Motor

Below the channels is the foundation shelf and on the electrified rails carried on this I have shown a 00 motor truck in preference to H.O., because it is larger and more powerful, but, as I have already said, an 0 gauge, on the 1¼in. track, might very well be used. In any case, the ratio of the gearing will have to be altered in order to avoid excessive speed in the miniature trains. I shall refer to this matter of speed at greater length presently. The particular motor, or motors, to be adopted, must be determined before any woodwork construction is done, for the size and height of the motor truck will settle the clearance or distance between the foundation board and the channels.

Whatever size of motor truck and scale of railway are used, the motor must carry a slotted plate, P (Fig. 3), capable of rising and falling with a parallel movement. In Fig. 2 this movement is provided by four bell cranks, P.M., Fig. 3, each pair fixed on their shafts and fitted with coupling bars. For want of a better word I have termed this assembly a "pantagraph."

Now the distance between the slots in the top plate of the pantagraph, which are lettered X and Y, in Fig. 2, must equal the amount of separation of the pins A and B, and pin A must be exactly in the centre of the locomotive slide, which length must equal the length of the locomotive measured over the buffers.

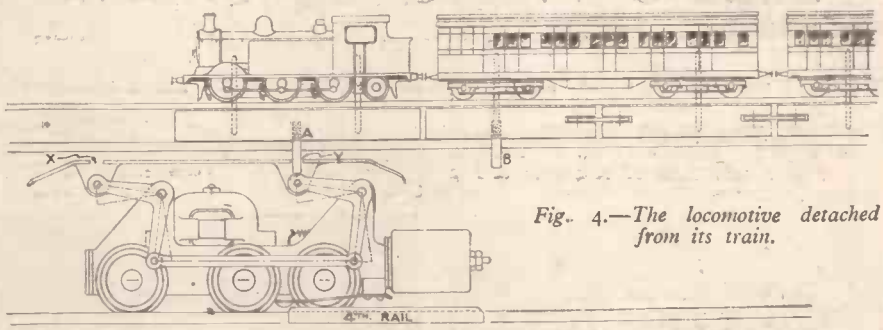


Fig. 4.—The locomotive detached from its train.

It will be noted that the locomotive drawn in Fig. 2 is a double-ended tank engine. We are going to assume that the train has run into the up platform of a terminal station. (S.P. are station platforms in Fig. 3) and that there is another and similar terminus at the other end of the line, or a branch of the same. The train has been stopped, or is just about to be stopped, by the operator, in the position shown. The object of the pantagraph is to uncouple the engine from the train, to take it over two crossovers and couple it up again on the other end of the train for a return journey; such uncoupling and recoupling being done automatically. Note that there is no connection between the engine and the train except through the pantagraph.

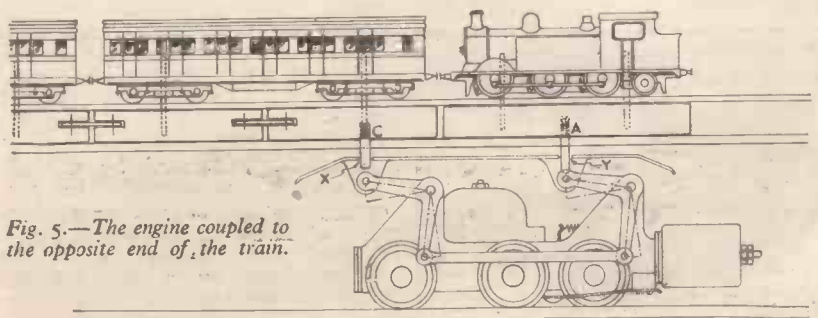


Fig. 5.—The engine coupled to the opposite end of the train.

Fig. 6.—Plan of track switches at the terminus.

The way in which this is done is as follows: Beside the motor track there is a very short fourth rail, electrically connected to the third rail (Figs. 2 and 3). Mounted upon an insulated block on the truck is a lightly sprung brush, S.B., and this is wired to one end of the coil of a solenoid, the other end of which coil is earthed to the frame of the truck so that the solenoid receives its current via the third rail, fourth rail, brush, coil winding, frame, wheels and running rails. The solenoid sliding core S.C., carried by arm S.A., in Fig. 3, is drawn into the solenoid coil at the moment that S.B. makes contact on the fourth rail. This action of the solenoid pulls down the pantagraph, which is normally held up by the light spring shown in Fig. 2, thereby drawing the slots X and Y, in the plate, clear of both pins A and B. Now, with the slotted plate of the pantagraph still down, the motor continues to travel, leaving both engine and train stationary, until the brush, S.B., leaves the fourth rail when the pantagraph rises and pin A which at first was in slot X is now engaged with slot Y. At this stage the position is as shown in Fig. 4.

If the motor is then allowed to travel the engine moves away from its train, passes down to the station buffer stops, reverses, runs over a crossover, along the down line, past the down platform, reverses, runs over another crossover to the up line and backs on to the other end of the train where the sloping end of the plate of the pantagraph acts as a latch and is depressed by pin C until that pin is engaged with the slot X. The train can then be started and the whole of it passes over the last mentioned crossover to the down line and proceeds on its journey.

The reader will notice that the pantagraph plate has a latch, or slope, at both ends; this is because exactly the same arrangement of track will be at the terminus at the other end and a similar performance will take place there, the only difference being that it will be the opposite end of the pantagraph which will engage with the train.

The amplitude of movement of the pantagraph is limited by the arrangement of the solenoid core: in the down position by the core coming up to the inside back of the soft-iron casing of the coil and in the up position by the nuts screwed on a pin, tapped into the end of the core; by means of these nuts the up position can be adjusted.

It should be noted that the locomotive pin A must project downwards at least 3/32 of an inch further than the coach pins B and C. The need for this will be apparent from a study of Fig. 5, for it will be seen that if the pins were all of the same length the depression of the pantagraph plate by the latch action on pin C would cause the slot Y to become disengaged from A and the engine would be left behind. It is true that the loco. would be picked up again after the train had started, but it would look absurd for the train to travel and catch up its own engine.

Points and Switches

The electrified track on which the motor runs can be of ordinary brass strip having little tin plates soldered to it at intervals, these plates being pinned down to the wooden shelf. Third rail and fourth rail being a little deeper, so as to project higher, can be done in the same way. The wood will form a sufficiently good insulator between the rails. This track will, for the running rails, need points or switch tongues, but these points and rail junctions need not be so complicated with frogs and check rails as if they were visible. Some will have to be mechanically worked, some can be fitted with springs to keep them open in one direction only, and some, of the trailing kind, freely automatic, opened by the passage of the wheel flanges from either line.

But beside the points and switches in the electrical track there must be points in the channels for the slides, and these can be of hardwood. Fig. 6 is a plan of the terminus in which the train, shown in the preceding illustrations, is supposed to be standing. In this plan the engine has been moved from the left hand, passed through switch 1, along the down line, through switch 2; it has opened automatic switch 3 and been coupled up to the right-hand end coach. When the train leaves it will go through switch 3, which the engine has already opened, cross to the down line, and so away on its journey.

(To be continued)

Simple Hydro Equipment

On a Running Stream in Anglesey

MANY sources of water power are neglected in this country and many megawatts are running to waste. The accompanying illustrations show what can be done with a minimum of resources and a trickle of water.

Breaking away from the conventional vertical or horizontal shaft, the set shown is at 30 deg. to the horizontal, thus combining the advantages of both. The blade angle is cunningly devised, providing sufficient reaction to overcome thrust and, at the same time, remove all energy from the water (see illustration A). In fact, one blade stopped the water and the next, following on, knocked it off the shelf (see illustration B—shelf not shown).

The speed varied between 0-180-0 r.p.m.; the last, when the water level rose above the top vanes, simultaneously driving the runner both ways at once, and completely dismantling the equipment.

Illustrations B and C give, respectively, a good impression of the station and operating staff.

This short description and illustrations are reproduced from "'English Electric' and Its People," the magazine of the English Electric Co., Ltd.

BOOKS RECEIVED

Photography at School and College. By M. K. Kidd. Published by Focal Press, Ltd. 200 pages. Price 7s. 6d. net.

THIS handy book is specially written for active young people, showing the short cuts not only to successful photography in general, but especially to the type of photography they desire most to indulge in. The book explains, with the aid of diagrams and half-tone illustrations, how to take first-rate pictures with whatever camera you happen to possess; the best angles and technique in dealing with various photographic subjects, from taking portraits and groups to covering excursions, speech days and sports, or getting a close-up of a very small insect.

Small Electric Motor Construction. By J. Gordon Hall. Published by Percival Marshall and Co., Ltd. 86 pages. Price 5s. net.

THIS useful handbook, which is a second edition, has been revised and enlarged, and within its pages will be found data and simple formulæ for enabling those with limited electrical knowledge and mathematical knowledge, modest equipment and mechanical skill to design and construct small motors to meet all requirements. The book is illustrated with numerous diagrams and half-tone illustrations.

Model Steam Locomotives. By Henry Greenly. Published by Cassell and Co., Ltd. 320 pages. Price 15s. net.

THE revision of this important work, which has been undertaken by Ernest A. Steel, enables the amateur and the professional model-maker to incorporate the latest devices and improvements in steam locomotives into his models. Many new and valuable diagrams and illustrations relating to the latest types of steam locomotives on British or other railways have been included. In future years this book will, no doubt, serve as a guide to this fascinating branch of model making.

An Aquarium Aerator

How to Make a Useful Appurtenance for the Home Aquarium

By E. S. BROWN

THE apparatus shown in the accompanying illustrations is quite simple and inexpensive to make, and operates silently and efficiently with the minimum of attention.

Before proceeding with the constructional details a few explanatory words on its method of operation are perhaps desirable.

A supply of water is kept in the container A, Fig. 1. This flows through the valve B and issues from the restricted orifice C in a succession of drips which enter the funnel shaped receptacle D. This compresses the air within the tubing E and forces same through the outlet F situated in the aquarium.

The air vent G provided in the compression chamber H is necessary to ensure a continual supply of air to replace that being used.

The only really critical measurements that should be adhered to during construction is that relating to the diameter of the tubing to ensure a reasonable air capacity, the length of the tubing E, between water level and the base of the compression chamber, which is not less than 9in., and also the dimensions of the compression chamber. The size of the compression chamber is important in order to give sufficient impetus to the falling drops of water to ensure a satisfactory compression and discharge of air within the aquarium.

Water Container

The water container A, Fig. 1, can be adopted from any earthenware or glass receptacle of approximately two pints capacity. As a suggestion, a fairly large flower-pot would suit admirably as the need for making a hole in the bottom—a fairly difficult proposition—would be avoided.

Assuming that a flower pot is used, the porosity of same will have to be stopped otherwise a considerable seepage of water will occur. This can be done by well warming the flower-pot, then applying paraffin wax to the outside. The molten wax will be quickly absorbed, and the pot is then put aside to cool off.

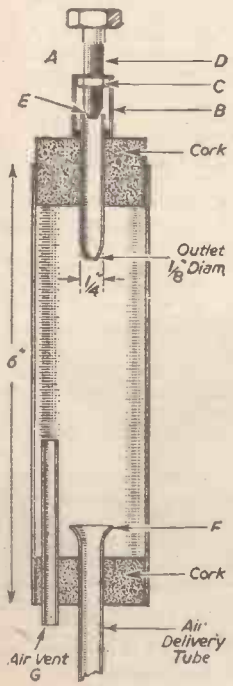


Fig. 2.—Section of compression chamber.

The Feed Valve

The valve A, Fig. 2, is constructed from a short length of ¼in. internal diameter copper tubing to the top of which is soldered an inverted "U" shaped strip of copper, B. A ⅜in. diameter hole is drilled in the centre of the "U" and a ⅜in. diameter brass nut, C, is soldered concentric with it. The brass bolt D then has its end ground to a cone shape, E, and is then inserted in the nut and screwed down to test for accuracy. It is essential that the construction of the valve assembly is very carefully made otherwise the cone will not seat within the copper tubing. Although not absolutely essential a more accurate fitting of the cone can be established by applying a little emery powder paste to the mating surfaces and grinding in by rotating the bolt several times, afterwards carefully removing the paste.

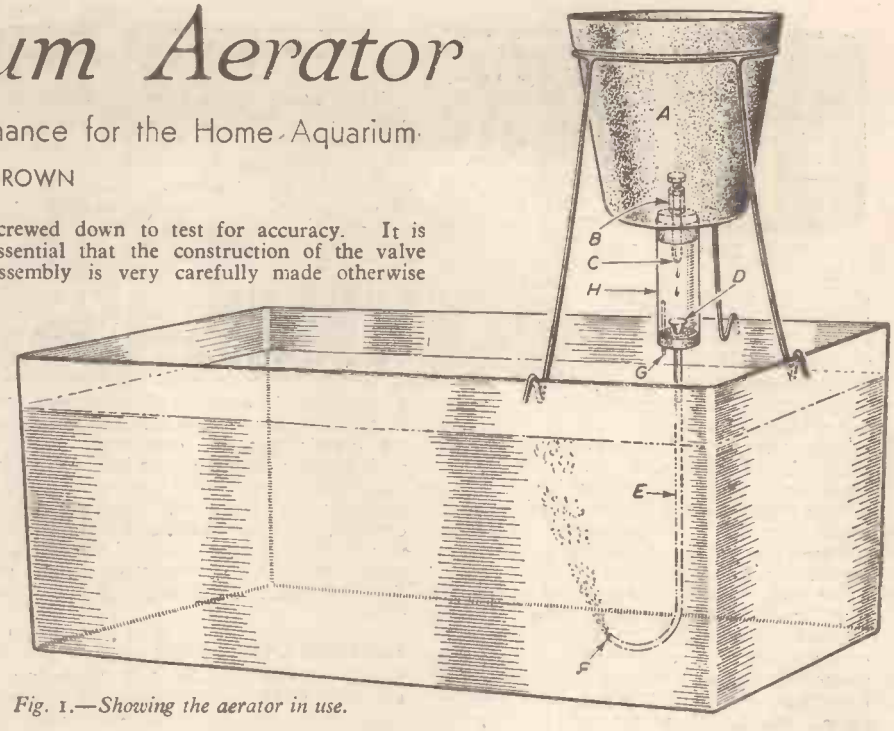


Fig. 1.—Showing the aerator in use.

The other end of the copper tube is restricted to an orifice of approximately ⅛in. diameter by carefully tapping with a ball-peen hammer until correct.

A tight fitting cork is next required for the hole in the flower-pot. Before inserting, however, a hole slightly smaller in diameter than the copper tubing is made in the cork. The tubing is then inserted and the cork fitted into the base of the flower-pot with the valve assembly uppermost. It should be noted, however, from the illustration that the cork should be fairly long to allow an appreciable length to project from the base of the flower-pot.

Compression Chamber

The compression chamber is constructed from a 6in. length of glass tubing of an internal diameter to fit the cork used in the valve assembly.

The air delivery tube E, Fig. 1, is constructed from a suitable length of ¼in. internal diameter glass tubing which can be purchased quite cheaply from a chemical accessory supplier.

The exit end F, is bent into the required shape by holding the tube in a blow-lamp or bunsen burner flame until bright red hot, and then gently bending. If the tubing is bent with a pair of pliers the jaws should be heated to the same temperature as that of the tubing, otherwise, if the hot tubing is gripped with cold pliers the tubing will immediately contract and shatter.

The straight end of the tube is next inserted in a cork, which is then pushed well down the length of the tubing. The end of the tube is then heated until red hot, then a hot tang-end of a file inserted and gently twisted to form a funnel-shaped receptacle F (Fig. 2).

The air vent G is constructed from a short length of glass tubing which is inserted in the cork. The cork with its components is then carefully fitted into the glass compression chamber.

The entire assembly is then pushed on the cork projecting from the flower-pot base.

Bent-wire Stand

A suitable stand can be constructed by stout wire to clip on to the aquarium sides (Fig. 3). The stand is easily made by making a ring slightly smaller than the upper circumference of the flower-pot, and by soldering three supports to same of sufficient length to allow the air-exit tube to rest along the bed of the aquarium.

The extreme ends of the supports should be bent into a "U" shape to fit the top edge of the aquarium.

To operate the aerator the assembly is placed in the stand and the water receptacle filled with water from the aquarium. This is important, as otherwise, should the aquarium be fairly full, the additional water would cause an overflow.

The valve should then be carefully adjusted to permit 20 or so drops of water to flow per minute. The drops should enter the air delivery tube fair and square, and any corrections can be made by gently pressing the valve assembly tube in the required direction.

At every drop of water a succession of air bubbles should be emitted from the end of the exit tube.

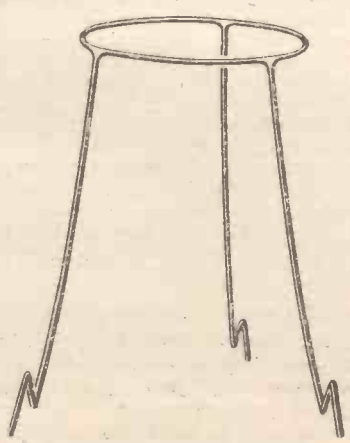


Fig. 3.—The bent-wire stand.

Centrifugal Force and the Rotor

SIR,—*Re* my article in the November issue and Mr. Grocock's letter in the January issue on the above subject. His explanation of events is very precise and interesting, but he makes a remarkable statement when he avers that people who say "centrifugal" are not practical. I say they are practical *par excellence*. I myself wrote the article with a proper regard for the titular adjective on the front page of your magazine. A student learns in the text-books that there is really no such thing as centrifugal force, and, among other matters, he is also apprised of the fact that "force," "energy" and "power" have specific meanings. Nevertheless, when he goes out into the wide world, not wishing to be regarded as a pedant or blue-stocking, he falls back on the blithe use of "centrifugal force," and readily says "energy" when he means "power," or vice-versa.

Your correspondent has taken the high and dry theoretical view which, of course, he has the right to do, but if anyone should care to go higher and drier he will find that your correspondent has made a gross error all through his letter. He uses the word "force" when the laws of relativity clearly announce that there is no such thing—it is merely a sort of bend in the space-time *continuum*.

But, quite understandably, your correspondent has shelved these laws and used the forbidden word so as to make his letter, at least, readable. I used the same latitude in my article. Mr. Grocock knows that in spite of the above laws, in simple speech, and in the mind of the practical man, there will always be "force"—and the same with centrifugal force.—P. BOWN (Northampton).

Centrifugal Force and Centripetal Force

SIR,—Mr. T. A. Grocock's explanation and formulæ appear formidable and impressive. Given the opportunity, he no doubt would prove the alphabet non-existent. Such an importunate theory will surely mislead many readers, and I think they would appreciate the Editor's decision regarding the matter.—R. G. LEY (Nottingham).

[*A body in motion resists any force tending to make it deviate from a straight line. When the body is rotating, the particles are constrained to move in circular paths. The inertia of the mass restricts this constraint and produces tension acting outwards from the centre of rotation. The inertia in this case is called centrifugal force, and the tension centripetal force. The terms are in use throughout the world and they correctly describe the two forces. Mr. T. A. Grocock wishes to be the only one in step, and disagrees with the teachings of our universities and technical colleges. Needless to say, we do not agree with his views, and we shall continue to use the terms in this journal and in our technical publications.*—ED.]

Denture Repair with "Perspex" Cement

SIR,—I was very interested in H. Burtenshaw's letter on denture repair with Perspex cement. May I point out that the factor of stress and strain is most important to take into consideration when repairing dentures. During the mastication of food a considerable amount of stress and strain is forced on the denture and I cannot see how the repair can be completely successful with Perspex cement as the joint can only be a temporary one. This is assuming that the denture was completely broken and not cracked. If this was the case and the cement was applied to the facing of the joint, i.e., edge to edge, then it might hold for a short time.—DENTAL MECHANIC (South Derbyshire).

Telescope Object Glass

SIR,—I noted recently a reply in your journal to a correspondent who inquired whether a German air camera lens, 36in. focal length and f/6.3 aperture, could be used as a telescope objective.

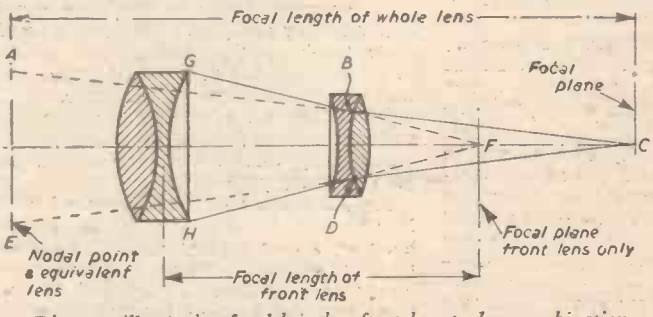


Diagram illustrating focal lengths of a telescope lens combination. Note.—A.B.C., G.F., E.D.C. and H.F. are straight lines.

Telephoto lenses are amongst the hardest to design to get the aberrations down to a *just acceptably* low value. Invariably, the front *positive* component has *large* residual aberrations which are *approximately* corrected by the rear *negative* component. In fact, the lens will, by the standards of even poor telescope objectives, have large zonal spherical aberration and no aperture above about f/11 will be good enough to view with an eyepiece of some ½in. to 1in. focal length—i.e., a 3¼in. O.G. of 36in. focal length.

Further, you state that the front component will anyway have a focal length *longer* than the objective as a whole. This is not correct. A telephoto combination has a relatively *short* focal length front lens—*invariably* shorter than the objective as a whole—followed by a negative component on the style of a Galilean opera glass, whilst, as stated earlier, the front component taken alone has really appalling aberrations.—J. B. CLIFTON (Broadmayne).

The Tipsy Top

SIR,—I have, like many others, tried to understand the behaviour of this top and have failed. A kind of description is given in J. Perry's "Spinning Tops" (Society for the Promotion of Christian Knowledge, 1929) where the phenomenon is put down to the "speeding up of the precessional movement" of the top. But since this means nothing to the layman, a more elaborate explanation would be welcome.

The fact that the hemispherical part of the top has no pivot would not explain the fact that this part actually rises against gravity. Why does it not continue spinning on its side?

Further information on this subject would be very welcome.—Dr. E. ELKAN (Pinner).

SIR,—I was very interested to see the short article on the above, but you have missed an even greater mystery than the one you explain. It is as follows: If a small arrow is drawn on the top, pointing in the direction which the top is spun initially, it will be found that the top is spinning in the opposite direction after it has turned over. In other words, if it is spun clockwise, it will still be spinning clockwise, when it has turned over.—B. W. APPLETON (Mistley).

Outboard Motor and Weed-ridden Waters

SIR,—Will you kindly consider the following queries:

Do you know of any appliances designed to enable an outboard motor to run in weed-ridden waters without fouling the propeller? Is there any literature on this problem? Has any research been done on it? The solution I am seeking must not be a partial solution only—like the Atco impeller's circular shield, or the Aquajets' impeller unit, or a streamlined cage (which I have found unsatisfactory)—it must be a propelling unit incapable of fouling weed.

On inland waterways weeds are found in long stretches, growing from the bottom to the surface of the water, and also floating in bunches.

Weed clings to the transmission housing as well as the propeller. Any anti-weed device must:

(a) have a low resistance to the water;
(b) must not pick up weeds itself.

Even a small amount of weed carried along by an anti-fouling device causes a big loss of speed in a small boat, as my experiments with attachable cages have shown.

Can you suggest some lines on which to experiment?—C. F. CLEMENTS (Taunton).

[*Readers' suggestions are invited.*—ED.]

Interplanetary Travel

SIR,—May I thank you for your very interesting article on "Interplanetary Travel"?

There is, however, one small point which, although not telling against the project as a whole, seems to me to be of interest.

The law known as Roche's law states, keeping it in simple terms, that a zone exists around every planet, of radius 2.45 times the radius of the planet itself, wherein any satellite would be torn to pieces by the gravitational effect of the planet (of Saturns size which are assumed to be the remains of a satellite which has entered this danger zone).

Applying the law to the earth, and taking the earth's radius at 3,957 miles ≏ 7,616,781 metres, we have a near limit of approximately 22,086,113 metres for the orbit of a satellite. It is quite true that this law may concern only large bodies, but I think the point to be of interest.—H. AINSCOUGH (Nuneaton).

THE WORLD OF MODELS

Gauge 0 Model Railway : Passenger-carrying Miniature Railway.

By "MOTILUS"

IT is interesting sometimes to reflect on the different reasons why people follow the model railway hobby. In almost any group of enthusiasts you will find a variety of answers to the enquiry, "Why do you have a model railway?" Some say they like building their own locomotives and rolling stock, track, signals and accessories; others will tell you they buy their basic equipment ready-made but enjoy painting scenic backgrounds, building stations, signal boxes and other lineside features; for some, it is "scale appearance" that is all important, whilst others perform feats of electrical engineering in endeavours to perfect remote-control methods, and there are even those who set themselves brain puzzles in traffic working by running their trains to factual timetables. The one thing common to them all, and possibly the only one, is an intense interest in real railways, which has led to their adoption of the model railway hobby in leisure hours.

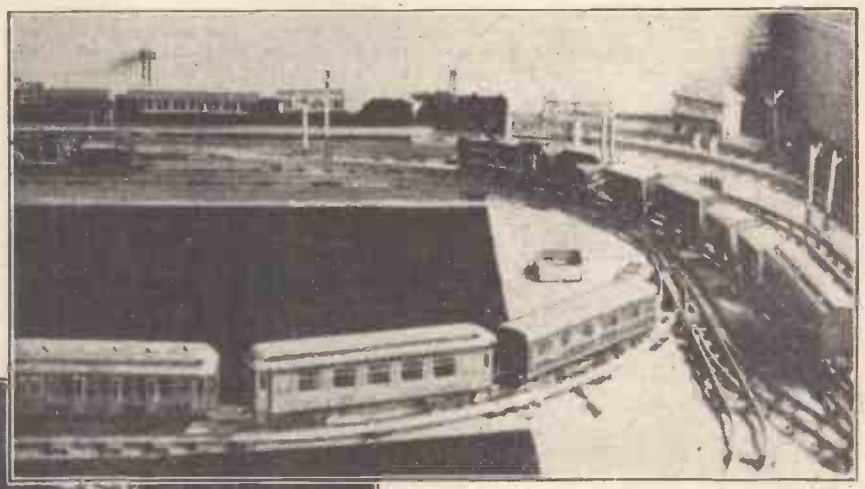


Fig. 1.—A view of Mr. Chirnside's railway. The entrance to Euston carriage sidings is in the foreground. On the right a parcel train stands at Bletchley, while in the background the 7.50 a.m. ex-Crewe stands at Rugby.

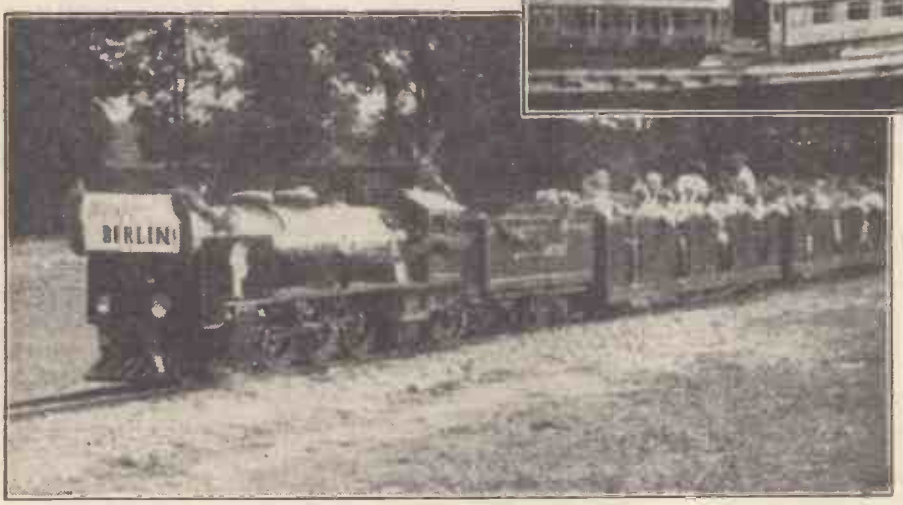


Fig. 2.—The Leipzig Lilliput Train decorated for the opening of this Lilliput Railway in a Leipzig park. Passengers can enjoy an eight-minute run on this 15in. gauge miniature railway.

Gauge O Model Railway

I was very glad recently to hear from one of the rarer enthusiasts for traffic working, and to receive some good photographs of his model railway. This is Mr. J. Beveridge Chirnside, of Lancaster, who has evolved quite an elaborate system which he works with the help of his son. The railway is Gauge O, with several clockwork locomotives for drawing passenger and goods trains (Fig. 1). The locomotives and rolling stock are mostly by Bassett-Lowke, so that Mr. Chirnside must also be particular about the realistic appearance of his trains.

The railway is laid out in two attic rooms in Mr. Chirnside's home. The rooms are connected by a long passage, and when two operators are working in the separate attics they can communicate with one another by the standard bell signals, some old apparatus having been purchased from one of the railway companies; quite an authentic touch! The layout comprises the main line from Euston to Carlisle, with branches to Birmingham, Plymouth, Holyhead, Manchester, Liverpool, Blackpool and Heysham. The trains run to a timetable based on the prototype, which must mean that many hours are spent in the happy pastime of drawing up timetables to allow for the efficient running of express and slow passenger trains, goods trains and fish trains.

This fine model railway is certainly an excellent example of how very interesting a clockwork layout can be, providing, of course, that space is available, as the Euston-Carlisle main line, with its many branches, is quite an ambitious project. I am sure that Mr. Chirnside must have many visitors.

Passenger-carrying Miniature Railway

News of quite a different kind of model

(*Continued on page 174*)

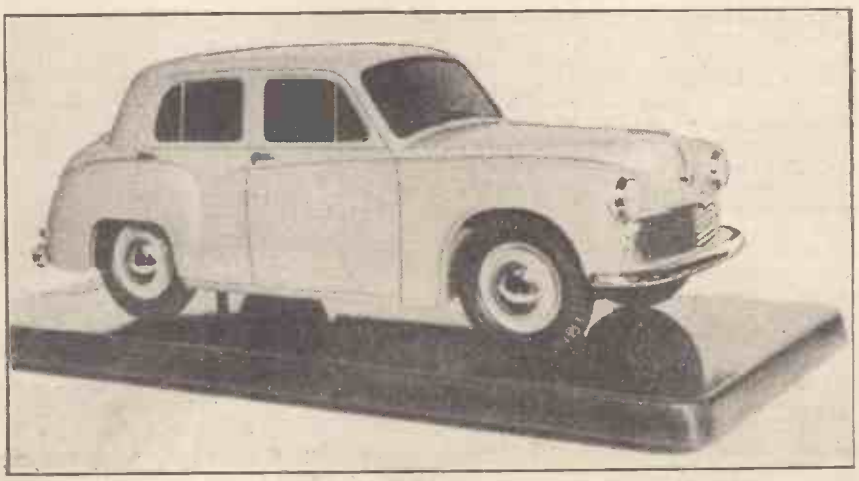


Fig. 3.—An exterior model of a Hillman Minx saloon car to a scale of 1/10th full size. Model built by Bassett-Lowke, Ltd., to the order of Messrs. Rootes, Ltd.

MAKING A Cycle Trailer

Constructional Details of a Strong and Serviceable Outfit

By J. H. LONG

(*Continued from page 119, January issue*)

ANOTHER view of the underside of the trailer (Fig. 9) illustrates the assembly of the suspension system. Two pieces of thin angle iron, 1½in. by 1½in. by ⅛in. (bed iron), bolted to the sides of the framework form a rigid link between the spring anchor bars and the pivot bar. The anchor bars are riveted to the respective angle irons and securely bolted to the cross-piece. Further details will be found in Fig. 10 which represents a cross-section taken through AA (Fig. 9) looking in the direction of the arrow.

The effective length of the compression springs can be varied by adding or removing the associated packing washers. This adjustment is correct when the wheel forks take up an approximately horizontal position with the trailer fully loaded.

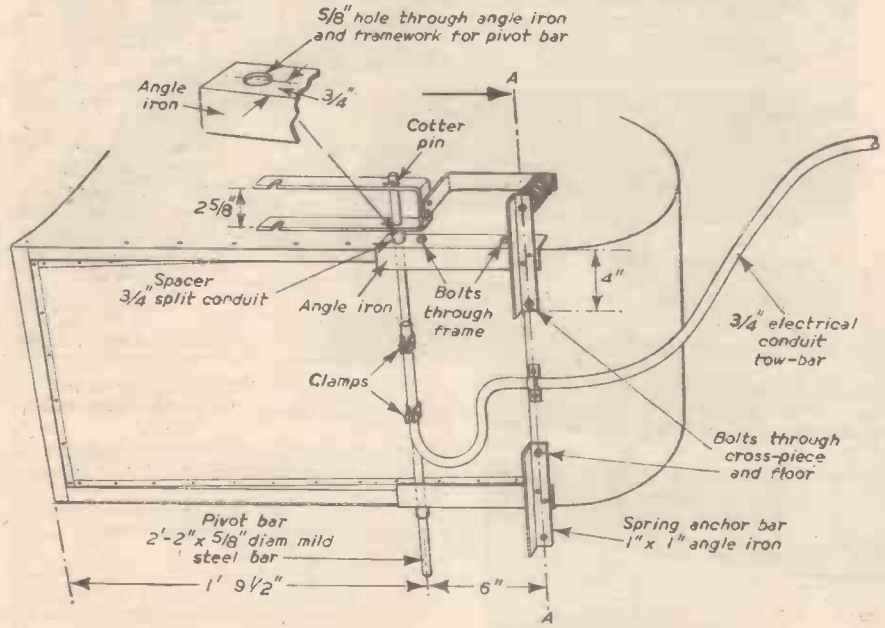


Fig. 9:—Underside of coach, showing the suspension system.

The Tow-bar Universal Joint

The connection between the tow-bar and the cycle saddle pillar must be in the form of a universal joint capable of operating through a wide angle in all directions to ensure that it will be unharmed should the towing cycle fall to the ground or double back on the trailer.

The universal joint pictured in Fig. 11 consists of two eye-bolts made from 3/16in. round section silver steel and interlocked with each other. One of them is accommodated in a clearance hole drilled through the cycle saddle pillar, and the other in a similarly drilled hole through the plug sweated into one end of the tow-bar insertion piece.

While the eye-bolts are free to rotate, lateral movement is restricted by the thrust collars and the 3/16in. Whitworth nuts. Both nuts and collars are sweated in position, the nuts first being screwed on to short threads provided for them on the bolt ends.

The tow-bar insertion piece consists of a length of pipe or tube with an external diameter slightly less than that of the bore of the tow-bar such that it is a sliding fit and easily inserted. It is located and held within the end of the tow-bar by means of a cotter, the latter being received in slots suitably cut in the tow-bar and insertion piece. These slots may conveniently be worked with the aid of a file type saw and finished off using warding files.

The cotter is retained by the lock and chain so that in the event of failure of the joint the tow-bar will not be released. All that is required to hitch the trailer is to push the insertion piece into the end of the tow-bar, insert the cotter, and secure with the lock and chain.

The Tow-bar

A piece of solid drawn electrical conduit about 5ft. 6in. long was selected for the tow-bar and here again light alloy tubing would reduce weight. It should be bent in an even curve following the outline of the cycle mudguard and then sweeping gracefully away to meet the underside of the trailer. Here the end of the tow-bar is bent "U" fashion, clamped to the pivot bar, and secured to the cross-piece by means of an ordinary conduit saddle (see Fig. 9).

In bending the conduit it is important that the few inches accommodating the insertion piece be kept perfectly straight to preserve a freely sliding fit.

Seating

The illustration, Fig. 12, shows a "cut-away" view of the chair and its position inside the trailer. The height of the chair back and the angle it makes with the floor are omitted since they are best determined from the interior dimensions of the completed trailer.

Oak of 1in. by ½in. section forms the framework of the original chair, and the component parts are well jointed together for maximum strength.

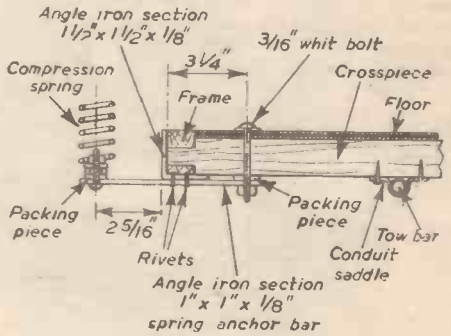


Fig. 10.—Part section on line AA (Fig. 9).

Full constructional details are not given, but they are fully illustrated, and should not present any difficulty.

When the chair is in place the tongue, which is screwed to the underside of the front chair rail, is located beneath the saddle provided for the purpose, while the tongues fixed to each end of the top chair rail engage with the "L" shaped hooks, these being screwed to the underside of the chair support. A combined downward and forward movement places the chair in position.

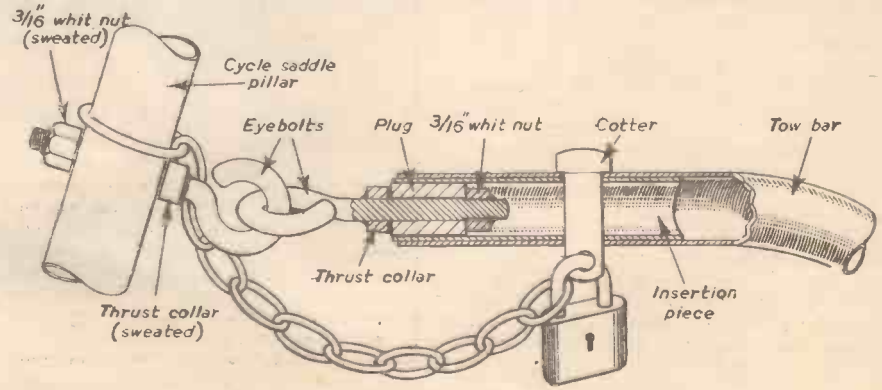


Fig. 11.—Details of the tow-bar universal joint.

Accessories

If a hood is desired it is suggested that one of mohair would be very serviceable, and this material may be obtained in various colours from most pram renovating establishments.

A rear light can be fed from a battery conveniently situated within the trailer, or alternatively, from the cycle lighting system by means of a cable via a plug and socket and the tow-bar.

Alternative Materials

Owing to the prevailing shortage of metals, there may be some difficulty in obtaining sheet metal for the coachwork. In this event plywood and/or plastic sheet could be used, suitably worked and finished.

With regard to the wheels, larger sizes may be fitted provided the suspension system is modified accordingly. It is not recommended that smaller wheels than those specified should be fitted.

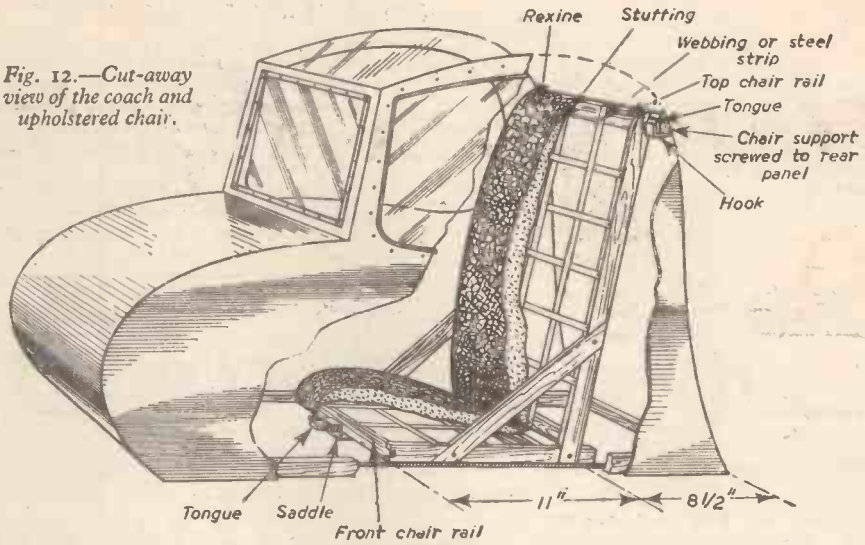


Fig. 12.—Cut-away view of the coach and upholstered chair.

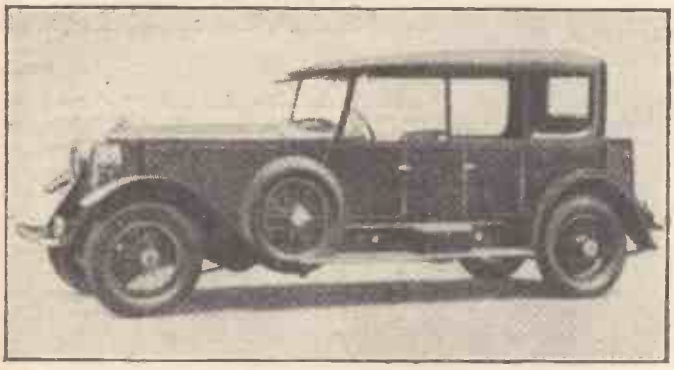
The Problem of the Steam Car

Extracts from a Lecture by M. Harman Lewis, B.Sc., F.Inst.Fuel

WHEN one comes to consider the suitability of the various prime movers for driving a vehicle on the roads, a very short survey of their characteristics will show that the steam engine and the electric motor are the most appropriate.

Both the steam engine and the electric motor—I refer particularly to the D.C. motor—have the ability to start up from a standstill and at the same time exert an enormous starting effort even before movement takes place. This large torque can, of course, be maintained over a considerable speed range.

By comparison, the internal combustion engine, in the shape of the petrol and the diesel, has no starting effort from a standstill and, when operating, has a comparatively limited torque which is, however, approximately constant over the engine speed range. Actually, the steam engine of comparable size has an initial starting effort or torque of some 5/6 times that of the petrol engine. The diesel engine has a somewhat higher torque, but the speed range is more limited than that of the petrol engine.



A 1924 Doble steam car.

Commercial road vehicles operated by steam, with the exception of the latest Sentinels and the latest Foden, of which only a very few were made, were noisy and, unfortunately, frequently gave the impression of dirt and inefficiency. Earlier steam-operated vehicles, such as the steam roller, traction engine, etc., are known too well for the noise they created.

Early Types

Time does not permit me to describe in detail any of the early types, but the Serpollet, Turner-Miesse, White and Stanley were conspicuous examples. Some of the very early cars were built in the form of an American buggy and were of the lightest description imaginable, the mechanism consisting of a little engine and boiler with hardly any automatic control or condensing equipment.

The White steam car persisted until about 1915, and I believe there were four or more models made during their career, the size being 15, 20, 30 and 40 nominal horse-power.

To my mind, this car had very many good points, the engine was a two-cylinder compound, about 2½in. diameter high-pressure cylinder and 3in. stroke, and the car was provided with a two-speed gear, the high gear being 3 to 1, and a neutral. The boiler, which was operated by a vaporising burner, was situated under one of the front seats. Cynics were wont to say that this was deliberate, for the seat became too hot to sit on for long, necessitating a fair number of stops, which, however, were frequently enforced for other reasons. The car certainly ran very well, but my earliest memory was the enormous amount of hand pumping of water that the driver had to cope with, especially in hilly districts.

Four-cylinder Engines

The early Serpollet cars were conspicuous in having four-cylinder, single-acting, poppet valve engines, and the leading feature of the system was the proportional method whereby the water feed was proportional to the fuel feed, so that, theoretically, the water was put into the boiler in exact quantity to allow the burner to produce superheated steam at the correct pressure.

The Stanley car was of quite a different calibre to the White and Serpollet, and the engine was a horizontal one only and built together with the back axle and directly coupled thereto. Two principal sizes were made, notably the 10 nominal horse-power, which had a two-cylinder, double-acting engine, both high pressure, about 3½in. bore × 4in. stroke; the 20 h.p. was a similar engine, 4in. × 5in., and some larger ones were built, all, however, having slide valves. The 10 h.p. and 20 h.p. sizes mentioned were geared to about 1½ to 1 to the back axle, so that the engine only ran about 900 r.p.m. at 60 m.p.h. By contrast, the 15 h.p. White ran about 2,000 r.p.m. at the same road speed.

I should mention here that a Stanley car of special design accomplished the amazing speed of 127 m.p.h. as far back as 1906, and, shortly after this astonishing performance, which no similar sized petrol engine had been able to approach, the steam car in this country was banned from taking part in any competition. Much of the present position of the steam car during the past 20 years can be partly attributed to this narrow-minded decision.

The Doble Car

After the 1914-18 war, the Doble car appeared and created a remarkable impression. These cars were built in California and were manufactured in a most expensive way with a view to competing with the high-class petrol-engined cars of that time. At one time they experimented with a "Unaflow" engine which, however, was abandoned as it is primarily unsuitable unless a full vacuum is available. The Doble cars of this period had a four-cylinder engine arranged on the back axle in a similar way to the Stanley and geared thereto in a ratio of 1½ to 1. The engine really consisted of two compound engines, one arranged each side of the centre line of the car. In each case the high pressure cylinder was set at 180 deg. to the low pressure, one large piston valve serving the two. The other engine crankshaft was set at 90 deg. to the first, thus enabling starting to take place under any condition from a standstill. The boiler had a number of up-to-date features, of which the most conspicuous was the provision of fuel and air for combustion by mechanical means. Fuel was picked up by a special form of carburettor and air was supplied by a small fan about 6in. in diameter operated by a 12-volt electric motor. The combustible mixture was blown into the combustion chamber, which was at the top of the boiler, and ignited by an electric spark plug. The boiler was of single tube purely contraflow, the water going in at the

bottom, the superheated steam leaving at the top.

The question is naturally asked why have steam cars not been made in any quantity. There are many reasons for this, probably the principal one is that the generator was not really developed to a reliable state until just before the war. There were undoubtedly considerable difficulties with the earlier Doble generators in the 1920's and the firm went into liquidation about 1931. However, considerable development work was carried out by Mr. Doble himself, some in New Zealand and a good deal in this country, and a lot of progress was made in the years just before the war. Even then the boiler was really a contraflow one and this in itself creates certain difficulties, especially when starting from cold.

With regard to possibilities in the future, first, what can the steam car offer? Certainly a smooth and silky running power unit without any gear changing. If properly applied, remarkable acceleration with, at the same time, very small maintenance costs. There is something particularly delightful in being able to move a car by just one pedal without any gear or clutch, and the impression given when such a car is moved from standstill is quite uncanny, because there is no noise from the starter, engine, or gearbox, to indicate that the vehicle is about to be moved.

Trade Notes

A Review of the Latest Appliances, Tools and Accessories

Selenium Photo-electric Cells

G. R. PRODUCTS, 22, Runnymead Avenue, Bristol, 4, are marketing a useful series of Selenium Barrier Layer Photo-cells ranging from 37mm. to 67mm. diameter.

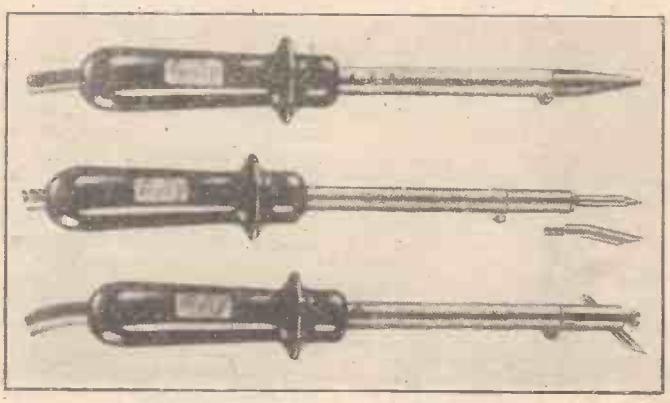
These cells will generate a current to an external circuit proportional to the intensity of light falling upon them. At 100 foot-candles the open circuit voltage is between 0.20 and 0.30 volts, giving a current output of 0.50 to 0.65 micro-amps, per foot-candle per sq. cm. of active area. The cells are operative to both natural and artificial light intensities and spectral response is very similar to that of the human eye. The graphical curve for current output foot-candle follows a linear law (straight line) with low load resistance (100 ohms), and a logarithmic law (curved line) with high load resistance (1,000 ohms). All cells are subject to an arduous ageing process and must pass at least three critical tests before despatch.

The prices of these cells (unmounted) range from 5s. 6d. for the smallest size, to 20s. for the 67mm. size. The popular size 40mm. by 22mm. is priced at 7s. 6d. (unmounted) and 21s. (mounted).

This firm also supply two photo-electric exposure meter construction kits, the reflected light model, priced at 37s. 6d., and the high light model, priced at 42s. 6d. Full details of these kits are given in leaflets which are obtainable from G. R. Products at the address given.

Wolf Electric Soldering Irons

NEW additions to the range of Wolf Electric Soldering Irons have recently been announced, and all these are the straight handle type. They comprise three models—Types 22, 32 and 42, which, whilst retaining all the general features so popular in the original range, have been designed to meet the demand for conventional straight handle types of Wolf design and manufacture.



New Wolf Electric Soldering Irons.

Amongst the first important users of these new models was the G.P.O. Engineering Department. To them, the straight handle soldering iron was indispensable in their particular class of work, involving as it does the daily soldering of many thousands of connections in telephone exchanges throughout the country. These new electric irons are of unusually high efficiency, and are a welcome addition to a range of models for all standard voltages to meet the consistent and exacting requirements of constant use.

In keeping with all other models the heating elements are designed to concentrate heat on the working point, providing a rapid and constant heat. They are sturdily built to withstand heavy usage, and are fitted with hard wooden handles with a heat deflecting skirt.

THE WORLD OF MODELS

(*Continued from page* 171)

railway comes to me from a correspondent in Germany. Mr. W. Richter, of Leipzig, has sent me a description of the Leipzig Lilliput Railway, which is a miniature, 15in. gauge, passenger-carrying railway in a park in North Leipzig. The line is laid round an ornamental lake and describes one circuit, with sidings into a locomotive and carriage shed, near the station where passengers start their pleasure trip and alight when it is finished. A complete circuit takes about eight minutes, non-stop. There are four open-bogie carriages for passengers, and on a fine summer's day these are surely crowded to capacity.

The model locomotive is a 4-6-2 "Pacific" type engine, built in 1925 by Messrs. Krauss and Co., of Munich. It is coal-fired, has 30-horse power, and can reach a speed of about 20 m.p.h. The illustration, Fig. 2, shows the gaily-bedecked train on the day when the railway was first opened, last August.

Scale Model Car

The demand for post-war motor cars, especially those within the reach of the average buyer, brings on to the market cars that are efficient, serviceable and yet attractive vehicles, free from unnecessary exterior decoration.

The need for the export of British-made cars has meant large publicity schemes, and one of the most satisfactory means of effective publicity is the use of scale models. These are easily transported for window displays and for the use of agents and travellers when obtaining orders.

The photograph of the model car (Fig. 3) is of the popular Hillman Minx saloon. The body design is functional and pleasant in outline. This model is to a scale of 1/10th full size, and was built to the order of the well-known and enterprising company, Messrs. Rootes, Ltd.

Club Reports

Aylesbury and District S.M.E.

THE December meeting of this society, held, as usual, at Hampden Buildings, on the 19th of December, was devoted to a sale of bits and pieces under the title of Rummage Sale. This proved to be very remunerative, £6 16s. 9d. being raised for the club funds. So ends another year for the club, and looking back I think it is fair to say that the year has been quite successful.—Hon. secretary, E. H. SMITH, Mulberry Tree Cottage, Devonshire Avenue, Amersham, Bucks.

Northern Models Exhibition

THE Fourth Northern Models Exhibition will be held in the Corn and Produce Exchange, Hanging Ditch, Manchester, on Friday, Saturday and Sunday, March 21st, 22nd and 23rd, 1952, opening at 11 a.m. each day.

We are hoping to have a well known television personality to open the exhibition on the Friday. To present the awards we have the Right Hon. The Lord Brabazon of Tara, M.C. The presentation will take place on the Sunday afternoon.

Entry forms, etc., are being sent in the near future to all previous entrants. We shall, however, be pleased to send full details to anyone interested who writes to the exhibition secretary, Mr. E. AXON, 5, Winstanley Road, Sale, Manchester.

QUERIES and ENQUIRIES

A stamped, addressed envelope, three penny stamps, and the query coupon from the current issue, which appears on page 40 (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.

Perfume Making

I UNDERSTAND that "scent" can be made by the boiling of water into which flower petals are placed, and then condensing the vapour back into a liquid.

Will you explain if this is so, and is there a quicker method of making "scent," perhaps by the use of chemicals ?—P. Roberts (Torquay).

PLANTS and flowers which contain oily perfumes which are volatile in steam (lavender, for instance) can have their perfume extracted by distilling them with water in the manner which you describe, and indeed, this is quite a well-known way of extracting these perfumes and essential oils.

But, unfortunately, when you say that you want to make "scent" we cannot help you much, because there are many hundreds of different scents, each requiring their own individual method of preparation. Most of the modern perfumes which you see in bottles are nothing more than solutions of blended essential oils and synthetic odiferous chemicals in dilute alcohol, the alcohol being by far the main constituent of the scent.

Perfume making calls for expert knowledge. Then, again, the odiferous constituents are expensive and hard to obtain (particularly in small quantities). Finally, the "absolute alcohol" required for perfume making is very expensive, costing about 78s. per lb., this excessively high cost being mostly due to the heavy excise duty on alcohol.

Your best move at present would be to study a number of books on perfumes which should be available in your nearest reference library or obtainable through your County Library, then you would be in a better position to appreciate all the intricacies and difficulties of perfume making. Suitable books for you would be: E. J. Parry's, "A Cyclopædia of Perfumery (2 vols.); E. J. Parry's, "Chemistry of Essential Oils and Artificial Perfumes"; W. A. Poucher's "Treatise on Practical Perfumery"; H. S. Redgrove's "Scent and All About It."

Colouring a Cement Floor

A NEW concrete floor is being put in my kitchenette and I want to know if it is possible to colour the final ½in. scarlet.

Is there a white cement on the market that could be used for finishing off ?

I imagine this would take a dye better than the usual grey of Portland cement.—G. Gallin (Thurso).

CEMENT cannot be dyed; that is to say stained by means of a soluble staining solution. It can be coloured by means of insoluble pigments which are mixed with it. A cement floor cannot be coloured scarlet except by actually painting its surface.

The standard red concrete colour is essentially a brick-red. It is produced by mixing about 15 per cent. red iron oxide with the dry cement and then by applying in the usual way.

White cement will not take any dye permanently. It may be made to absorb a dye, but the dye soon disappears, fades, or is destroyed by chemical action, washing, etc. There are several good white cements—"Snowcrete," for example.

If you want to colour the surface of your concrete floor, you will have to lay on it a thin coat of a cement coloured by admixture of a dry colour. This is the only permanent way, and the task is not easy, because an upper "skim" coat of cement laid on an existing concrete floor tends usually to flake away, to chip off, or otherwise deteriorate. To make a good, lasting job of a coloured concrete floor the entire mass of concrete or cement should be coloured and laid in one piece.

Strengthening Plaster Casts

I WISH to strengthen some ornamental castings for wall decoration with a fibre similar to that in paper. I have tried asbestos but find much of this is powder. I understand the plastic industry uses fillers of this kind. Can you give me names of any firms selling a suitable fibre ?—K. Johnson (Notts).

ASBESTOS fibre is excellent for the purpose which you name. This material can be obtained in several grades apart, of course, from powder form. Apply to Messrs. Turner Brothers Asbestos Co., Ltd., Rochdale, Lancs, or to Messrs. J. Milne Cooper & Co., Ltd., Kobar Works, Bradford, Yorks.

A very cheap material is paper pulp, which is made by shredding thin papers such as newspaper material, and simmering it for several hours in a solution of one part washing soda in 10 parts of water.

Waste hair is another useful material. There is a variety known as "Plasterer's Hair." It can be obtained from Messrs. H. Berry & Co., Ltd., Fogg Street Mill, Stockport, Cheshire, or from Messrs. A. N. Cooke & Co, Ltd., 114-150, Bradford Road, Dewsbury, Yorks.

Waste hemp, flax and jute are also useful materials. These can be obtained from any of the following firms: Messrs. Anderson & Chalmers, Ltd., St. Rollox Works, Arbroath; Messrs. Blakelock & Kerr, Ltd., Dalhousie Street, Carnoustie, Angus; Messrs. G. Wallace & Co., Ltd., Balgay Waste Works, Marshall Street, Lochee, Dundee; Messrs. Tough Brothers, Ltd., Anchor Works, Dundee.

Separating Oxygen from Peroxide of Hydrogen

COULD you tell me how to separate oxygen from peroxide of hydrogen (20 vols.) by a simple process, as I wish to use the oxygen for aerating my goldfish tanks ?—R. J. Parfitt (Shepton Mallet).

HYDROGEN peroxide readily gives up one half of its oxygen content and is converted into water as a result.

If you merely wish to generate oxygen from hydrogen peroxide, the following is a good practical method:

Add about 1 c.c. of sulphuric acid to every 100 c.cs. of hydrogen peroxide and drop the mixture on to a fairly strong solution of potassium permanganate contained in a flask or jar provided with an exit tube. A rapid evolution of oxygen will take place at ordinary temperatures. This should be passed through a wash bottle, after which it can be fed directly into the aquarium tank.

The wash bottle merely contains a little water through which the oxygen is allowed to bubble.

It is, however, quite unnecessary to use pure oxygen for the aeration of your goldfish tank because most of it will be wasted for, at a temperature of about 20 deg. C. (68 deg. F.) only 3 volumes of oxygen are dissolved by every 100 volumes of water. The aeration of the water can be done just as well by blowing air through the water in a fine stream.

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.

Platinising Glass

CAN you advise me on how to platinise glass for the purpose of soldering glass to metal as in Geiger-Miller tubes with metal cathodes ?—J. Orr (London, N.W.).

GLASS components such as you mention are usually platinised by the method of electrical sputtering. In this method, the component is placed in a high vacuum, and platinum metal is raised to a very high temperature and the particles of the metal are virtually evaporated on to the glass surface so that they condense on it in the form of a continuous film of any required thickness. This is the only reliable method of depositing platinum or other metals on non-conducting surfaces, but unfortunately the equipment necessary is very costly.

The chemical methods of depositing platinum only give very thin films of the metal which are hardly sufficient for attachment surfaces, and we do not recommend them. Here is one such formula:—

Dissolve a little platinum chloride in warm rectified spirit and allow it to digest therein for about an hour or until the platinum salt has dissolved. Stir the alcoholic solution into about four times its volume of lavender oil or essence of lavender. Brush the resulting solution over the glass surface. Then place the glass article in a muffle furnace capable of attaining a temperature of around 800 deg. C. for about half an hour. A layer of platinum will be deposited on the glass according to the strength of the platinum solution.

Platinum chloride is a very expensive salt. It may be obtained from Messrs. Johnson, Matthey & Co., Ltd., Hatton Garden, London, E.C. It is possible that this firm may be able to supply you with some other platinum preparation for the chemical deposition of platinum on glass surfaces.

Curing Tobacco Leaves

I WISH to construct apparatus to cure tobacco leaves. I understand that after drying the leaves they are subjected to a heat treatment of 30 deg. F. and are kept in a humid state. The idea I had in mind was to construct something to fit on an oil-stove, but I do not know how to keep the leaves humid. I shall be glad of any suggestions you can offer.—C. Hardy (Bath).

THE tobacco leaves should be placed in shallow wooden trays and kept accurately at the required temperature by placing the trays in the hot sun or on top of a warm oven or range. Once every day the leaves should be sprayed with water, using a fine spray for this purpose. An ordinary garden spray having a fine rose or nozzle will suffice for this purpose. Each day, after spraying, the leaves should be turned over.

Another way is to place the trays on greenhouse shelving or staging, close up to glass. Spray the air in the greenhouse with water every day. Obtain a dry and wet bulb thermometer and hang this inside the greenhouse. It will enable you to read off the degree of humidity within the greenhouse. So long as this registers a relative humidity of from 80 to 100 per cent., the humidity will be quite suitable for your purpose.

Your proposed method of using an oil-stove to apply heat to the leaves is quite good, in which case you would have to construct the trays (wood or metal) so as to slide within a framework, in the centre of which the oil-stove was burning. Here again, of course, the required humidity would have to be maintained by regular spraying.

Lens Grinding

CAN you explain the working principle of a lens-grinding lathe of sufficient precision to grind lenses about 10-12 mm. in diameter ? I believe it is possible to convert a watchmaker's lathe for this purpose, but without knowing how a lens grinding lathe works I do not know what conversions are needed.—J. Baker (Oxford).

LENS grinding and polishing is not done in a lathe, but in a machine having a vertical spindle, on the top of which is mounted a turntable, something like a faceplate; on this turntable the lens to be ground and polished is centrally secured by dogs or jaws. The spindle is slowly revolved by a worm and tangent gear. Coupled with the worm shaft and revolving at a different revolution speed through the medium of mitre gears is another vertical shaft having at its upper end a crank arm to which is bolted a crankpin, adjustable for length of throw. From this crankpin a long connecting rod extends across the machine over the turntable. The purpose of this rod is to carry the grinding tool, which tool, usually of cast iron, is machined accurately to templates for the exact curvature to be given to the lens. The tool is rotated slowly by hand, being mounted in a bearing in the connecting rod.

If a number of small lenses are being dealt with instead of one large one, they are cemented by means of pitch on a former which in turn is mounted on the turntable.

A fair number of tools are called for, all of the same curvature, for use, in succession, from the roughing stage to the final polishing, and the abrasive will be changed from coarse carborundum to commence with to the very finest rouge for polishing.

An illustration of a machine as above described, and more complete details of its construction and use, will be found in the work "The Telescope," by Louis Bell, Ph.D., published by the McGraw-Hill Book Company, Inc. New York: 370, Seventh Avenue, and London: 6 and 8, Bouverie Street, E.C.4.

"Resin Glue" : Bleaching Obeche Wood

I AM building a model yacht "bread and butter" method, and I would like to use the most suitable glue. I understand a gap-filling resin glue using a catalyst is very satisfactory and, if this is the case, can you give me the supplier's name and address, and approximate cost?

Also, can you give me a formula for this type of glue? The wood I am using is obeche, and the deck plank is very badly marked with a patch of dark graining, not unlike a black ink stain. Is it possible to bleach out this disfigurement, and would the bleaching effect be permanent under a varnish?—R. W. McVie (Glasgow).

THE "resin glue" which you inquire about is one compounded by Bakelite, Ltd., 18, Grosvenor Gardens, London, S.W.1, from which firm you will be able to obtain full particulars regarding the present supply position. Such an adhesive would be very satisfactory provided that a little filler, such as wood flour, were stirred into it.

To bleach the obeche wood, brush over it a paste made of chloride of lime and COLD water. Allow this to dry on, then brush over the wood a solution of acetic or hydrochloric acid (one in four). Repeat the process until the stain has gone. Finally, well wash the wood in running water for at least an hour in order to get rid of every trace of the acid. If this is not completely eliminated, the wood will crumble sooner or later. It is better to use acetic acid because, although it is more expensive than hydrochloric acid, its action on the wood is much milder.

Ink Thickening Substance

HAVE you any suggestion for a suitable substance which might be added to ordinary blue-black writing ink in order to increase the viscosity of the ink? I wish to use such an ink in "stylo" type fountain pens with which I am experimenting.

I have obtained the ideal consistency of ink by adding one part of glycerine to six parts of ink, but, of course, the hygroscopic nature of the glycerine causes the writing to remain wet and sticky on the paper.—S. J. Frewin (Sunderland).

PLACE in an ordinary bottle of ink a fragment of gum arabic about the size of a pea. Allow it to remain overnight. Then stir it into solution with a glass rod. Dissolve in the same ink, also, about as much sugar as will cover a sixpenny piece. Then stir in three drops of carbolic acid to prevent mouldy growths developing in the ink.

If the resulting ink is not sufficiently thick enough, dissolve more gum arabic in it.

It is obvious, as you point out, that glycerine cannot be used for thickening ink, for it is non-evaporative and hygroscopic and remains wet on the paper.

Gelatine can be used in place of (or in addition to) gum arabic, but the latter is much to be preferred.

Overglaze Pottery Painting

WHAT is a suitable recipe for the oil that is used to mix the powdered colours for overglaze pottery painting? The oil I have in mind smells of turpentine but takes about two hours to dry, being very sticky whilst drying.

I would also like to know the chemical names and formulæ of the ingredients used and where I can obtain them.—J. Stephenson (Billingham).

THE oil which you mention is usually a good quality raw linseed oil, which is often mixed with one-third of its bulk of genuine turpentine and has incorporated with it a proportion of a paint drier. There are, also, various synthetic resin varnishes, which, being quick-drying, are being used for a like purpose. Sometimes, too, a pale oil copal varnish is used. We cannot tell you the names and the formulæ of all the ingredients used in these preparations, because they are so many and so varied. You may obtain them in small amounts for amateur work from Dryad Ltd., St. Nicholas Street, Leicester. Other firms supplying such materials are: Messrs. G. W. Russell & Co., Ltd., Hitchin, Herts; Messrs. Geo. Rowney & Co., Ltd., 10 & 11, Percy Street, London, W.1; Messrs. Winsor & Newton, Ltd., 38, Rathbone Place, London, W.1.

Detergents—Effect on Rubber

COULD you please inform me if the detergents used in modern household washing compounds have a deleterious effect upon rubber after prolonged use? My interest in asking concerns the rollers of washing machines, subject as they are to pressure.—B. W. Nappey (Barnehurst).

THE various detergent "aids" which are incorporated into washing powders comprise various salts of sodium, among which may be mentioned the silicates, metasilicates, per-carbonates, per-borates of that metal. Used singly, none of these salts is supposed to affect rubber, particularly in the cold. It is very doubtful whether, when employed in admixture and in the normal low concentrations they will have any effect on a well vulcanised rubber, but if you wish to investigate this point further we suggest that you apply for an opinion to The Director, The British Laundeters' Research Association, Hill View Gardens, Hendon, London, N.W.4.

Making Garden Ornaments

I WISH to make some concrete garden ornaments, using a cement mould. Should I make the mould of neat cement and how can I stop the cast from sticking to the mould? I want to colour the ornaments a brownish shade; can you tell me what to mix with the concrete to do this so that it won't rub off?—B. Allen (Ilford).

TO colour the concrete ornaments, mix with the concrete material (before slaking with water) 15 per cent. of its weight of either raw umber (for cool browns) or burnt umber (for warmer browns). The use of burnt sienna will produce even warmer and redder browns. These mineral pigments are cheap and can be procured from most colour shops and decorators' stores.

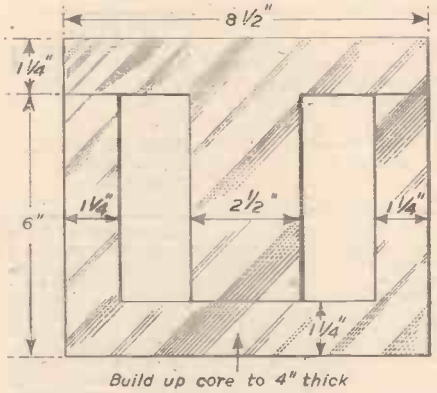
In order to prevent the concrete from sticking to the mould, coat the interior surface of the mould with a solution of Vaseline in paraffin oil or of paraffin wax in benzole. It is better, too, if a quantity of fine slate dust is worked into these solutions, but, usually, if the solutions are made strong enough, no sticking will be experienced.

The mould need not be of neat cement, but should be comprised of a mixture of equal parts of cement and very fine filler (stone dust, brick dust, etc.).

Transformer for Welding

I WISH to build a small arc welder which will weld to a ¼in. thickness. Can you give me details of the size and windings of a suitable transformer? My mains supply is 230 volts A.C.—N. Massey (West Bromwich).

WE suggest that you build the following equipment. The core of the transformer could be constructed of Stalloy stampings 0.014in. thick to the dimensions



Dimensions of stampings for a transformer for use with a small arc welder.

given in the accompanying diagram, the stampings being lightly insulated on one side. A former, through which the centre limb of the stampings will afterwards be threaded, should be wound with the primary coil having 168 turns of 10 s.w.g. D.C.C. wire. Over the primary should be wound a layer of leatheroid about 0.08in. thick, before winding on the secondary coil. The secondary coil should have 50 turns of D.C.C. copper conductors having a cross sectional area of 0.025 sq. in., with a tapping at the 43rd turn. When assembling the core the insulated sides of the stampings should all face the same way, adjacent layers of stampings being reversed so that the joints in one layer are covered by the next layer. The stampings should be tightly packed and clamped so as to avoid vibration.

A choke coil should be connected between the secondary terminal and the welding electrode. This could be constructed with a core of Stalloy stampings about 0.014in. thick, lightly insulated on one side. The centre limb should be built up to a cross-sectional area of approximately 7.5 sq. in. The coil on the centre limb should have 110 turns of D.C.C. conductor having a cross sectional area of 0.025 sq. in.; the coil being tapped at the 98th, 90th, 84th, 78th, 74th and 70th turns for use on the higher welding currents. Air gaps of approximately ¼in. should be left in each limb of the core; if required these gaps can be filled with wood so that the core can be clamped up solid. Adjustment of the air gap will provide a means of adjusting the choking effect, if required. The stampings may be obtained from Messrs. Joseph Sankey & Sons, Ltd., of Bilston, Staffs.

Silvering Glass Tubing

CAN you give me a method for silvering the inside of glass tubing? Also, can you suggest a backing paint to protect same?—M. Ward (Dublin).

FIRST of all, thoroughly clean the tube with soap and water, using a special tube-cleaning brush for the purpose. Then rinse the tubes out thoroughly with plain water so that they are scrupulously clean. Plug the bottom of the tube and stand it upright. Into the tube pour the silvering solution and let it remain therein for about 20 minutes until the silvering has occurred. Then gently rinse the tube out with water and allow to dry.

The silvering solution must be made in three parts, as follows:

(a) Rochelle salts	..	50 grams.
Water	..	500 ccs.
(b) Silver nitrate	..	5 grams.
Water	..	500 ccs.
(c) Strong ammonia	..	100 ,,
Water	..	500 ,,

Take 100 of (b), add (c) drop by drop until the precipitate which first forms just redissolves. Then add one more drop of (b) until a faint permanent turbidity is formed. Then add 20 ccs. of (a). Mix thoroughly and use immediately.

A good protective backing paint for silvering may be made by dissolving scrap celluloid in a mixture of 2 parts acetone and 1 part amyl acetate. This solution should be sprayed on to the silvering, but if spraying is not feasible apply the backing lacquer with a very soft camel-hair brush, taking great care not to drag the fine silver layer away from the glass. Then allow the coating to dry at ordinary temperature, *not* by heat. Be sure, also, that the silvering is completely dry before the lacquer is applied.

Weed-killing on Gravel Path

I HAVE a gravel path which has been layed on grass, and any amount of hoeing is ineffective in keeping grass and weeds down.

Could you give me a formula for a good home-made weed-killer which would be effective? Would the treated area be dangerous to any poultry, and for how long?—John Douglas (Fife).

A STRONG solution of copper sulphate rendered alkaline is as good and as cheap a weed-killer for paths as any, and the materials are easily obtainable. Make it this way:

Dissolve in every gallon of water about 5 lb. of crude copper sulphate and then add to the blue liquid about half a pound of caustic soda, stirring well. A sludgy liquor will result. This is kept stirred and then sprinkled on the weed-ridden path; about 1 gallon of the liquid will be sufficient to treat 20 sq. yd. It is a good plan to treat the path on alternate weeks with this mixture and with a mixture of 1 part of creosote and 12 parts of water, this mixture also being kept well stirred.

The path so treated would certainly be injurious to poultry which might happen to pick anything up from it, and this hazard would be present for at least eight or ten weeks after the last treatment of the path.

The best way of dealing with a path such as yours is to have it concreted, asphalted, or to give it a tarmac surface. Through these surface layers, weeds cannot possibly make progress.

Solid Transparent Materials

I AM interested in mounting biological specimens and wish to try doing this in a solid transparent medium. I understand that there are three types of material which can be made to set in a transparent block after the specimen has been embedded; these are methyl methacrylate, Ward's bioplastic and Marco polyester resin.

Can you tell me the makers or suppliers of these three substances?—R. W. Hall (Herts).

METHYL methacrylate and the various other polylester resins and their co-polymers can all be obtained in solution form from Vinyl Products, Ltd., Butter Hill, Carshalton, Surrey. Ward's bioplastic could, we think, best be obtained from Messrs. Flatters & Garnet, Ltd., Oxford Road, Manchester, 13, or from Messrs. Philip Harris and Co., Ltd., 144/146, Edmund Street, Birmingham.

Better than any of these materials for your specific purpose would, we think, be "Catacast" resin, a synthetic syrupy liquid, which is manufactured by Catalin, Ltd., Waltham Abbey, Essex. This syrup is premixed with a small proportion of acid accelerator, after which it is poured round the specimen. The syrup is then catalytically set and hardened, after about 24 hours standing the product being a solid, glass-like mass surrounding the specimen.

Wood Stains

WOULD you please let me know which three powders or crystals, soluble in methylated spirit, I can use for staining oak, walnut and mahogany for french polishing?—S. G. Hill (Abingdon).

YOU can purchase these wood stains ready-made in powder form from any paint or decorators' shop, but if you wish to make them yourself, you will require the following spirit-soluble dyes which may be obtained, price about 2s. 6d. per oz., from Messrs. Griffin & Tatlock, Ltd., Kemble Street, Kingsway, London, W.C.2—Bismarck Brown, Brilliant Green, Spirit Red, Fast Yellow.

Strong solutions of these dyes should be made up separately in methylated spirit. The wood stains can then be made up as follows, although the final adjustment of the colours will have to be determined by yourself, because so much depends on the colour of the wood being stained, its surface, and the depth of colour required:

Mahogany: Mix together Bismarck Brown solution and a little Spirit Red solution, according to the shade of red desired.

Walnut: Use either Bismarck Brown solution alone or render this solution more yellow by adding to it a few drops of the Fast Yellow solution.

Oak: Use a mixture of Bismarck Brown solution and Brilliant Green solution.

Very little of the green will be required, otherwise the stain will become almost black. Some workers prefer to stain the wood first with the green stain alone and then to go over it separately with the brown stain until the desired shade of oak is obtained. It is impossible to give you any further directions here because tastes differ so considerably in shades of oak, some people preferring a very light oak, others preferring a shade of oak which is almost black.

RESISTANCE MATS.—Make ideal heating mats for Aquariums, Photographic solutions, Print dryers, etc. Mains voltage. Black heat, size 10in. x 6in. Price, 2/6, post free.

B.T.H. 16 m.m TALKIE PROJECTORS.—Complete. Model S.R.B., also spares for same.

ACFIL PUMPS.—These pumps enable you to fill all accumulators on the bench with the carboy at floor level. Brand new, only 30/-, post 1/6.

INTERESTED IN FISHING?—Then send for one of our tapered whip aerials and make yourself a fine rod worth pounds. Consists of three tubular steel, copper-plated sections 4ft. long which screw into each other and are well finished, 7/6, carriage 1/-.

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THERMOSTAT SWITCH.—Bimetal type in sealed glass tube, 2½in. x ¼in. 30 deg. Cent. Ideal for Aquariums, Wax and Oil Baths, Gluepots, etc. Will control 1 amp at 240 v., 5/- each.

THERMOSTAT. Satchwell 12in. stem, 0/250v. A.C./D.C., 15 amp. 10 to 90 deg. Cent., 35/-.

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THE Cyclist
Editor: F. J. CAMM
VOL. XX FEBRUARY, 1952 No. 357

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Comments of the Month

THE MASSED START IMBROGLIO

CYCLE MANUFACTURERS' UNION OFFERS TO MEDIATE

By F. J. C.

THE Cycle Manufacturers' Union has offered to mediate in the long-drawn-out dispute between the B.L.R.C., the N.C.U. and the R.T.T.C. This surprise move comes after all efforts to get the disputants together, on a *vis-à-vis* basis in the hope of finding a solution to the problem, have reached vanishing point. At the moment of going to press it is not known what chances of success will attend this latest move to bring the dispute to a close; for members of the B.L.R.C. have stated that the bicycle manufacturers through their union have not been too well disposed towards massed start racing. They are represented on the National Committee of Cycling, and quite recently this committee has condemned massed start racing in a notice circulated to the Press.

Independently, too, the manufacturers have in the past expressed views against it, and members of the Union have been instructed not to take advertising space in B.L.R.C. programmes.

Some League members, therefore, take the view that it cannot accept as an arbiter an organisation which has already prejudged the issue, and thus cannot bring an impartial mind to bear on the discussion.

If the problem is to be re-explored by some organisation apart from the disputants, such must be entirely independent and known not to have expressed violent views either way. In the early days of cycling sport manufacturers were keen supporters of all forms of cycle racing, but because of the malpractices connected with trade association with the sport, the N.C.U. took steps to expunge from cycle racing shamateurs, or makers' amateurs as they were then called. The trade itself in those days was very much opposed to the N.C.U.

Amateurs supported by the trade could earn considerable sums of money without sacrificing their amateur status. Since then, of course, that practice has ceased, and in its place has grown a fully recognised professional class of racing cyclists which the trade legitimately supports.

Nowadays, the relationship between the Manufacturers' Union and the various cycling bodies is one of amity and close co-operation. It is all the more to be deplored then that this new offer should have been made after the announcement to which we have referred. It would have been far better had the manufacturers, with their knowledge of previous disputes, offered to mediate directly the present imbroglio revealed itself.

The fact that the Manufacturers' Union has decided not to support further massed start events until a solution is found may force the issue, for it is unlikely that massed start racing can survive without it, as it is at least a semi-professional form of racing. If indeed a solution is not found the League will have to find other sources of revenue in order to maintain its events. All of the facts of the dispute are known, and the Union should be not unmindful of the fact that in similar disputes of years gone by it has been found that the N.C.U. was wrong.

From its methods of handling the present dispute it is evident that it has learned little, if anything, from its past experiences. Before any association could be accepted as a mediator it would be necessary to ensure that the disputants would accept as final and binding the decisions reached. As far as we can see there is no possibility of that. Massed start racing is obviously wanted and is here to stay. It is perfectly legal, as is now established, largely as a result of our efforts, and in spite of the oft-repeated statements of cycling legislators and others, that road racing is illegal.

Every time trial is a race; it does not matter whether a race has a massed start or a massed finish, whether it is a time trial or an attempt at road record. The State has no power to banish it at present, and if it seeks to obtain such powers it would have to ban all forms of cycle sport which take place on the roads.

It is our earnest hope that during 1952 the problem will be solved, and peace restored to a sport which can be irreparably damaged if it continues.

1952 CYCLE SHOW

IT is a welcome announcement that the Council of the British Cycle and Motor Cycle Manufacturers and Traders Union has resolved to hold a Cycle and Motor Cycle Show at Earls Court this year from November 15th to 22nd. Whether the later announcement from the Ministry of Supply that the British bicycle industry can expect to receive a cut of 50 per cent. in its steel supplies this year will affect the decision remains to be seen. In some cases the cut would amount to 75 per cent. and this must mean a considerable drop in exports as well as unemployment in the industry.

Bicycle exports are bringing in £25,000,000 a year in foreign currency. The steel cut will, of course, mean a further restriction in supplies of bicycles to the home market, but the most serious effect will be upon our export trade, for if supplies to foreign countries are reduced there are plenty of foreign countries, including Japan, waiting to walk in. Once a market is lost it is difficult to regain it.

Perhaps after the Manufacturers' Union has issued its official protest wiser counsels will prevail. This is a case where a little steel earns a lot of money, and keeps tens of thousands in employment.

REAR LIGHTS—DEPUTATION TO MINISTER

MR. GURNEY BRAITHWAITE, M.P., Parliamentary Secretary to the Ministry of Transport, recently received a deputation from the National Committee on Cycling, representing the organised cyclists of Great Britain, who placed before him their objections to the provision of the Road Transport Lighting (Cycles) Act of 1945 that cyclists should be compelled to carry a rear light, a red reflector, and a white patch.

They explained their objections to the compulsory red rear light, and pressed strongly that the cyclist should be permitted to make the choice between a rear light and a reflector with a white patch. The Parliamentary Secretary promised to convey the views of the deputation to the Minister.

PEDESTRIAN CROSSINGS

THE new zebra crossings are in general being respected by motorists. In discussing the matter, however, with the police we learn the pedestrians are not so helpful. They still cross the road where they think they will and ignore the crossings. Crossings will never be successful until their use is made compulsory, and pedestrians brought more into line with the Road Traffic Act. As we have remarked on more than one occasion, anything which moves along the road can be considered as a vehicle, and should, therefore, be subject to the same laws. Whether one uses one's legs for pedalling or for walking, one has a bounden duty, as Lord Simon has stated, to all other road users. It is unfortunately true that some thousands of accidents are caused each year by pedestrians who escape scatheless.

Pedestrians, however, have not yet exhibited their faith in crossings to the extent of always using them. Perhaps when they observe that motorists are prepared to stop when pedestrians indicate their intentions to cross they will come to regard them as the only safe means of crossing the road.

From past experience of the old pedestrian crossings, pedestrians may be excused if they are a little apprehensive at present.

In view of Lord Simon's judgment they now know that they can be sued for damage they cause by their carelessness and their jay-walking.

THE FIRST RACE ON PNEUMATICS

THE Dunlop Rubber Company has presented to the Museum and Art Gallery at Strandmillis, Belfast, a film of a re-staged version of the first cycle race in which the pneumatic tyre was used. It is well known that these races which were part of the Queen's College Sports were won by William Hume, who, in our special issue published before the war to celebrate the Diamond Jubilee of the pneumatic tyre, retold the story of those famous races.

Building a Cycle Frame

Construction, Brazing and Finishing

By W. HILL

IN spite of the increase in mass-production methods, the art of light-weight cycle-frame building still remains a highly skilled craft, and the discriminating club man (or woman) who uses a cycle for pleasure riding usually goes to one of the "bespoke" makers when he or she requires a machine that combines ease of propulsion with light weight and elegant appearance.

The light gauge tubing used and the intricately patterned lug work which is a feature of the modern light-weight frame, calls for special care during the mitreing, brazing and filing-up operations, whilst if the machine is to handle and steer correctly the design must be correct and the frame and wheel alignment must be exact.

Fig. 1 illustrates a frame which conforms to modern ideas and should form a basis for a light and responsive machine. The dimensions, such as fork offset and the angles of the head tube and lugs, have been found to be suitable for fast road work and should be adhered to; but of course details such as section of fork blades, chain and seat stays, choice of fork ends and brazed-on "bits" can be varied to suit the desires of the maker or rider.

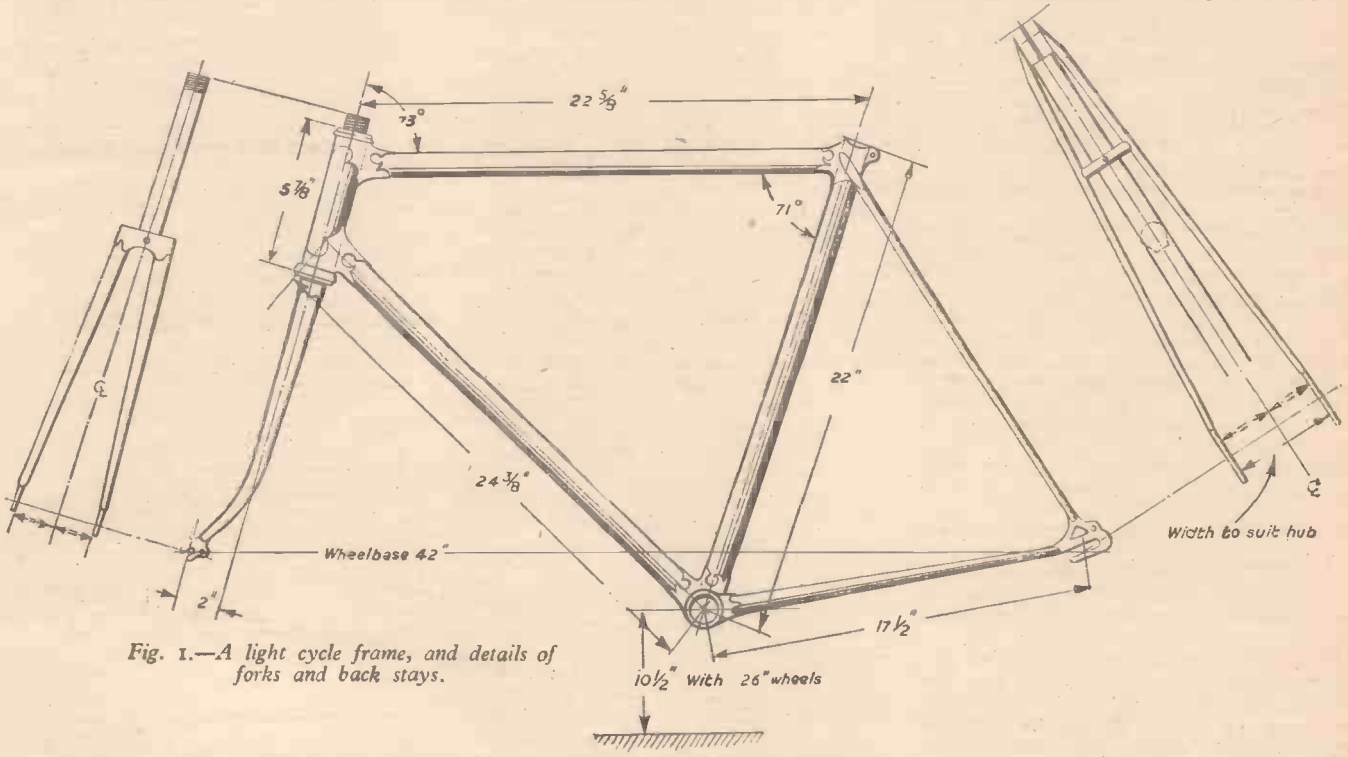


Fig. 1.—A light cycle frame, and details of forks and back stays.

The dimensions on the drawing are centre to centre, whilst in the panel alongside are details of the gauge and length of the tubes, with full allowance for mitreing.

A surface table is the best basis for a frame jig especially if quantities have to be produced. It is possible to produce a frame that is accurate without a jig, but of course the building takes much longer, and as great care must be taken to ensure correct frame alignment, it becomes necessary to check up periodically as the building proceeds.

Tools

Even if a prototype only is being built, if no surface table is available, it is advisable to have a set of straight edges as described below. These can easily be made, and will amply repay the time spent on making them.

The long, straight edge (Fig. 2A) is a piece of 1in. x ¼in. bright mild steel 4ft. long. At one end is fitted a pointer made from ½in. x 1/16in. flat strip and secured by a bolt and wing nut. This straight edge with its adjustable pointer is for checking the alignment of the rear fork ends with the head and seat tubes. That in Fig. 2B is used to align the down and seat tubes in correct relationship to the bottom bracket axle, and Fig. 2C is a test bar for inserting in the head tube and is used for setting the head and seat tubes in the same plane.

Fig. 2D is a simple fixture for trueing up the front fork. The illustrations are self-explanatory.

Mitreing

Before commencing to cut any frame tubes to length check the gauge of the three 1⅛in. diameter tubes. It will be found that one is butted or thickened at one end only, this is the seat tube. Try the seat pillar in the tube and it should fit in one end but not in the other, any surplus metal must be cut off the thin end, i.e., the end which the seat pillar will fit as otherwise the butt will be cut away. The tube is purposely thickened at the end where the stress is greatest, and it is also helps to counteract the inevitable loss in strength when the tube is heated during brazing.

If the top and down tubes are too long it is best to cut a little off each end so that the reinforced portion is kept as long as possible. Cut all tubes to length using a hacksaw blade, with fine teeth. The next operation is the mitreing of the ends of the tubes to give a close-fitting joint. This is one of the most important operations and should be done carefully as follows: Push the down tube into its bore in the bottom head lug until the end of the tube is level with the end of the bore at *each side* of the lug and the squared end of the tube projects into the head tube bore, next scribe a line on that part of the down tube which projects into the bore, keeping the scriber point close to the contour of the lug. On removing the tube from the lug, the two segments which must be removed will be clearly marked.

These should first be sawn out by taking a diagonal cut with the hacksaw and then filed down to the line, using an 8in. second cut half-round file to get the correct shape. During this and all subsequent operations the tubes must not be gripped directly in the vice jaws as this may damage them, but should be held between wood vice clamps that have been bored out to the correct diameter. Insert the tube into the lug and it should just fill the bore, and the head tube should then be inserted and the down tube pushed home against it. If the mitreing has been carried out correctly the down tube should fit snugly against the head tube, the shaped end of the down tube making contact with the head tube at all points. A good fit here is one of the secrets of a "lively" machine.

Next put the bottom bracket shell on to the other end of the down tube until a full hold is obtained and scribe as before, but making sure that the head lug and bottom bracket shell are in line. Proceed as before with all joints, that is, both ends of the top tube and the bottom end of the seat tube.

Before assembling the main diamond, drill a ⅛in. diameter hole in the front of the seat tube inside the lug so that any gases generated in the top tube during brazing can escape. This must not be omitted as the pressure inside the tube can blow out molten brass on to the operator, and, even if this

does not occur, pressure is often sufficient to prevent proper penetration of the spelter into the joint. Air escape holes must also be provided in chain stays, seat stays and front fork blades; in fact, in any tube that has a blind end.

The Lug Set

There are many excellent lug sets on the market at present, both malleable iron and pressed steel, some can be bought already cut away to fancy designs. Many small makers use these lugs as they are, but others design their own cutouts, either by cutting away a plain lug or by modifying one which has already been cut away. When designing a cut-out pattern, the thing to bear in mind is that the function of the lug is to hold the tubes rigidly in position, and strength and brazing area should not be sacrificed to obtain ornamental effects. Fancy scroll work has an appeal to some people, but many patterns used by some makers are expensive to produce and clean up after brazing, besides seriously weakening the joint. Decide therefore on a practical design, make sure that all cutouts are symmetrical (as it is too late after the frame has been brazed up) and thin the lug down so that when it is brazed to the tube no sudden change in section takes place, as this tends to concentrate the stresses at one point.

The ideal arrangement is to have a lug which provides ample brazing area all round the tube, and also has a thin wavy, flexible edge at the point where the tube emerges from the bore.

The front fork crown should be cut away to match, all burrs and rust removed from the bores of the complete lug set and all holes which require tapping, such as lubricator and mudguard, stay holes should be tapped at this stage.

TUBE LENGTHS WITH FULL ALLOWANCE FOR MITRE.	
Top, double butt, 21 x 23g.	22"
Down, double butt, 19 x 21g.	23⅜"
Head, 20g.	5 7/16"
Seat, single butt, 21 x 23g.	21½"
Chain Stays	15⅛"
Seat Stays	19"
FRONT FORK	
Column, single butt	7⅜"
Fork Blades, single butt	14⅛"

Assembly

The various tubes and lugs should now fit together without any springing or straining. It is very important that the alignment of the tubes and lugs should be perfect, as if a tube is heated whilst in a strained condition it will bend. After assembling to check all dimensions are correct, the "diamond" must be dismantled and every tube end and lug bore thoroughly cleaned. A paste should be made by mixing water and brazing flux until it is about as thick as cream and both surfaces to be joined liberally coated with it.

The top head lug, head tube and top tube should be assembled after fluxing and then drilled and pegged. Wire nails make excellent brazing pegs if the commercial article is not available and the holes should be drilled so that the peg will just drive in.

Brazing Methods

This is now ready for brazing and the procedure to be adopted depends on the equipment available. For many years the coal gas and air blowpipe and brazing hearth was used for most brazing jobs, but more recently new methods have come to the fore and have been used for cycle building.

Some methods such as the molten bath process have been used in the cycle industry for bulk production with a certain amount of success, but it is not suitable for brazing very light gauge tubing unless a very strict control is kept on temperature. The most popular methods used for light-weight frame production are (1) coal gas and compressed air, (2) the oxy-propane blowpipe, and (3) the oxy-acetylene blowpipe. Each method has its advantages, but also presents some problems; briefly they are as follow:—

The coal gas and air torch gives a large flame with a temperature of 1,870 deg. C. This means that a backing of firebrick or similar refractory material must be provided if brazing heat is to be maintained. This makes it difficult on some jobs to get round the back of the joint that is being brazed, and the large spreading flame makes control of the molten spelter difficult. Another disadvantage is that much of the heat is spread along the frame tubes, which has a weakening effect on the frame.

Thousands of good machines have been made by this method and it has the advantage of being cheap to run and install. With the oxy-propane and oxy-acetylene blowpipes the flame is considerably smaller and hotter, namely 2,500 deg. C. and 3,200 deg. C. respectively. This means that with the hotter, more concentrated flame, control of temperature and the brazing metal is easier, but the blowpipe must be kept moving so that local overheating does not take place. Brazing is best done "downhand," that is the work should be so arranged so that gravity assists the molten metal to flow into the joint. As no fire brick backing is required behind the joint, it is possible to hold the frame in some rotatable fixture. The ordinary cycle assembly stand as used by most repairers is ideal.

The operator should always direct the point of the flame (which should be adjusted to a neutral condition) on to the lug and thicker parts of the joint, never on to the tube. Only when the lug is uniformly heated should the brazing commence and it should be done swiftly and continuously, the operator working right round the lug, as the spelter is melted into the joint. Whilst the lug is still hot after completing a joint the job should be turned over so that the adjacent tube is in the "downhand" position ready for brazing and this tube should be brazed in position. This procedure preheats the lug and consequently saves gas and time and also completes the brazing without having to reheat the metal.

When brazing, the heat should be just sufficient to draw the brass through the joint, but no more. Any blobs of surplus metal should be brushed off with a wire brush whilst they are still molten. A correctly brazed joint should have a yellow golden appearance not blackened or copper coloured; this denotes an overheated condition, the most frequent cause of tube fracture.

The brass should not extend more than ⅛in. to 3/16in. up the tube and none should be spilled over the side of the lug as it will have to be filed off later. Most important of all the brass should run right through the joint. Some makers prefer to use a bronze rod of similar specification to those used in bronze welding and if oxy-propane or acetylene and 1/16in. diameter rods are used very strong neat joints can be made.

For those who prefer low temperature brazing, the silver solders now on the market offer many different melting temperatures and other physical properties.

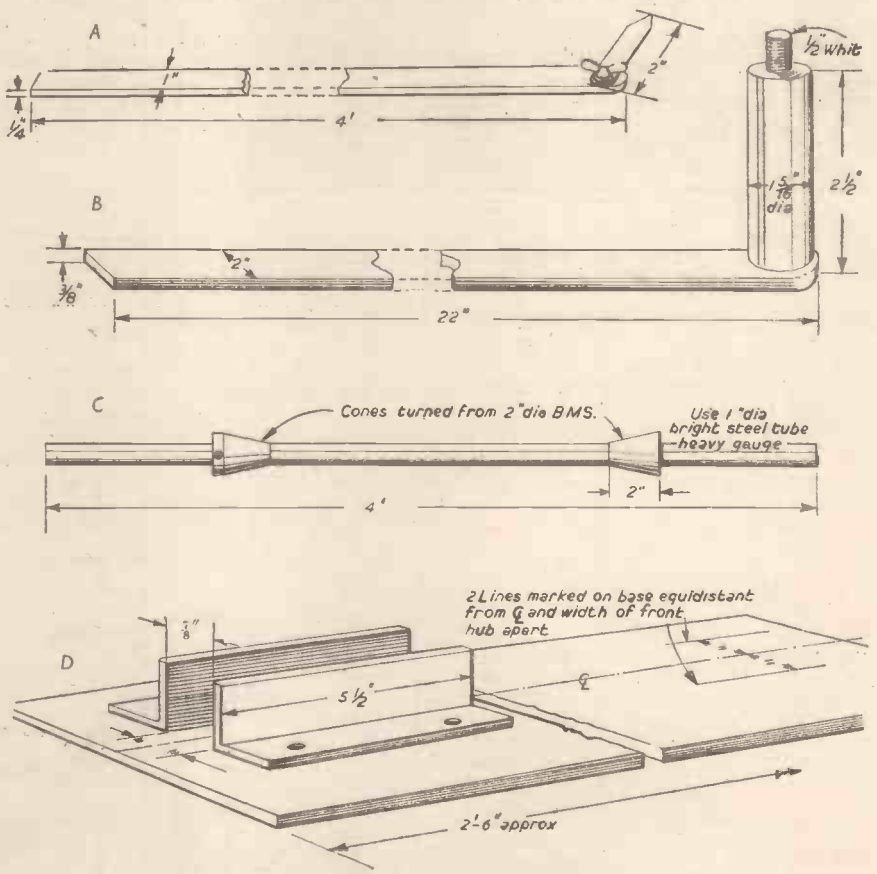


Fig. 2.—Straight edge, jigs and test bar.

Brazing Procedure

Whatever brazing method is adopted it should be carried out as follows. Assuming that the head and top tube have been thoroughly cleaned, fluxed and pinned the job should be arranged so that the top tube is vertical so that the brass will flow into the lug.

Commence to heat the lug, directing the flame on to its thicker parts, but do not attempt to warm it up too quickly or there will be a tendency for the thinner portions of the lug to become overheated.

(To be continued.)

Around the Wheelworld

By ICARUS

A Trailer Pram

MR. N. HOLMAN, of Skegness, has sent me the accompanying photograph of a trailer pram, for which he has recently applied for a patent. It is a perambulator-cycle-trailer and was recently demonstrated by Mr. Holman in the television programme entitled "Inventors' Club." The pram can be made to fit on the side of the cycle for those who prefer this arrangement.

Mr. N. Holman's Trailer Pram.

He claims for his invention that it provides comfortable sleeping accommodation for two infants, who are both fully protected against weather conditions; the older child has full freedom to sit or stand; both have unrestricted vision; a sun canopy with clips fixes on to the tubing; there are perspex screens; the coupling used for connecting to the cycle when used as a trailer always remains unseen.

"The "tram" can be securely connected to the cycle within 10 seconds, and has low wind resistance.

Herne Hill Track Promoter

THE N.C.U. has appointed John Dennis, former cycling journalist, as track promoter manager for Herne Hill. Dennis is, of course, the Northern Paragon national record holder. This appointment will enable A. R. Haine to give his entire attention to his duties as racing secretary. It is too early yet to state whether there will be more or fewer Herne Hill promotions. The appointment gives Dennis a golden opportunity of putting Herne Hill on its feet, and I wish him well in the task. Herne Hill in the early days of the present century was the scene of many historic races.

Can that same spirit be revived? Will the public still flock as they did in those days to see cycle racing? Do we require a different type of event? Is cycle racing still spectacular to the public, or does it only appeal to the converted? Previous attempts to make Herne Hill a paying proposition encourages the thought that the days when track racing as a public spectacle could draw crowds are over.

Those were the early days of the sport when it was comparatively new, when the trade spent considerable sums of money on prizes and cash awards, when people like the Cuca Cocoa Company could put up silver pots large enough for a small child to sit in. Motor racing has gone the same way as cycle sport. It has ceased to be spectacular. Even six-day racing in this country could not in its revival draw the crowds of the past.

Massed start racing, on the other hand, does do so, which suggests that the old must give place to the new.

Another Diamond Jubilee

CONGRATULATIONS to the Epsom C.C. on achieving 60 years of continuous existence. It was formed in the spring of 1891 with a membership of 15. The diamond jubilee dinner was attended by 70 members and guests. Its badge which was originally a simple cartouche shield inscribed with Epsom C.C. now incorporates an old Ordinary with the club name superimposed including the date of foundation, 1891.

A large number of clubs have in the past five years celebrated their golden and diamond jubilees.

"Sportsman of the Year"

THE national ballot to elect the "Sportsman of the Year," organised annually by *Sporting Record*, opened on Dec. 1st, 1951, for the sixth successive year when the public was invited to express their choice of the sporting personality considered to have done most during the year to raise the prestige of British sport.

Last year over 244,000 individual votes were received, and Reg. Harris, world professional sprint cycling champion, headed the poll, for the second year in succession.

There is this year again a wide choice of candidates to be considered, and the question as to which branch of sport has gained the greatest international recognition, and which exponent of that sport has made the greatest personal contribution to national prestige, is bound to excite spirited discussion.

Passing of Burden Barnes, O.B.E.

I WAS sorry to hear of the passing of J. Burden Barnes, O.B.E., who, until his death, was president of the Bath Road Club Limited. Barney, as he was known to all members, was revered throughout the world of cycling for his geniality, his wisdom and his knowledge of cycling. At one time a racing cyclist, he continued to ride a bicycle until the last few years of his life. He was an R.R.A. timekeeper. By the way, I learn that E. Coles-Webb, another old member of the Bath Road Cycling Club, is seriously ill following an operation.

A ⅛th Scale Model of Macmillan's Bicycle

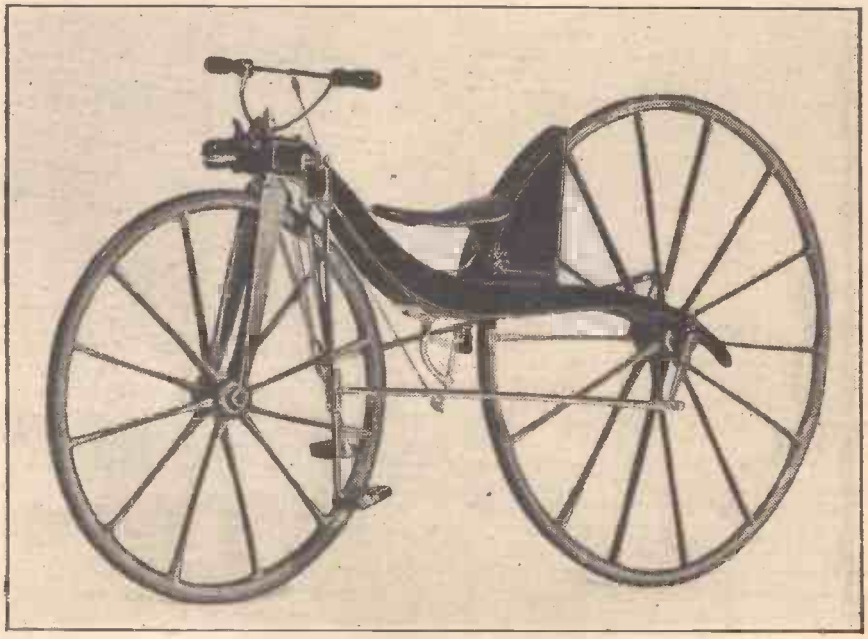
(*Continued from p.* 156)

1/16in. shorter than the circumference of the wheels, forming them into bands and silver-soldering the joints. When heated this will pass over the circumference of the wheels and on cooling will shrink and draw all joints tightly together. The two wheels are enormously strong.

The Backbone

The backbone is cut out of the solid. Let into the bottom is a small pulley over which passes the cord operating the rear brake from a twist-grip control on the handlebars. This is the first occasion on which twist-grip control, now popular on motor cycles, was employed.

The detailed drawings on page 156 should enable anyone to make a model of this historic machine. This is the first occasion on which complete drawings of every part of the machine have been published, and a set has been presented to the Science Museum and to the Centenary Road Club. I hope to have the model on exhibition this year, but in the meantime any reader who cares to see it may do so by appointment.



Three-quarter front view of the model built by Mr. F.J. Camm.

Wayside Thoughts

By F. J. URRY

Criccieth, North Wales.
The Castle dating from 1284 commanding wonderful views over sea and mountain.

Back to October

IT is a pleasant thing to contemplate a holiday memory when the winds howl and the rain lashes the leafless bushes, to remember the sunshine and soft winds, and the blue sea flashing flakes of light into the air as the sun touched the waves. For in early October my brother and I had the left-over luck of the summer for some eleven days and about 450 miles of riding without a drop of rain and scarcely the shadow of a cloud. Indeed it was the best break of the year, and as few folk wanted the roads for holiday purposes we had an unhurried journey of singular quietude. We stepped off the train at Swindon one mid-day out of the Midland fog into a misty brightness which became pure sunshine long before we reached Avebury to gaze again at the temples of our forefathers, and in another mile to wonder as thousands have done, the ancient meaning of Silbury Hill, the highest artificial mound of the Continent, hard by West Kennet on the main London-Bath road just west of Marlborough. We dodged Devizes and came on to Salisbury Plain by way of lesser roads, strolling over its folded formations with ease, a wind abaft, a warm air, and glorious sunshine. Indeed it was so good that we had worn out the daylight almost before we were aware of the fact. But the luck was with us in gallant fashion for at Tilshead we found the lady at the Black Horse once lived in our area and knew folk we knew; a merry introduction to an excellent meal and a good fire. That was a good start from which we never looked back, despite the warning that our return journey be carefully routed, for 50,000 troops and 7,000 motor vehicles wanted all Salisbury Plain for warlike exercises all the next week.

After Many Years

EARLY next morning we came to Stonehenge and duly paid our respects (and sixpences) to the 3,000 years of its character. Fifty-five years ago—before motor-cars—I came to this same place over chalky flint roads roughened by the tiny hooves of sheep, when the ancient stones were unguarded, no wire, no gates, no sixpence, and the great rolling plain was as lonely as a forgotten prairie, and as a youngster I thought then what the priests of this old religion would think of me on a bicycle, and as I stood amid the circle the memory returned. There is no answer, anyway until wireless reclaims (as it promises) the ancient ways of life of the Stone Age. A couple of hours later with lunch comfortably tucked away we sat in the cathedral close at Salisbury, bathed in the gold of sun, and saw the fleecy clouds play with the tall spire. No wonder that comforting American, Oliver Wendell Holmes called this green space graced with clerical art "the apple of the eye of England." We followed the beautiful Avon down to Fordingbridge, and, finding a little too much traffic on that Saturday afternoon, climbed into the New Forest, by way of Deadman Hill to Bramshaw Telegraph, over the lovely open heathland touched with the gold of gorse and backed by the tall trees just showing the slashed tints of autumn. On the way we repaired the only puncture of the tour provided by the ubiquitous tin-tack, and then we wanted tea. All the summer places were boarded up, the forest was lonely, and we had to ride over the ridge and down to Brook before that cycling ache for a cup of tea was satisfied. Lyndhurst was full of week-enders making play while the sun shone, so we tripped in the gloaming to Brockenhurst with the sunset streaming gloriously down the glades and shining like memorial windows on the great hardwood trunks of the forest giants. A very beautiful day to remember.

Tucked Away in Beauty

TO-DAY the recollection of this weather we enjoyed is like a flash of a jewel on the inner mind. Brother Bill had never been to Buckler's Hard on the Beaulieu river, a sheltered reach of water where many of England's old wooden walls first tasted salt water, and now given to the dainty grace of yachts for winter quarters; so the omission had to be repaired, but not before a climb over Rough Hill to sleepy Beaulieu itself, drowsing in the sun with the tide running in. We sat and smoked, and in due course strolled for a glance at the Abbey and later took the quiet lanes to Buckler's Hard, skirting the edge of the forest. The old inn, the little railed off colony, the steep forest bank dipping to the river, and the wide background of its rushy flats, made the perfect picture. Life went quietly by with the business of tucking the many comely yachts and motor-cruisers into their winter beds, a quietly animated scene almost without sound that made one respect another mode of travel. We dreamed away an hour with coffee on the lawn of the inn, and the air was warm enough to discard raiment. Then we slipped along the lanes to Lymington through wide forest glades with here and there the bleaching fields of stubble, a perfect English scene of peace. We came to Lymington just on lunch-time and learned a ferry would leave for Wight at 2.30—plenty of time for lunch. It was Sunday and Lymington had shut down on the season's catering, but after some searching we found a sufficiency of food, followed by the chug across the Solent to Yarmouth. That lively little harbour was jammed with summer yachts and cruisers, owners and helpers busy snugging them down for winter, which seemed a shame on a day warmer and sunnier than any in July.

The Quiet Wight

A YOUTHFUL memory sent us over the hill to take tea in Alum Bay, stroll on those crumbling cliffs to better get into vision the white columns of the Needles. The few miles to Freshwater Bay we made in the golden glow of the setting sun, expecting the Albion, known of old, would feed and house us. But the Albion was boarded up for winter—like the yachts—and only one hotel seemed to be in working order, but that provided a couple of beds and gave us a sufficiency of food. I intended to go over the coast-road—the old military road—to Niton, and had no idea it had been transformed since my last visit into a first-class highway from the ridged and stony track of the old days. Only a few others than ourselves wanted it that morning, but I can understand how it buzzes with coach and bus and private car in "the season." Indeed it struck us that the Isle of Wight is only an idle cyclist's paradise in the "off" season, very early in spring or late in autumn, for its narrow, winding, hilly roads, while excellently surfaced must be a navigation test when they are fully occupied. We promised ourselves a lazy elevenses at Niton—nothing doing—so on to Blackgang, which was worse, for a recent slip of cliff made walking down the chine precarious, and every refreshment house was locked and discarded. Over the new cut road we climbed high to linger at long last by the Undercliff under the bowers of Week Down and then Boniface, drifting into Ventnor for a needed lunch. The pull out of Ventnor awakened us to the loveliness of the day, and the glory of the visions along that coast road to Shanklin from high up on the downs. If you hurry over this road on such a day as that vouchsafed us, you are indeed a vandal.

Back to Boyhood

DRIFTING circumspectly down Cowleas, the long hill into Shanklin, we were hailed by Bill Davey and a couple of his friends, doing as we were, taking a short break to gather a few miles in such weather, but probably to gather them a little more rapidly than we were. Tea at Shanklin followed by a lazy stroll along the cliffs in the cooling fall of the evening, until we saw the natives riding bicycles along the paths, and that was too much of a temptation not to follow. Sandown, too, seemed to be out of the catering business and as quiet as a forgotten colony, but we did find one hostel working with a welcome in its hand. Sandown has extended a trifle along the Yaverland road over which we passed in the morning to visit Yarborough Monument, erected to the earl of that title as the first commodore of the R.Y.S., our interest in this being that our grandfather shifted the granite column inland some hundred yards or so when the Government of that day built Bembridge Fort.

A stop by the ancient village pound, with the 16th century Bell Hotel on the right.

CYCLORAMA

By H. W. ELEY

Immortality in Wax

TO have one's effigy in Madame Tussaud's exhibition is a tribute to fame indeed, and I learn that Geoff Duke, the world champion motor-cyclist, with his Norton machine, is to be added to the famous collection in Baker Street. "Geoff" joins Reg Harris in the exhibition's group of famous sportsmen, and I welcome this tribute to two fine champions, who have done so much to uphold British prestige, and earned such laurels by their consistent successes. I shall look out for the figures of these two popular sportsmen when next I pay a visit to the "waxwork show" . . . where, ever since childhood days, I have loved to spend an hour.

Full Order Books

FOLLOWING the Cycle and Motor-cycle Show held last November, the British cycle and motor-cycle industry has full order books for the next twelve months. The show raised the value of exports already ordered to more than £25,000,000 . . . enough, coupled with home demands, to keep factories working for at least a year. According to the president of the Manufacturers' Union, Mr. F. A. Kimberley, the only "snag" is adequate supplies of the right kind of materials. If these are forthcoming, then it might be possible to still further increase the industry's contribution to the export drive. A truly healthy state of affairs in these days when we hear so much of languishing British trade, and the loss of markets!

February Fill-dyke

IN view of the alarming amount of rainfall in November and the earlier months of 1951 it would do no harm if February, known traditionally as "Fill-dyke," withheld her gurgling rains and gave us some of the drying winds of March. In my hilly Derbyshire, where we never run short of water, the fields have been sodden, the brooks full, and the farmers have, for once, had a legitimate grumble . . . for work on the land has been difficult indeed. But we are philosophers in this grey county of the hills and dales, and know that dark skies can quickly turn to blue . . . and even on the dreariest day one is not without the song of birds.

Cyclists at Church

ON a January Sunday, when the air was crisp and keen, and the road hard, I saw a score or more cyclists emerging from the little country church, and learned that they had been attending a special "Cyclists' Service" . . . organised by a priest who was himself an ardent rider. What a happy idea! Those fellows and girls looked as if they had enjoyed their pilgrimage to that old ivy-covered church, and when afterwards I made the acquaintance of the vicar, I had no doubt that he had talked in "cyclists' language" when he addressed those riders. He told me that his collection was "well up," and he voted the riders "good sports" for their generosity. This is a notion which could well be copied by cycling clubs . . . most village churches have something of interest to show, and most country parsons are lovable, knowledgable folk. . . .

Museum Piece

IT is a far cry back to the days of 1889 . . . a year famous in the annals of the cycling movement, because it was on May 18th of that year that the pneumatic tyre was first used in a race. That epoch-making race took place at Ormeau, Belfast, at a spot less than a mile from the Museum and Art Gallery at Stranmillis, Belfast. Now, that museum has accepted a film depicting the race, from the Dunlop Rubber Company, and the film will be used by the museum authorities for educational purposes in connection with their schools services. Already, this museum possesses numerous relics of John Boyd Dunlop, including a bicycle used by him.

An Old Controversy

OVER the years, I have heard many rather heated discussions as to which is "the prettiest village in England." And I have also read many letters on the subject. It is now revived in my mind by receipt of a letter from a cyclist in Oxfordshire, who asks for my opinion. Well, I have never passed a verdict on this thorny subject, and never shall. There are so many "prettiest villages" . . . and sometimes my vote goes to one, and sometimes to another. For instance, when I ride in "silly Suffolk" and come to Long Melford, I am quite sure that it should be awarded the palm. But . . . when I come to a village of thatch and charm in Wiltshire, I am inclined to alter my views; and there have been occasions when I have thought that pride of place should be given to Tissington, in Derbyshire, or to some hamlet nestling in the shadow of the Quantock hills in fair Somerset. It is largely a matter of mood . . . but the great thing is that this England of ours is rich in scenic gems; no county can claim all the beauty, and no district has a monopoly of all the charm and glory of an English village . . . with its green, its inn, its ancient church, its age-old trees, and its mellow loveliness which has matured through the long years. Let us be content to leave it at that!

Those Inn Signs

JUDGING by the letters I receive about inn signs, their quaintness and origins, this subject is one which holds quite a fascination for the cyclist. Rightly so I think, for it is a subject full of interest, and for the man keen on the past and customs of yore it is a grand study. The other day my postbag contained a letter asking whether I had ever heard of an inn named "The Hank and Buckle." A strange and uncommon name surely . . . but, as it happened, I knew the inn which bears this sign. It is in the Derbyshire village of Etwall, not far from Derby itself. Now, I have never seen another inn of this curious name, and it may well be unique. Anyway, I have noted it down in my "inn sign catalogue." Some day we shall have to revive that good series of pictured stories which appeared in THE CYCLIST some few years ago! Meanwhile, I keep an eye open, when riding in the country, for curious and out-of-the-ordinary names, and always try to discover their derivations.

The Vogue of St. Valentine

FOR some years "Valentines" seemed to drop out of popular favour . . . but they are enjoying a new lease of life. If we do not, now, live in an age of swooning maidens, and love-lorn swains, romance is still with us, and lovers' greetings still have meaning. The stationer's shop in my neighbouring town has its window dressed with Valentines, and I am sure that these colourful greeting cards do much to sustain old friendships, bind hearts together, and bridge the "distance which divides." How long ago good Saint Valentine lived I do not know; but, like St. Swithun, he still holds his kingdom, and, in a prosaic world, bravely bears the torch of romance. . . .

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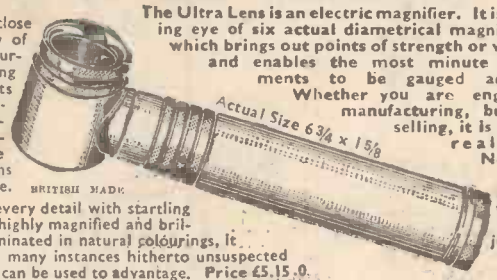

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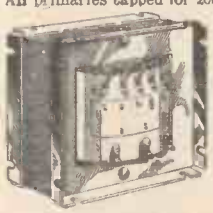

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