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A DOUBLE-SEATER CANOE

NEWNES

PRACTICAL MECHANICS

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JUNE 1945

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PRACTICAL MECHANICS

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Editor: F. J. CAMM

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FAIR COMMENT—BY THE EDITOR

Peace!

WITH the unconditional surrender of Germany peace returns to this country and to Europe. It may not be long before the Yellow race ceases to be a peril, and peace will return to the entire world. We can look forward to a gradual return to the world as we knew it in 1939, to a world where we are free to follow our pursuits and legitimate business, a world of hobbies, sports and pastimes, a world where science is not prostituted to war, but guided into channels which will benefit mankind.

Some good emerges from war. We are on the eve of the jet- and rocket-propelled era, and already one famous manufacturer has produced a car fitted with an internal combustion turbine.

Many other things have been developed during the war which will benefit the public in peace. There will be a gradual return of people from the Services to civilian life, and it is natural that their thoughts are now turning again to their pre-war interests, such as radio, model aeroplanes, model boats, chemistry, model locomotives, lathework, and the arts and crafts.

Journals which have catered for those needs have performed a great task in keeping going during the war, and one has only to read the letters sent by readers who have received copies abroad to realise the great link a journal forges between the outposts of Empire and home. During the war journals in common with other businesses have been very short of staff, and to add to the difficulties there has been the very rigid censorship on the publication of details of new inventions and scientific developments.

At the moment we do not know when paper control will be relaxed, and post-war plans in connection with periodicals must await that time which, fortunately, does not seem too far distant. For the past five years this journal has appeared in its wartime utility dress, but in spite of all the difficulties which beset editors and publishers, we have done our utmost to provide reading matter up to our pre-war standards. Now that the war in Europe is over and Norway is clear, we may hope that supplies of paper pulp will reach this country in sufficient quantities to enable us to remedy the present acute shortage of supplies of all journals, to increase the quantity of pages and the quality of the paper.

Shipping, of course, will remain a difficult problem for some time, and under the demobilisation scheme it will be some little time before staff returns. Our plans, however, are laid and we now await the men and the materials.

Can you remember our pre-war issues and the style in which they were produced? The three-colour cover featuring one of the main articles? The details of the Flying Flea, the Luton Minor, our canoes, the £20 car, our wireless and television receivers, our petrol-driven model 'planes, our model boats, photographic apparatus, articles on lathework, and the general features which leavened the more serious technical matter?

As soon as the censorship is withdrawn we shall be able to publish detailed illustrated articles on many of the things which have been developed during the war, and perhaps we soon will be able to reinstate our full query service, for during the war we have had to curtail the ambit of our Advisory Service. The great thing is that peace is here, and once again this country emerges victorious, but a large debt of gratitude is owed by us not only to our sailors, our airmen and our soldiers, but to the skill of our scientists and our technicians who, starting off from scratch in 1939, have overhauled the Germans and beaten them to their knees in ignominious and humiliating defeat.

The S.M.A.E. Appeal

THE Society of Model Aeronautical Engineers, which is the sole body recognised by the Royal Aero Club to govern model aeronautics in this country, has settled its plan for the future. We were responsible for the formation of this body just after the last war. Previously the Kite and Model Aeroplane Association had been the governing body but it went out of existence during the last war. There had sprung up a largish London club known as the London Aero Models Association, and it was in the course of one of our lectures to that body that we made the suggestion that this club should approach the R.Ae.C. with a view to securing recognition as the body to replace the old K.M.A.A. The R.Ae.C. accorded such recognition, and it remains and is likely to remain the governing body.

The science of model aeronautics is a most important one at this period in the history of aviation. Most of our leading aircraft designers such as Handley Page, A. V. Roe, H. O. Short, C. R. Fairey, De Havilland, Sydney Camm and others were model-makers. Now that we have entered upon jet and rocket propulsion, model-makers of the scientific type have a further important task to perform.

The S.M.A.E. has announced its plans for future development, and it has issued an appeal, signed by Lord Brabazon of Tara, for funds to enable it to establish central headquarters in London, and to develop education, training and research in all matters concerning aeronautics. The appeal is supported by a number of leading authorities in the aeronautical world, and they all accentuate the great value of models in the sphere of experiment and in developing the air-mindedness of the youth of the country and in advancing our technical knowledge. It is hoped to raise £25,000 as a result of the appeal, and donations should be sent to Lord Brabazon of Tara, 333, Grand Buildings, Trafalgar Square, London, W.C.2.

How Bomber Pilots Were Trained

MANY may have wondered how our pilots were trained in the skilled business of pin-pointing their targets by night, in spite of enemy attempts to thwart them. Half a dozen complete air-crews were put into what are called synthetic trainers, and all of them simultaneously taught their job of finding and hitting their target. Dummy fires and dummy targets, false messages, atmospherics, night code signs, bad weather, and a host of navigational and technical problems were simulated on the ground by the ingenious improvisation of the principle of rediffusion. The pilots thus made their mistakes on the ground instead of in the air.

The rediffusion trainer has been in use since 1940. Some years before the war mechanical training devices such as the Link trainer had been used by the R.A.F., but no attempt had been made at the collective training of crews by similar methods. The idea behind rediffusion is that the members of an air-crew—pilot, navigator and wireless operator—who had already received specialised training, should be brought together in a synthetic aeroplane, and by means of external apparatus controlled by an instructor allowed to fly a course similar to that which they would fly in battle conditions. The idea was embodied in an apparatus which took the form of a cubicle like the fuselage of a bomber, equipped with all the relevant instruments for navigation. The dark compartment is connected to the instructor by wire over which he can send messages, and also reproduce the different kinds of interference which are liable to take place during a flight. He can give the crews practice in operating procedure, including wireless and celestial navigation, and teach them how to fix their position by these methods. He can also reproduce the aural and visual effects the crew would experience on the way to, and near, their target. Projected cinematograph pictures give them fleeting glimpses of the land or sea below them. Stars are simulated by means of spots of light reflected in mirrors, and sound and light effects reproduce the impressions of enemy searchlights, flak and bomb bursts. Wired wireless is adopted for all wireless communication and navigational parts of this new trainer.

A Double-seater Canoe

Constructional Details of a Serviceable Craft Built During the War

By F. HOOK

The complete canoe.

THE design and method of constructing this canoe is the outcome of a desire to build a canoe in wartime when there is but little choice of material. Originally the idea was to build a completely collapsible boat of the Falbot type, but the necessary plywood, ash rods, brass ferrules and rubberised canvas were not available. Another consideration was that the boat must seat two people, and be capable of carrying camping gear at the same time. Finally, the canoe must be easy to transport by train so that waterways in various parts of the country may be visited.

The usual size for a two-seater canoe is 18 feet in length. It was obviously impossible to carry a rigid boat of this length in a guard's van on a train. This, together with the notion of prefabricated boats, gave rise to the scheme of building the boat in two halves, each 9 feet long and bolting them together in the centre. Each half of the canoe was to be watertight in itself. This latter idea offered the hope that if a puncture was picked up in one half of the canoe, at least one half of the crew would escape a wetting. How this will work out in practice cannot be said as, so far, no damage has been received in the hull in spite of many miles of travel.

General Details

The sketches in Fig. 1 show the two halves of the canoe ready to be bolted together. Coach bolts and wing-nuts are used. A thin rubber washer is placed over each bolt as it protrudes from the one half of the canoe, before pushing the bolts into the other half. This washer will stop leaks at the bolt holes. The lower two holes are the only ones under water the whole time, but it is advisable to use washers on all the bolts. Cycle puncture patches can be used after a neat hole has been cut in the centre of the patch.

In commercial folding canoes the cross-frames are of plywood but quite satisfactory frames have been made from ½in. thick deal strips, glued and screwed together. The top and bottom strips are 1½in. wide. The side strips are 1¾in. wide at the middle, and taper off each end to 1½in. wide (Fig. 2).

It is very important that a waterproof glue such as "Casco" should be used as well as brass screws. The proximity to damp would soon loosen the usual Scotch glue, and steel screws would soon disintegrate. Copper tacks should be used for fixing the covering cloth for the same reason.

The timber for the side strips (or stringers as they are called) and cross-frames should be chosen to be as free of knots as possible. For the stringers builders' lathes could be used. The actual size employed in this canoe is 1in. × ¾in. when planed all round. Planing is not vitally necessary but it makes for a neater job, and is easier to paint.

Many makeshifts will have suggested themselves for covering the canoe. In the writer's case some good quality blackout material, green in colour, was available consisting of two layers of canvas separated by a layer of rubber solution. It is still not possible to buy tarpaulin cloth "by the yard," but there are second-hand tarpaulin clothes advertised, and these would do if not too badly damaged, and if it could be arranged for the seam to come along the keel strip. Care must be taken with seamed material that the seam is really waterproof. Unbleached calico is too light a cloth for a double-seater canoe, but it has been used successfully for the smaller single-seater.

For the final finish marine paint is best, but none of this was available for this canoe. An improvised, and satisfactory, finish was used consisting of two priming coats of red lead and linseed oil and driers, followed by two coats of good quality lead paint of suitable colour.

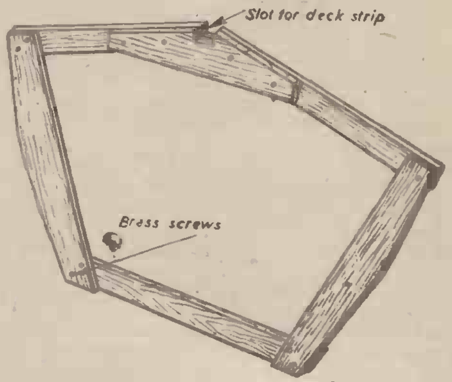


Fig. 2.—General construction of the cross-frames.

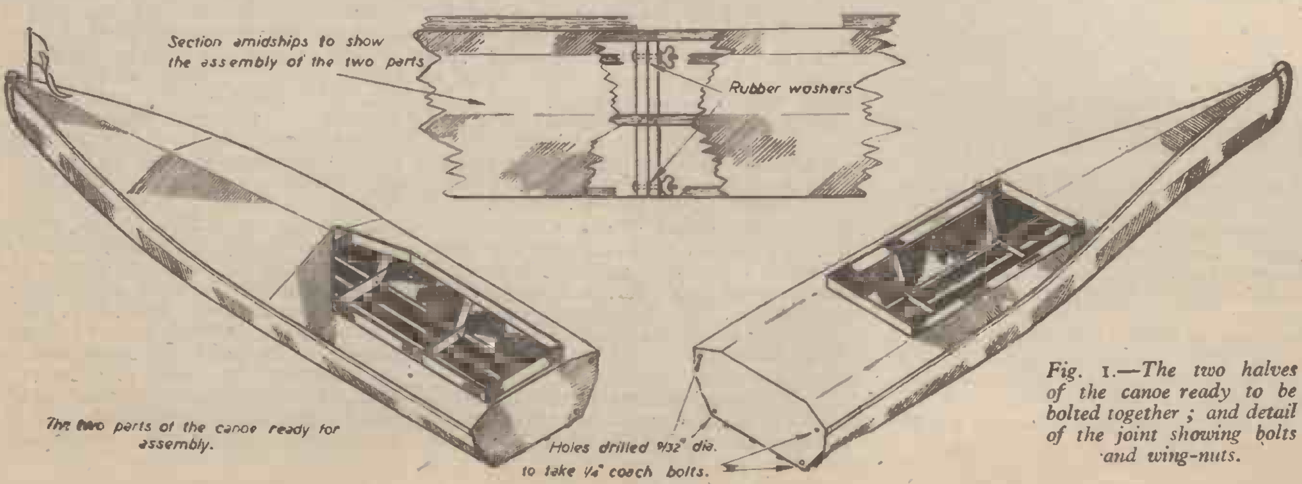


Fig. 1.—The two halves of the canoe ready to be bolted together; and detail of the joint showing bolts and wing-nuts.

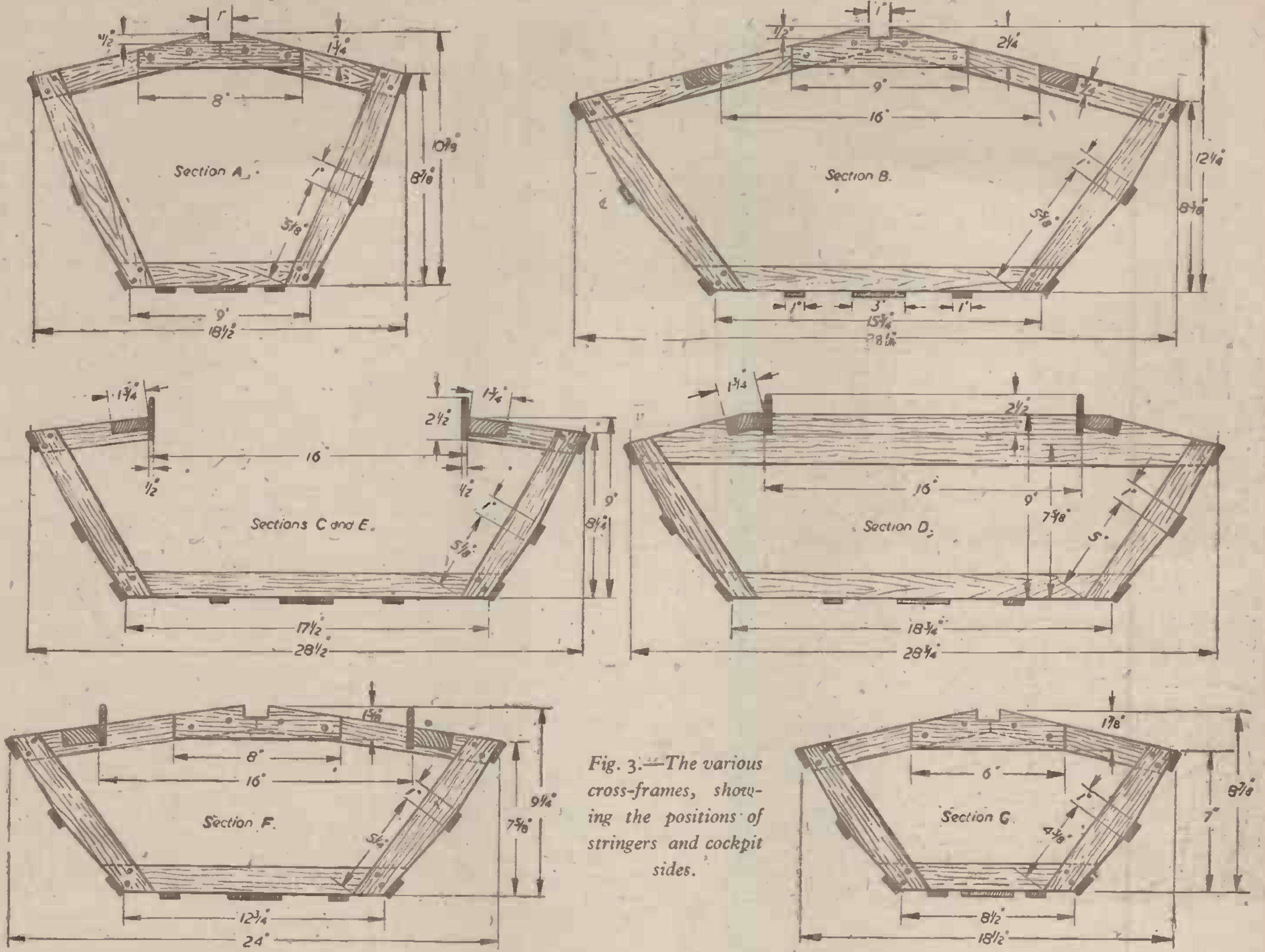


Fig. 3.—The various cross-frames, showing the positions of stringers and cockpit sides.

Making the Cross-frames.

First, the design of the frames, Figs. 3A-G, should be transferred in full size to some 30in. × 22in. sheets of drawing paper. The back of a roll of old wallpaper is a good substitute; packing paper may also be used. The pieces of wood for each frame are prepared to fit exactly the full scale plan. When ready, the top pieces are drilled and countersunk and screwed to the pieces below. The under strips should be drilled with a fine bradawl or drill to prevent their splitting. Before finally screwing together the corner joints should be glued with "Casco" waterproof glue prepared according to the instructions on the tin.

The two frames at the middle of the canoe are somewhat different to the remainder as they have to be flush on one side where they face each other at the joint of the two halves of the canoe. It should be noticed that the top and bottom strips are of ½in. timber, and the side members of 1in. timber (Fig. 4). If some plywood is available then these two frames can be covered on the flush side and additional rigidity will be obtained.

Stem and stern posts are prepared according to Fig. 5.

Assembly of Frames to the Keel

Carefully prepare the two keel strips to width, thickness and length. It is important that the strips should be straight in their entire length if the boat is to be balanced. Before assembling the frames and stem and stern pieces to the keel, gauge a centre-line down both sides of the keel. Then when the cross-frames are assembled, make sure that the centre of the frames are upon this centre-line.

The keel strips are screwed to the bottoms of the cross-frames and stem and stern posts at distances indicated in Fig. 6. Each frame is fixed with two 1¼in. No. 6 brass countersunk screws.

With the cross-frames secured to the frames, turn over the assembly and place the two parts end to end on a level floor and temporarily fix the keels to the floor with some screws. The two centre frames may be bolted together as they will be in the finished canoe. Coach bolts 2½in. × ¼in. are used. The cross-frames should be strutted temporarily in a vertical position.

Assembly of the Stringers

The stringers or side strips and deck strips must be prepared to size 1in. × ¼in. These should be free of knots, if possible and all edges should be slightly chamfered and glasspapered before assembly.

Start with the top edge stringers: screw

The canoe in an ideal setting.

This picture shows the sleek lines of the canoe which is due to the care taken with the covering canvas.

them to the centre cross-frames and work along to the stem and stern posts. Sight along these stringers as you proceed to ensure that the "line" of the canoe is smooth and regular.

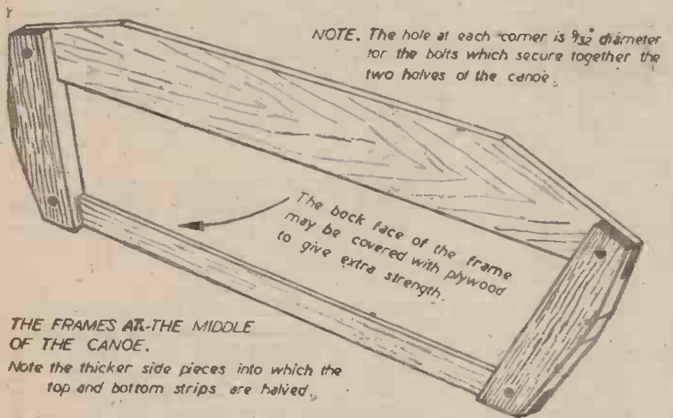


Fig. 4.—Details of the middle frames, showing the holes for the bolts.

Make any little adjustments as required. Where the stringers meet the stem and stern posts the ends will be trimmed to length, and bevelled on the inside, as in Fig. 7.

The second set of stringers are next screwed into place and then the two deck strips. The lowest set of stringers will be easier to fix when the canoe is removed from its temporary fixing to the floor.

Remove the strutting and screws through the keel to the floor and unbolt the two halves of the canoe. The cockpit sides should now be prepared, ¾in. × 1¾in., and secured in place (Fig. 6). Screw through the cross-frames into these pieces. A V-front may be arranged for the front cockpit, and also for the rear one if desired.

Turn the canoe over and fix the lowest set of stringers. Prepare the floor strips and screw them to the bottom of the cross-frames (Fig. 6). The ends of these should be chamfered to obviate any chaffing of the canvas covering.

Fill up the spaces between the stringers at the stem and stern posts and at the centre cross-frames (Figs. 7 and 8). Round off all the edges which will come in contact with the canvas covering.

The whole framework of the canoe can now be glasspapered down and given two coats of paint.

Covering

Various make-shift materials will have to be used to cover the canoe. Second-hand tarpaulin cloth may be used. It is very strong and already waterproofed. The disadvantage is that the width of material used is 36in., and this means a joint under water. If care is taken to get this joint along the keel strip, there should be no great difficulty in obtaining a good watertight joint as a skid-strip is screwed on later over the joint. The following covering instructions apply to the use of 60in. wide material and, of course, the only differences in its use is that it dispenses with the seam along the keel necessary with 36in. material.

The length of material required will be two lengths each 11ft. long, this allowing for the necessary folding at the ends of each section.

Folding the Canvas

Having obtained suitable material, turn one half of the boat upside down and support on some boxes. Fold the canvas in half lengthwise and crease a centre-line which should be along down the gauged centre-line of the keel. Start at one end and, allowing sufficient for folding at each end, secure the canvas along the centre-line. Keep the canvas stretched as tightly as possible. Put in copper tacks

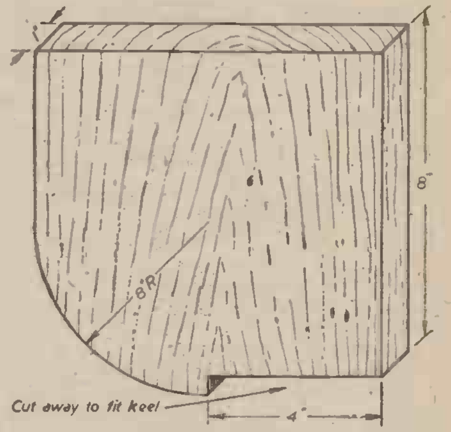


Fig. 5.—Dimensions for stem and stern post.

at 3in. apart. Do not drive the tacks home at first, as wrinkles appear from time to time later on, and tacks have to be withdrawn in order to smooth out the wrinkle.

The canoe section is then turned right

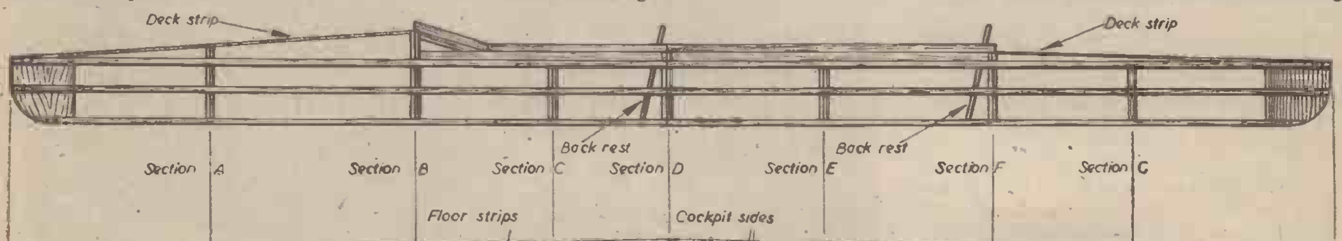


Fig. 6.—Side elevation of complete framework, and plan showing main keel strips and deck framework.

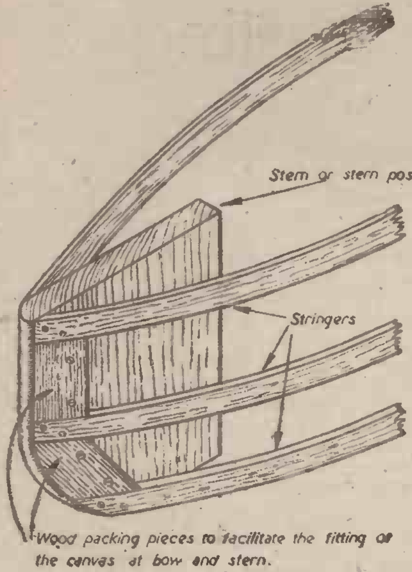


Fig. 7.—Method of securing stringers at the stem and stern posts.

way up and the canvas is stretched over the sides of the cockpit and secured.

A certain amount of trimming will be needed where the canvas meets on the centre deck strips. Allow about an inch overlap. Before these laps are finally tacked down, some thick paint must be brushed under the joint and then tacked down with tacks 1in. apart.

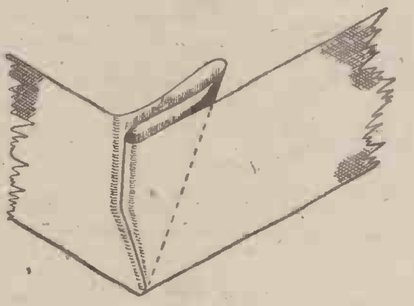


Fig. 10.—Folds of canvas at the corners of the middle frame.

The finish at the stem and stern and centre sections must be neatly folded and tacked down. On no account make cuts in the cloth (see Fig. 9). The folds at the centre amidships are similar to the packing of a parcel (Fig. 10).

If the material is wide enough, it is possible to cover the hull and deck with but one joint along the centre deck strip. Failing this, a separate deck covering will have to be made with the tacked joint along each gunwale.

Coaming Strips

When the covering canvas is in place the coaming strips of 2½in. × ½in. wood are secured around the inside of the cockpits. For additional strength it is advisable to fit corner blocks with glue and screws.

Seats

A simple seat and back rest may be constructed as suggested in Fig. 6. These are not vital necessities, but add to the appearance and comfort. The back rest can be hinged to the seat with 1in. back flap-hinges; the back will then fold down when not in use.

Rubbing Strips

A canvas covering will not stand dragging along the ground or over shoals in a shallow stream, so steps must be taken to preserve

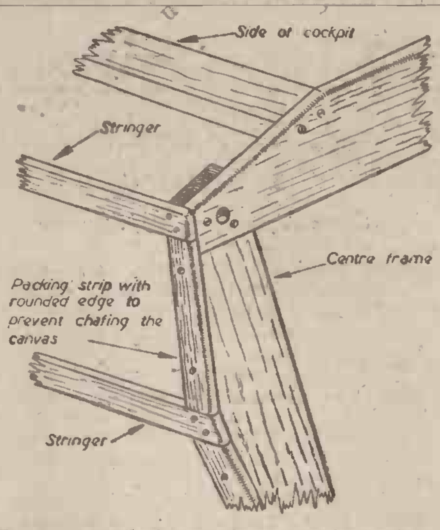


Fig. 8.—Detail of centre frame showing packing strips.

the canvas in likely wearing spots. Strips ¾in. × ¼in. are secured along each of the floor strips and the keel strips. This latter strip will be doubly useful in completing the waterproofing of the canvas joint if narrow canvas has been used. Before screwing down the strips apply a thick layer of thick paint to the canvas and the strip.

Two other rubbing strips are required—one on the top edge and bottom edges of the sides of the canoe. The top edge especially comes in for a lot of rubbing against landing stages and banks of streams.

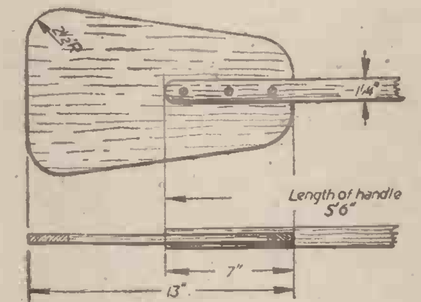


Fig. 11.—Details of construction of double-ended paddles.

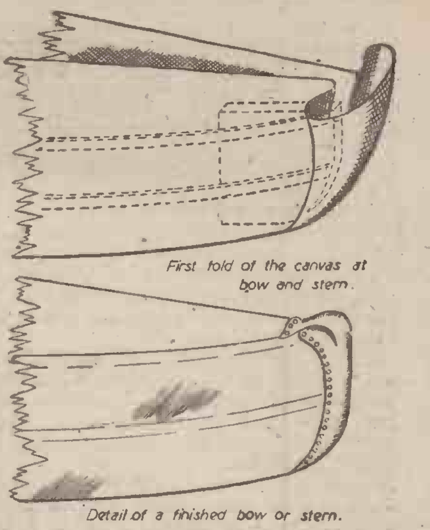


Fig. 9.—Method of folding the canvas at the bow and stern.

Finishing

The finishing of the canvas covering is important, as there should be no leakages when the canoe is afloat. Two or three thin coats of priming made with red lead and boiled linseed oil, with the addition of driers such as terebine, will form a good foundation, and will penetrate into the canvas. Allow each coat to dry thoroughly before the next is applied. Finally, two finishing coats of lead paint may be put on. A final coat of boat varnish would be admirable if obtainable. Do not be misled into using varnish for inside use, as this is useless under water.

Paddles

A pair of double-ended paddles will be required. There are various ways of making these. The expert can perhaps make the handles to take apart in the middle with a brass tube joint like a tent pole. The blades may also be shaped out like the blades used in rowing boats. This is a job for the expert carpenter. The simplest way for the amateur is to use a 1¼in. diameter broomstick about 5ft. 6in. long, and into each end slot a flat blade ⅜in. thick. The blades can be secured with waterproof glue and brass screws or bolts (Fig. 11). Finally, the blades, and part way up the handle to the point of holding, may be painted to match the hull of the canoe.

The two halves of the canoe strapped together and ready for transport.

High-power Short-circuit Testing–2

Testing Circuit, Making Circuit Breaker, Recording Apparatus

By S. STATON

(*Continued from page 272, May issue*)

IN the last article we considered the requirements of a circuit breaker under service conditions, and the consequent tests necessary to prove that a given breaker is capable of meeting all requirements.

This is the side of short-circuit testing that interests the purchaser.

There is another side of the subject, however, and that is the fact that short-circuit testing enables the design engineer to make close study and investigations of circuit breaker performance and behaviour under the severest conditions.

Up to the year 1937 there were no agreed tests specified, and a great lack of testing stations. The design engineer had to depend upon the results of a circuit breaker in service for any information to help him in new designs. In 1937, after several years of research and investigations by a special committee, a complete and comprehensive standards specification was issued by the British Standards Institution (BSS. 116/37), setting out the conditions for the testing and rating of oil circuit breakers. The specification had the good effect of compelling manufacturers of switchgear to set up proper testing stations to cover its requirements.

From these special testing stations, the designer has obtained an abundance of data, which has enabled him to design circuit breakers of greater ability than previously, and more in accord with the conditions met with in service.

From the foregoing it will be seen that there are two objects in short-circuit testing:

(1) To prove to the purchaser that a given design of breaker will meet all the requirements of the British Standards Specification No. 116/37.

(2) To enable the design engineer to make close study of circuit breaker performance under the worst possible conditions, arc interruption phenomena, arc control devices, various types of contacts, materials and speed of break, etc.

Testing Station

From what has been outlined on the subject of short-circuit testing, it will be apparent to the reader that most of the equipment that goes to make up a modern short-circuit testing station is special and very costly.

The first essential of a testing station is that it must be capable of reproducing all possible service conditions with the finest control and provision for recording all testing operations.

Equipment

The equipment falls under seven headings, as follows:

(1) Source of power.
(2) Testing circuit.
(3) Recording apparatus.
(4) Control and observation.
(5) Facilities for transport and handling of circuit breakers.
(6) Oil handling equipment.
(7) Safety first.

We shall consider these seven headings in some detail.

Source of Power

The actual power for short-circuit testing is obtained from an alternator which has to be specially designed and constructed for the purpose. In most instances single motor generator sets are used, power for the motor being obtained from the supply mains, although two similar smaller sets could be used to give the same power output as one large set. The alternator must be capable of withstanding the shocks due to continued short circuits and supplying short-circuit power for testing the largest of circuit breakers. Modern large circuit breakers are rated up to 1,500 or 2,000 m.v.a.

(The term m.v.a. is now used in preference to k.v.a., thus 1 m.v.a. = 1,000 k.v.a.)

Two thousand m.v.a. is therefore 2,000,000 k.v.a., which figure will give some idea of the machine required.

It is important to realise that the alternator would not be capable of delivering this power continuously, and it is usual practice to switch off the prime mover at the instant before the short circuit occurs. The stored up energy of the rotating mass of the alternator must be sufficient to provide this power for the duration of the short circuit at negligible drop in voltage.

An example will serve to clear the readers' mind on this point. A short-circuit test at 2,000,000 k.v.a., 0.30 power factor lasting 0.20 second takes—

$$\frac{2,000,000 \times 0.30 \times 0.20}{60 \times 60} = 33.3 \text{ k.w.h.s.}$$

from the generator.

The stator windings must be arranged so they can be connected in either star or delta. This is usually accomplished by means of a link board, tapings from the windings being brought out to the link board.

The windings must be of very low reactance value and mechanically strong. All tapings and links should be designed and constructed with the mechanical forces due to short-circuit currents well in view. The field circuit is controlled from the control room by means of a motor-operated rheostat giving coarse and fine control.

Testing Circuit

Fig. 4 shows the circuit diagram of a testing station designed for rapid change-over from

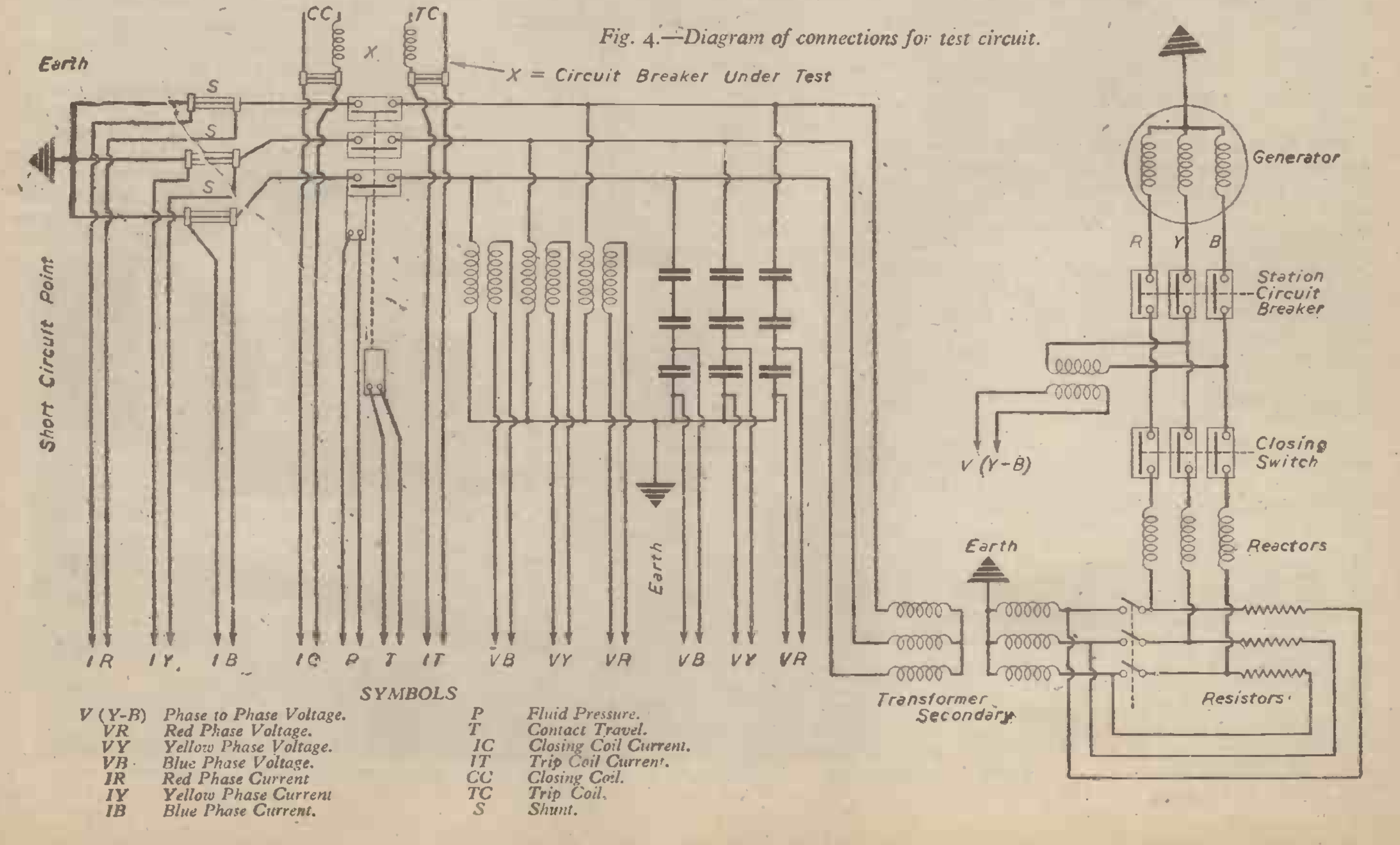


Fig. 4.—Diagram of connections for test circuit.

one set of conditions to another. Where possible, use is made of link boards and change-over isolators, which make for reliability and elimination of error, and, of course, rapid easy change-over of circuits. The circuit will be seen to comprise the following items:

(1) Station master breaker.
(2) "Making" circuit breaker.
(3) Reactors.
(4) Resistances.
(5) Transformers.
(6) Circuit breaker under test.
(7) Short-circuit point.
(8) Connections to recording equipment.

It will be interesting to consider these items separately.

Station Master Breaker

This breaker is provided to interrupt the short-circuit current if the breaker under test should fail. It is also used to interrupt the current for "make" tests and "short time" current carrying capacity tests. The breaker obviously has to be capable of dealing with the maximum short-circuit power from the generating plant, and since it is the protection for the generator, it must have frequent inspection and be carefully maintained.

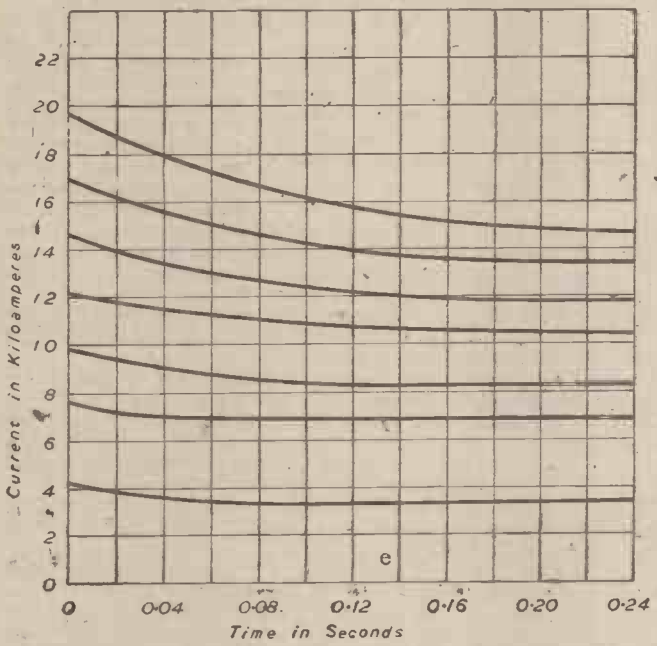


Fig. 5.—Curves showing decrement of current for various values of test circuit reactance.

Making Circuit Breaker

This circuit breaker is used for the purpose of "break" tests, in which the circuit breaker under test is not called upon to "make" the current. The short circuit is established by closing the making circuit breaker. It thus has to be capable of making and carrying the peak short-circuit current. The breaker may be air insulated if it is connected between the generator and transformers. Being connected in this way, its working voltage would be that of the generator, and only small clearances between the frame and "live" parts of the breaker would be necessary, thus permitting the breaker to be of reasonable size. It will be appreciated that, particularly from the maintenance point of view, it is very desirable to have an air breaker, which obviates the necessity of removing the oil tank to service the contacts. The closing coil must be sufficiently strong quickly to close the breaker against the opposing electro-magnetic forces set up under circuit conditions, and to give a high closing speed in order to prevent excessive burning of the contacts when making.

Reactors

The initial value of the short-circuit current depends upon the generator voltage and the impedance of the circuit between the generator and point of short circuit. In a short-circuit testing station a bank of reactors are used to vary the value of impedance for a given generator voltage, and so vary the value of the short-circuit current. A number of current time curves for various values of reactances with a given generator voltage is shown in Fig. 5.

In the previous article it was stated that short-circuit tests must be carried out at power factors of 0.15 and 0.30, which are, of course, very low.

The current limiting reactors must be specially designed with this in view. They must also be mechanically strong, and able to carry the short-circuit current without undue heating. Air core reactors are the most commonly used, and it is usual to make them sectionalised, so that series or parallel connection can be effected.

Tapings are taken out to an easily adjustable link board.

Resistances

Resistances are included in the testing circuit for two reasons:

(1) Power factor control.
(2) Control of decrement of D.C. component.

A separate bank of resistances is used for each, and are connected in series with the test circuit.

The power factor control resistances are used mainly for special tests where the power factor is to be higher than in B.S.S. 116/37; e.g., to test a breaker under normal load breaking conditions, in this case the power factor would be about 0.80.

It has been explained that if the short-circuit occurs at the instant of zero voltage the current wave is displaced with respect to the zero line, and the resulting curve split up into an A.C. and D.C. component. The D.C. component is dissipated in the circuit resistance, and therefore control of the decrement may be effected by varying the test circuit resistance. The resistances must be designed and arranged to operate within the specified power factor limits, viz., 0.15 and 0.30. Here again, as in the case of the alternator windings and reactors, link boards are used for easy and rapid change-over.

Transformers

Step up and step down transformers are included in the test circuit to make possible the testing of circuit breakers whose rated voltage falls outside the range of the generating plant. Circuit breakers vary in their rated voltage, between 440 volts and 132,000 volts. The combination of generator and transformers with their various methods of connection, viz., star, delta, series parallel make it possible to include any circuit breaker within this range. It is well known that the British electrical supply industry works with voltage values which are multiples of 11; these are as follows:

440 volts, 3,300 volts, 11,000 volts, 22,000 volts, 33,000 volts, 66,000 volts and 132,000 volts.

The test plant is therefore arranged to give these various values of voltage.

Circuit Breaker Under Test

The circuit breaker under test is connected between the generator and point of short circuit as shown in Fig. 4. Its closing and trip coils are connected to the control relay (explained later).

Short-circuit Point

The short-circuit point is merely a heavy copper shorting bar, firmly connected to each of the three-phase lines and solidly earthed. Connections to recording apparatus are taken from the main testing circuit, and will be described under the next heading.

Recording Apparatus

Short-circuit test records are taken by two types of oscillograph:

(1) electro-magnetic oscillograph,
(2) cathode ray oscillograph.

A restriking voltage indicator is used for measuring the high-frequency restriking transient voltage characteristics of the test circuit and circuit breaker combined.

The electro-magnetic oscillograph must be capable of recording the following values:

(1) Phase to phase volts.
(2) Red phase current.
(3) Red phase volts to neutral.
(4) Red phase watts.
(5) Yellow phase volts to neutral.
(6) Yellow phase current.
(7) Yellow phase watts.
(8) Blue phase current.
(9) Blue phase volts to neutral.
(10) Blue phase watts.
(11) Fluid pressure.
(12) Contact travel.
(13) Closing coil current.
(14) Trip coil current.
(15) 50-cycle timing wave.

All the above quantities are recorded on a film which moves along during the exposure. The width of the film varies according to the design of the electro-magnetic oscillograph, but a typical width is 12in., while the average length of film exposed for a normal short-circuit test on a circuit breaker is approximately 12in. again. A normal short-circuit test takes approximately 0.20 to 0.25 second, which gives a film speed of approximately 5ft. per second. Actual electro-magnetic oscillograph records illustrating how all the above quantities appear on a film will be shown and described in a later article.

Fig. 4 shows how all the connections are made to the test circuit for the purposes of recording.

(To be continued.)

Hands Off Inventors!

The Case Against Government Control of Invention

By Prof. A. M. LOW

IF Parliament continues to muddle research with invention, I think we stand a very good chance of wrecking the most important industry in the country. Inventors must be encouraged by freedom, and if we continue wartime plans for the examination of inventions into peace, it will prove more damaging to enterprise than any other form of control.

It may be argued that some final authority is essential during war, when only one main object is in mind. But how can regimented research assist the art of invention? Imagine a Government bureau for the production of pictures, music, or books, without any other competition at all—does any sane person believe that good or lasting results would be produced?

Professor A. M. Low is president of the Institute of Patentees. He demonstrated a method of television before the Institute of Automobile Engineers in 1914. Inventor and patentee of the first Queen Bee built by the R.F.C. in 1915-16. He was also responsible for contact eye-glasses, the audiometer for the photography of sound, and a system of anti-aircraft rocket control in 1916. In 1940 he designed a method for using rockets from aircraft. Author of "The Future," "Benefits of War," etc., etc.

Invention is not a science but an art. In normal times the failures, hopes, and months of patient research were supported by those who had the courage or capital to back the inventor-artist until the masses could learn the value of the new ideas.

To-day, a totally different set of conditions apply. There is only one firm. No competition, and no appeal against a committee whose sanction is required before material, models and tests are possible.

As a country, we produced the telephone, locomotive, the turbine, electric motors, the telegraph, and innumerable inventions that have benefited the whole world. All these epoch-marking discoveries were laughed to scorn by experts and by the same type of committee which might now be set up to "direct" originality. The same committee, perhaps, which decided in its time that tanks, high-explosives, machine-guns, aeroplanes and steam-driven ships were all useless for naval or military purposes.

Before the war, an inventor could work out details, find useful applications and ask manufacturers to help him. He had one year before the expense of a full patent became necessary, and his provisional application was quite secret. No one could see it upon any pretext.

Government Departments

Now what happens? This first application goes automatically to the various Government departments who know exactly what modifications are wanted, and have all the data of other similar patents before them. They can discuss the plan with manufacturers, make tests and even take out patents themselves to fit the precise requirements which only they can know. "Officials" then state what will be permitted to be made!

The real originator, as distinct from the adaptor, has no chance at all. It is totalitarianism run riot and certainly not to the good of a country which must originate or lose every trade advantage. We cannot compete in mere production, and if we are warned to guard against the loss of freedom for small firms, the Press, and of personal opinion, we should be twenty times more careful in the matter of patents. England is far too small to compete in quantities and although we cannot live by acting as agents for other people's brains, we have led the world for centuries in terms of original design.

If we now inherit a legacy of Government control over invention, and if the authorities are to control and restrict originality, it must have consequences from which trade will never recover. Parliament will soon consider amendments in patent law. To-day the Patent Office makes a large profit out of inventors who work on a totally different footing from major industrial concerns. Inventors are not often rich, and a modern empire patent can easily cost £1,000.

To subject the inventor to control and to kill his humble "back-of-an-envelope" plans by putting him at the mercy of academic pooh-bahs, is as childish as expecting the painter of a masterpiece to conform to mathematical law. It is typical of the bureaucratic mind which will soon become our main enemy, and we have already heard that taxation may be relieved for large research organisations without a thought for the man upon whose genius so much repetitive "research" is dependent.

Reconstruction

We have always been told that reconstruction is so vital. New buildings, new materials, and new tools. True, war has developed many of these desirable things, but what is happening to the novelties of 1946? Very little that is useful. If you chance to own a factory, so long as this is permitted, you might kindly be allowed to try a few experiments, always by permission of a Ministry commission. If you happen to be serving with the Forces, an idea cannot be patented without sanction, and unless that document is backed on a high level your chances are very slim indeed.

Parliament is discussing science and industry for the first time, and this is all to the good for they may have learned from war what the country has known for a quarter of a century. But if their final policy stops at grants to Government-supported institutions, or begins by taking control of private enterprise, they are doing little more than imitate the early phase of the Nazi régime.

Remember that your prosperity, health, comfort and the future of national industry depend entirely upon unrestricted invention, and then ask yourself if it is enough to say: "Queer people, inventors; I don't suppose they get much out of it and they are not interested in business." It would be well if they were, for until technical men concern themselves with the management of the new world of which we hear so much there is very little hope of progress. It still occasions little surprise that problems of coal, electricity and aviation should be controlled by lawyers or commercial experts who change their departments as if they were breaking their golf routine with a little tennis.

I read that in the building organisation set up by the authorities it is often necessary for permits to be obtained from about seven different Ministries before work can be begun. This is called organisation, a mysterious trade of which mastery seems to be claimed by those who have been unsuccessful in any other employment. Organisation is creeping into our scientific training most insidiously. It will soon compare very accurately with the only bad part of German science.

Psychology and Economics

Bureaucracy may not like to hear the truth, but the public should realise that the complication of existing data does not constitute knowledge. Excellent examples are the so-called sciences of psychology and economics. It does not help us to understanding of the mind to use Latin phraseology or to learn parrot-like sentences from a textbook. Yet anyone who knows a few leading publications on these subjects by heart could easily qualify with distinction. It was Shaw, I think, who once pointed out that the highest surgical degrees can sometimes be obtained by those who have never conducted an operation. Before long we shall "queue up," listlessly, to be docketed by a regimented medical profession.

In economics the position is even more amusing. If A sells halfpenny buns to B for one penny the fact is easy to grasp, but the economist will express the transaction in symbols and indulge in pages of useless mathematics that are taken to represent a degree of learning which is quite worthless, and which a machine could encompass far better.

This is the type of mind that is now being applied to the control of invention. Curves, statistics and formulæ usually appear after and not before great discoveries. Research is something that cannot be taught, and it is noteworthy that most great inventors in the past have been amateurs, and have not arisen from the official bureau into which our lives are now steadily passing.

We all know to-day that industry, from factory to shop, is very casual in its attitude to the public. Even laundries are not enthusiastic; it is a byword that the customer is a suppliant, for the good reason that competition is missing. While orders can be obtained without difficulty from the perfect client—the Government—manufacturers are not going to trouble. There is no urge to seek novelty or to attract trade. There is no *need*.

Shorn of initiative, why investigate any invention when profits are taken with one hand and subsidies paid with the other? The Treasury now proposes a Bill in which invention sales are to be taxed as income. Sell a patent for £500 and £250 is paid to the State. Gamble on the Stock Exchange in share holdings and if your capital appreciates by £10,000 overnight not one penny of tax is deducted. It is a mad manner in which to encourage the only true source of new business. Surely it is better to create home employment than to accumulate dividends abroad which will not greatly help those who have made the country's credit secure?

A good example seems to be that of magnesium from the sea, upon which millions were spent on factory plant. The works, we are now told, are closed. Metal from abroad is doubtless obtainable. Does this help the unhappy inventor to pay his fees or to obtain recompense for his labour? And when peace comes are all our factories likely to be more busy if new inventions are neglected during the changeover? If more business is not ready, why should more jobs be vacant when the vast munition output dwindles to a stream?

German Technical Development

How different in the United States of America! We have seen Germany first in the field with rockets, robots, radio-gliders, trailer bombs, heavy tank armament, jet fighters, magnetic mines, acoustic mines, injection engines and many other good things. No wonder that a leading aeronautical expert has said that above all we must find out about German technical development. We have allowed them about 72 years' scientific advance, but it sounds very humiliating for England!

In America they are not only making experimental progress—war research has advanced technical affairs by 20 years and has given us countless benefits, such as electronics, more efficient lighting and radio, better cars and new materials—but are preparing to supply at this very moment. Our reply so far is to prevent the export of machinery to the Argentine, to state that in three years television improvements may be available and to institute a tax for cars which renders the larger type, so essential to export, quite hopeless as far as home manufacture is concerned. America is designing cars to run on high octane fuel. If inventors are muzzled, our victory models will be 1939 chassis painted a different colour.

When I read the U.S.A. science papers on radio, plastics and chemistry I feel as if I was sitting in Noah's Ark watching the Queen Mary. We demand exports so that England may live and then crush inventors who make progress possible until they go abroad in despair. The export of inventions is worse than that of a few ounces of gold and the latter is now a crime. Instances are by no means lacking. "No materials"—"wait and see"—"permits are needed"—"there is no labour"—and a colossal tax on the poor goose that made the eggs possible as well as a series of ruinous fees.

The Magneto

Scientific invention gave England the magneto, but in 1914 it was imported. In 1945 our strategists are saying that the weapons of to-day must be banned so that war in 20 years' time cannot take place. We seem not to grasp the fact that modern knowledge will only help manufacturers of bows and arrows by the time the next war is ready. We have begun to import houses (without baths) made of steel, wood, aluminium, brick—there are so many bricks already that manufacture has virtually ceased—but no one cares, and the many inventors that could give comfort are no doubt receiving attention "through the usual channels."

The United States Navy recently published a list of what is wanted so that the whole country could contribute. No attempt to mobilise inventors has been made in England. Many of the best brains have not even been informed as to the problems which are being tackled by hidebound departments in the midst of busily "passing minutes." In America young people go to free laboratories to make experiments with promising ideas.

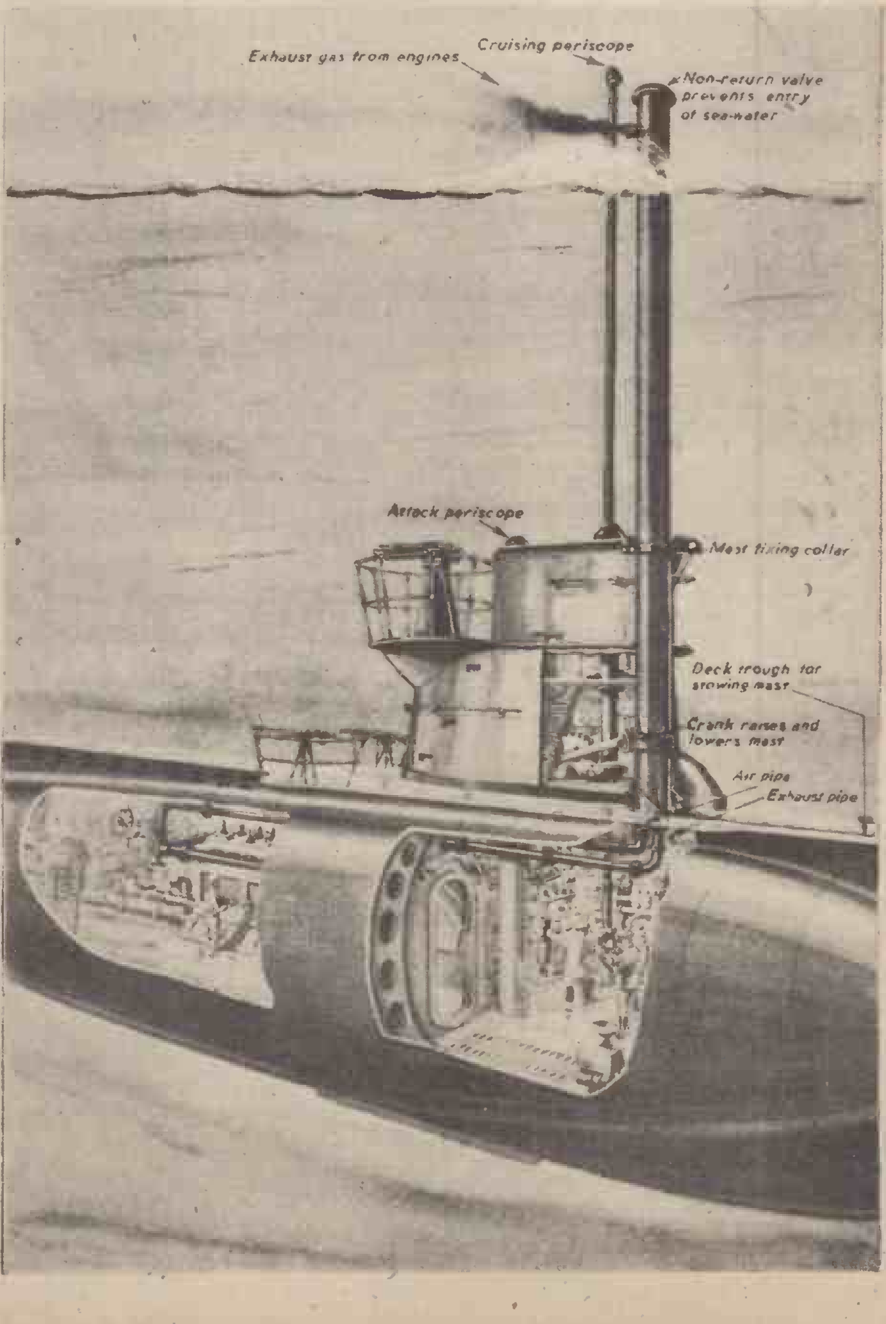
Baulked by Prejudice

It is sad when we think what a better place this earth could be if the inventor was not baulked by prejudice. I shall be asked, no doubt, who is to pay for all these fine things which the sacrifices of war have made possible. "Do not be so foolish," say the authorities, "as to imagine that if the money can be spent on war it can also be spent on peace." Why not? In the years before the war our expenditure on invention and research was negligible. Is the reason for our parsimony that the world's gold is buried in a hole into which no one has looked? One of our greatest economists showed his knowledge of the situation at the outbreak of war by explaining that Germany could not fight for more than a few months owing to their lack of capital. I have often wanted to ask whether British credit has been so poor that we were likely to run short of Typhoons at any moment if subscriptions did not reach the required mark. Another question which even inventors have begun to ask, is why does war credit necessarily stop with war, and, if so, how is the exact point decided when suddenly further credit will produce ruin, inflation and chaos?

I merely throw out these questions in the hope that the opinions of others may be obtained, but I will conclude by a final warning. If we think that production of 1939 goods under a new guise will help us to compete in any way with countries who will exploit the scientific advances of wartime to the utmost limit, we are asking for trouble which no amount of organising, and not even our famous economists can hope to remedy.

Schnorkel System for Submarines

To avoid the increasing punishment from our naval aircraft, German submarines were forced under water for long periods. This ingenious system enable them to use their heavy diesel engines whilst under water by allowing the exhaust gas to exit via the long mast protruding above the surface, as shown in the accompanying illustration. A second pipe in the mast permits the intake of air for recharging the air bottles. The fresh air is also essential for replacing that which became foul after a period of immersion. The compressed air is used for blowing water from the ballast tanks when it is desired to rise to the surface. Air is also necessary for recharging the electric batteries which provide power and light when in deep water. A specially long periscope is used with the mast. It is claimed that the submarine could remain under water for 20 to 30 days.



Making Model Railway Track

Tinplate Construction for "00" Gauge Electric Rails

By T. HADFIELD

(*Concluded from page 273, May issue.*)

As the gauge for these rails is only $\frac{5}{8}$in., it may seem too small for the amateur to attempt to make spare lines or points with any success. I will therefore describe how I made some spare track, including curves, straights, and points for a "OO" gauge electric railway.

To obtain the sheet tin for the rail section I used old tin cans in the same way as in making the "O" gauge lines described in the April issue. The average can will give a straight piece from the sides about $4\frac{1}{2}$in. by 9in., and this will make about six pieces, or two lengths of electric rail.

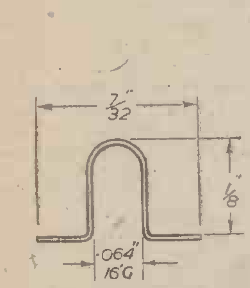


Fig. 1.—Simple rail section.

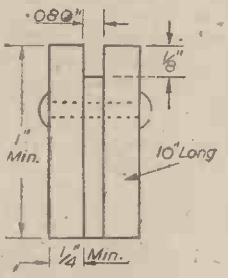
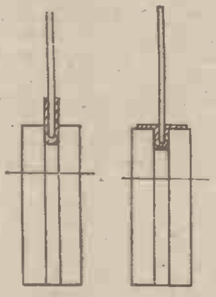


Fig. 5.—Forming block.



Figs. 6 and 7.—Method of forming the rail.

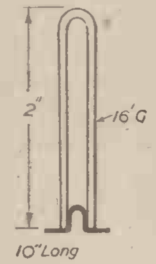


Fig. 8.—Simple cutting gauge.

Bending the Plate

The bending tools will be different from those already described and will be simpler to make, as the rail section is only of a simple form, as in the end view, Fig. 1. The preliminary bend is made with a hand folding tool, as shown in Fig. 2, and is about 10in. long.

The piece of plate is trimmed on one long edge with the snips, and this edge is slipped into the bender to the stop pins. If the tin plate is pressed down on the bench, and the bender turned over as in Fig. 3, a straight and neat fold is made, like Fig. 4, in end view, and this is then cut at the mark shown. This bend can be repeated with the remainder of the piece of tin plate, and several pieces made ready for the second operation.

Take a piece of 16 gauge M.S. about 3in. wide by 10in. long and see that this is quite straight and not twisted. True up one edge and file to a radius. Then slip it into the strips already bent and hammer the strips flat on a steel block, using only wood or hide mallets, but be gentle with the tin plate and don't distort or unduly hammer it.

The forming block, Fig. 5, is now made and sides may be made from any section of M.S. bar, the only dimensions that are important are $\frac{1}{8}$in. and .080in. or 14 gauge plate. If you have difficulty in obtaining this plate you can build it up with, say, 16 gauge and two pieces of tin plate, which will make .08$\frac{1}{4}$in., and this will be quite satisfactory.

See that the top edges of the inserted plates are quite straight and the $\frac{1}{8}$in. dimension is maintained at each end, and also that the top edges of the side plates are filed straight and smooth. These plates can then be drilled and riveted up with four or five rivets, or bolts may be used. This forming block is now held in a vice and the formed tin plate is fitted in the slot. The 3in. strip already made is driven between the tin plate to the bottom of the slot with a mallet, as shown in Fig. 6. The exposed edge of the tin plate is then opened out and pressed down over the edge of the side pieces of the former and hammered flat with a piece of hard wood, and should look like Fig. 7.

The formed rail can then be removed from the former and only requires trimming on the edge to the required width with snips. With the ordinary snips the formed rail may be twisted and distorted in cutting, but this will not matter so long as an even width of 7/32in. is maintained.

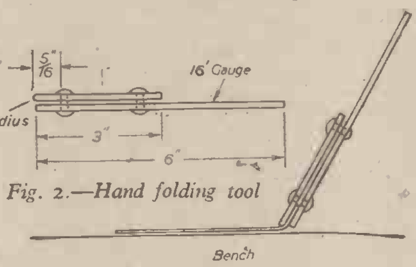


Fig. 2.—Hand folding tool

Fig. 3.—Method of bending the tinplate.

Fig. 4.—The folded tin plate before cutting.

It should then be tapped in the former with the 3in. strip, and the base of the rail straightened with the hard wood block as before. There are some special snips on the market which can be used to trim these edges, and are an American make called in the works "Gilbows," but if one has access to a bench guillotine or shears, this is the best. I used a bench guillotine, and made a simple gauge to guide the cut. This guide is shown in end view in Fig. 8 and is made of 16 gauge M.S. plate. The edges where the rail fits in tight is filed straight, and if this guide plate is held flat against the top blade of the shear, a true cut will be given to the formed rail, and any twist or distortion is prevented. This gauge can also be used with the hand shears.

Curved Rails

The rails for the curves are first formed and trimmed in the straight pieces and bent afterwards to the curves. The radius of the curves for the Trix is $13\frac{1}{2}$in. and if of any other make, the tools can be adapted to the particular radius.

For the bending of the formed rails another former and 3in. strip will be required, similar to Fig. 5, but the side plates are bent to the curve of the rails. Although the radius of the outside and inside rails varies slightly, they can be adjusted when assembling and all can be formed in the same bent former.

The straight formed rails are bent by hand, using the 3in. bent strip as a guide, and springing the rails on the edge of this strip. In this bending the flat flanges will distort so the strip and rail are tapped into the bent former, and the flat flanges straightened with a hard wood block and mallet to set them again. The formed rails can be easily cut by filing a deep nick in the top edge when it will break on bending.

Having formed the rails, the next job is assembly. As this is for an electric set, the two outer and the centre rails must *all* be insulated from each other. In the Trix set the rails are mounted on moulded bakelite bases, but for our own make we shall have to use wood, and this will be quite satisfactory, and if in plywood and stained black afterwards, it should look quite well.

The plywood will be required $\frac{3}{8}$in. thick to match the Trix, and the formed rails fastened by means of small nails through the edge of the flat base of the rails, small holes being punched for them.

To save a lot of joints which are always a source of trouble, the plywood can be in larger pieces than for a single length of rail, and then we can quickly make up any set formation.

To join the formed rails $\frac{1}{16}$in. diameter brass wire pins are used, and these are soldered to one side, the amount protruding being $\frac{3}{8}$in., and pointed to fit the other rail

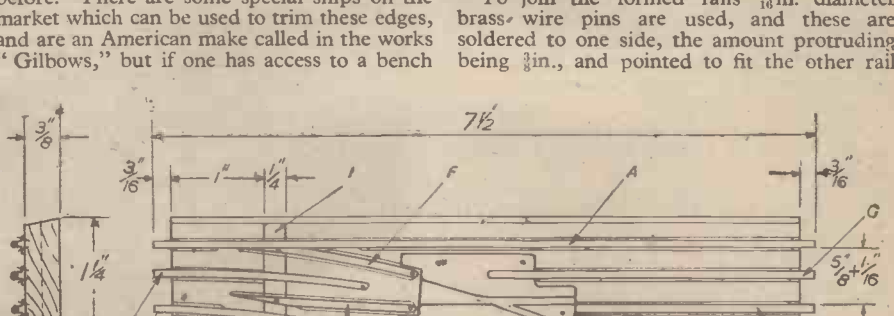


Fig. 9.—Layout for right-hand points.

it is coupling with. In soldering these pins, see that they are pressed into the top of the round part, and as an extra precaution the rails can be pinched with a small pair of round nose pliers under the pins to keep them in place, and this also applies to the rail it is coupling with.

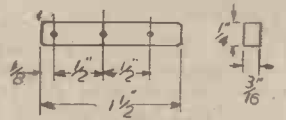


Fig. 10.—(Above) Tie plate for points.

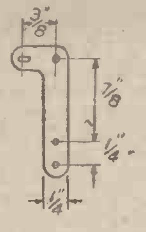


Fig. 12. — (Right) Point operating crank.

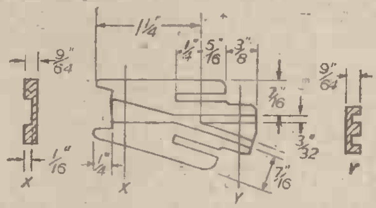


Fig. 11.—Insulating junction plate.

Points

With regard to points, a simple type is shown in detail in Fig. 9, which is to scale, and for the opposite hand all details can be reversed.

As I have already mentioned the Trix sets, before we commence making any points I had better explain fully the working and electrical connection of the rails, so that we shall not make any mistake. In the Trix the two outer rails are independently connected up to the two controllers, with the centre rail as a common return. This means that if two trains are on the lines at the same time, one will pick up current from one rail and the other from the other rail, so that each side can be made to operate each train separately, either backwards or forwards, or stopped separately. This means that the left-hand rails at the points must be coupled together, and the right-hand rails coupled together, so on no account must the right-hand rail touch the left-hand rail, but the centre rail must be in continuous connection and insulated from the other rails. This means that plates 1 and 2, which are in contact with all rails, must be of some insulating material. Another very important point with this system, it is not possible to lay out any formation of a figure eight, or fit any sets of points where the trains will cross over and reverse the direction, as you will see that the right-hand rail will then become connected to the left-hand rail, so that if we wish for this formation we must insert some insulating rail to prevent this cross connection.

With regard to the construction, I will take it in easy stages, so that although it may look difficult, we shall find it simple, but great care must be used as it is so small.

We will start with the wood base, and the dimensions are shown in Fig. 9, which is to scale. Mark out the position of the rails and cut the groove for plate 1 (Fig. 10) $\frac{3}{16}$in. deep and easy slide fit.

The rails A and D can now be cut to length, D being bent in the former to the standard curve. The flat portion on the inside of the rails A and D, where the movable rails E and F will fit, must be cut away so that E and F will fit close up.

Rails A and D can now be placed in position and nailed down through the flat edges into the wood base board.

Plate 2 is shown in detail in Fig. 11, and this must be made of insulating material, as already explained. The best and toughest material is bakelised fabric called under the trade names of Micarta, Tufnol, etc., but fibre, or even hard wood, will be satisfactory and must be carefully cut, and not split. Drill it with fine drills and either screw or nail down to the base in the position shown, and as the wheels will run on this, the gauge of $\frac{5}{8}$in. must be maintained. It is as well to make a simple gauge to check these rails when fitting on the base.

The rails C and B can now be cut and fitted in position, C being curved and B straight.

The moving rails E and F can now be made, and Fig. 13 shows how the end is cut to fit against the fixed rails. There is a piece of $\frac{1}{16}$in. wire soldered inside as shown, the long end fitting through a $\frac{1}{16}$in. hole in the base, and the short end fitting in a hole in plate 1. I have not given the lengths of this wire as it can be determined on assembly, the hole in the base being drilled to suit, but see that the ends of rail are a neat fit in plate 2, so that the wheels will not jump. The fitting of these movable rails is most important, and the fit of the tongue ends to the fixed rails will govern the efficient working of the points, so spend a little time on these and don't be afraid if several are scrapped in the first attempt. We can now try a truck round the lines to see if there is any tendency to jump, and any defect can then be put right.

Centre Rails

The centre rails can now be fitted and nailed, G and H fitting into the slots in plate 2. Rail J will require the side flanges of the rails cut off to clear the moving rails E and F. A $\frac{1}{16}$in. pin can be soldered into this

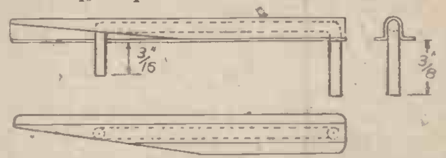


Fig. 13.—Method of joining the tongue of the moving rails.

end and fitted into a $\frac{1}{16}$in. hole in the base to fix this end, the other end being nailed through the flanges.

The operating crank 3 (Fig. 12) can be made from 16 gauge brass and fitted to work plate 1. All the ends of the rails can be filed square with a fine file, and connecting pins fitted and soldered in as required, for coupling up as already described.

For the electric connections, C and A must be coupled together, B and D coupled together, and G, H and J centre rails all connected for a common return.

Take care that C and B are not touching at the ends where they meet plate 2.

The Glider Pilot

LESS than four years ago the Glider Pilot Regiment was the unwanted baby of the Army, dumped from doorstep to doorstep of the Service Ministries.

To-day, as a single unit, it is probably the most potent fighting weapon at the disposal of the Supreme Command. A glider pilot is a volunteer. Nine times out of ten, he is already a trained soldier coming from almost any one of the fighting regiments of the British Army. He is selected for mental as well as exceptional physical qualifications; also for his capacity to accept discipline on its austerest (not its harshest) level.

The "Total" Soldier

The Glider Pilot Regiment sets out to make him into a "total" soldier.

The glider pilot, whatever weapons he knew, learns them all over again. Then he learns more weapons, till he can handle everything from a medium field gun to a pistol. He learns to drive every kind of vehicle from a tank to a motor-cycle.

Then he goes with the R.A.F. and learns a great part of their job. He flies power-driven aircraft, and from that goes on to every kind of glider. When he is not flying, he learns signalling and navigation.

After he has got his wings, knows his weapons, and has finished his battle training, the Regiment has still not finished with him. It sends him off on so-called "initiative" tests. It sticks half-a-crown in his pocket and sends him out on tasks that he can only see through by his wits. He is on his honour not to spend more than the half-crown carrying out the task, though the journey may take him to Land's End. He must do nothing illegal, must fulfil his task within a given time, and give a full report on his return to camp.

Out of such training the British glider pilot has been born, a new kind of man who lives a sort of three-dimensional life as a soldier; soldier and airman too.

A Locust tank from a Hamilcar manned in two minutes by men from the glider seen in the background on the left.

Inventions of Interest

By "Dynamo"

Pre-built Roads

PRE-FABRICATED houses are in the limelight. We may now have pre-fabricated roads, if an invention submitted to the British Patent Office is adopted by our surveyors. This new method of construction relates particularly to concrete roads.

The great disadvantage of concrete roadways and other similar surfaces is that when laid in the customary manner a considerable time is required for the setting of the concrete. The surface cannot be used for from ten days to three weeks, or even a month. Climatic conditions determine the length of time.

Furthermore, the ingredients for the concrete and machines for mixing it have to be transported to the site. And, as the laying of the road progresses, the mixed concrete has to be carried some distance upon a specially made track to the point of laying, as it cannot be moved over the freshly laid concrete.

The new method is designed to overcome these disadvantages. Broadly described, it is the making of a roadway or other surface from pre-cast elongated slabs arranged in laminated formation. The major axes of the slabs in each layer lie parallel and are inclined to the edges of the roadway. And these major axes in adjacent layers lie at an angle approximately of 90 deg. to each other.

The invention is applicable also to the rapid construction of factory floors, either temporary or permanent, and these floors can be immediately used.

Improved Gas Mask

A GAS mask which will enable the voice of the wearer to be heard has made its advent. It also affords low resistance to breathing without detracting from the protective efficacy of the respirator.

The mask has a diaphragm for speech and an expiratory valve with separate concentric paths for the sound of the voice and for the expired air.

Further objects of the device are cheaper production and easy replacement or renewal of parts. And the diaphragm and its mounting are removable.

Light on Callers

ACCORDING to a contrivance for which an application for a patent in this country has been made, when a person approaches a door and pushes the button which causes the bell to sound, an illuminating means is also made to function. Consequently the inhabitant of the house can inspect the caller before opening the door.

The electric push switch has a second contact which produces the illumination and has a delayed action. As a result, the light is maintained for some time after the bell has ceased to sound.

Improved Saucepan

TO enhance the heating efficiency of saucepans and other cooking utensils is the purpose of an invention for which an application for a patent has been made to the British Patent Office. The utensil has a metallic heat conducting bottom and side walls of heat insulating material. The walls are united with the bottom by a metallic lining extending to the metallic bottom of the vessel.

The heat insulating material may be of any suitable incombustible nature, a composition such as asbestos cement being preferred. The metallic part of the utensil can consist of the customary kind of metal employed in making cooking vessels, provided it is a good heat conductor and does not contaminate food.

A feature of the device consists in covering the exterior surface of the utensil, excepting the bottom, with a vitreous enamel or similar layer. When intended for use on open-flame burners, the whole exterior of the utensil may be so covered.

The information on this page is specially supplied to "Practical Mechanics" by Messrs. Hughes & Young, Patent Agents, of 7, Stone Buildings, Lincoln's Inn, London, W.C.2, who will be pleased to send free to readers mentioning this paper a copy of their handbook, "How to Patent an Invention."

Roof and Wall Covering

IN view of the coming activity in building operations after the war, suggested improvements in the construction of houses are worthy of consideration. A new roof and wall covering is the subject of an application for a patent in this country. It comprises individual units of some length which do not incorporate lap or other jointing. These units are adapted for fixing at any angular position from vertical to horizontal. And there is provided a watertight covering no matter at what angle the units are located.

Further objects are a covering simple and inexpensive to manufacture and assemble and which will permit any desired finish to be applied to it.

The invention comprises a number or series of sheet-like tiles placed side by side or edge to edge or both upon a roof or wall. It is characterised by the fact that each pair of adjacent tile sides or edges is covered by a one-piece cap anchored to and supported at intervals along its length by bridge pieces. These pieces are fixed to the roof or wall and the adjacent tile sides or edges are clamped between the cap and bridge pieces.

New Building Device

ANOTHER invention relating to building construction consists of a new method of erecting houses of two or more storeys. The construction includes first preparing a foundation. On this are erected columns supporting horizontal shuttering at or near the top of the columns. Concrete is then poured on the shuttering to form the reinforced concrete roof.

After this the shuttering is lowered as a unit to support the concrete for each of the reinforced concrete floors in turn. The walls, doors, windows and partitions are finally erected between the floors and the top flooring and roof.

For Motor Boats

BOAT propelling is the subject of an invention for which an application for a patent in this country has been made. The device is intended chiefly for high-speed craft such as motor torpedo boats having the rudder or rudders entirely beneath the bottom of the vessel.

The aim of the inventor has been to provide effective silencing of the engine exhaust and at the same time to utilise at the rudder the energy remaining in the exhaust gases in order to assist in the propulsion and steering of a boat. And a further object is, by the suction caused by the flow of water past apertures in the trailing edge of the rudder, to decrease the back pressure in the exhaust gases. By this means the overall efficiency of the power unit is increased.

The exhaust engine gases are conveyed into the rudder, the rudder blade being made hollow, and with delivery apertures in its trailing edge for the under-water discharge of the gases.

The gases are delivered astern through the above-mentioned apertures, so that by their momentum they assist the propulsion when the rudder is in the neutral position, and help the steering action of the rudder when the latter is angled for port or starboard steering.

A Sikorsky two-seater helicopter pauses to discharge a passenger.

Masters of Mechanics–103

John Dollond

The Inventive Instrument-maker and Pioneer of Achromatism

ACHROMATISM is the condition of being "achromatic."

The term "achromatic" is an optical one. It is applied to lenses of all varieties to denote that they produce images which are free from colour defects.

If we look at an object through a cheap magnifying glass we shall at once notice that the appearance of the object is marred and distorted by the presence of coloured fringes around it, particularly at the boundaries of the field of view. Such a lens is said to suffer from "chromatic aberration" (Greek: *Chroma*, "colour"), but a lens which has been specially corrected and does not produce such colour-fringed images is said to be "achromatic" (Greek: *a*, "without").

The reason why an ordinary single lens or magnifying glass fails to give an achromatic or "without-colour" image is because the various coloured components of white light are refracted or bent by the lens in varying degrees. White light, as we know, is composed of the seven spectral colours. But if rays of white light are directed through a single lens or a magnifying glass, the lens bends or refracts the green light in a different degree than it does a blue light. The blue light rays are diffracted differently from the red rays, and so on. Hence, the lens produces a more or less blurred image which is "contaminated" with unwanted spectral colours.

Now, in the early days of telescope design and construction, this inherent chromatic aberration of the single lenses then used

The single-lens microscope as it existed before its improvement by John Dollond. The instrument shown in the illustration was made about 1720, and is constructed from a cardboard tube and a wooden framework.

proved itself to be a technical bugbear of the greatest degree. You could not get a decent image of a planet or other heavenly body because, often enough, the image in the telescope eyepiece was fringed and distorted with colour bands and "rainbow effects." What was worse, the opticians and telescope

John Dollond.

constructors of the period believed that the trouble was incurable. They based their belief on technical grounds, the nature of which there is, perhaps, no necessity for us to enter into here. Even the great Newton held such views, and, indeed, he even went so far as to "prove" his contentions in this direction. Hence, when Sir Isaac Newton has declared that a thing was utterly impossible there were few who would ever wish to question him.

Refracting and Reflecting Telescopes

For this reason, therefore, opticians more or less gave up the idea of constructing larger and more improved "refracting" telescopes, as the instruments embodying lenses are termed. Instead, they concentrated on the development of "reflecting" telescopes, which latter are instruments containing a highly polished mirror specially ground to an exact degree of curvature. This mirror was fitted to the bottom of a wide telescope tube and the observer looked at the mirror reflection of the stars and planets by means of a specially designed eyepiece.

Such was the position of affairs in the scientific world when John Dollond was born at Spitalfields, London, on June 10th, 1706. The worthy Newton was still living vigorously, and had received his knighthood from the hands of Queen Anne in the previous year. But it is not very likely that the Dollond family cared much about Newton's theories at that time, even if they had ever heard mention of them, for Dollond's parents were Huguenots or Puritan refugees from the persecution which had then arisen on the Continent and, like many others, they had settled around London.

It is supposed that the Dollond family was originally a Dutch one, bearing the name *d'Hollende*. After a few generations of the family had lived in France, and had adopted Huguenot or Puritan principles, the name gradually became transformed into the simpler and less formal "Dollond."

Most of the members of the Dollond family were weavers—silk weavers—and this was the trade which the parents of John Dollond the optician and inventor settled down to at Spitalfields, near London. John Dollond never had any real schooling but, despite this fact, he grew up to be an intensely studious lad. Although put to silk-weaving at an early age, he studied in his spare time subjects like geometry, algebra, anatomy, Latin, Greek and theology, and when he was 15 years old his chief pastime comprised the solving of mathematical problems, the drawing of geometrical figures, and the making of accurate and serviceable sundials.

Spare-time Studies

Continuing at his silk-weaving, John Dollond married early. Before long he had a family of his own to support, which meant that he had to work harder and to devote less of his spare time to his studies. Ultimately he solved the problem by giving less time to sleep and by burning the midnight candle until the early hours of the morning. In this way he strenuously spent the early part of his career until his family cares became, as they invariably do, less burdensome with the gradual growing-up of his children.

The times were quiet ones when Sir Isaac Newton died in 1727. There was a stillness over every form of scientific and technological advancement. It was a sort of lull before the storm, because, very shortly, the Industrial Revolution, the product of the intensification of technical invention and discovery, was gradually to arise and, eventually, almost to revolutionise the ways of the world.

Although Newton was now dead, his tremendous prestige lived on, and the majority of the scientific world of Dollond's early days followed the belief of Newton that a lens

An eighteenth-century refracting telescope constructed on the "achromatic" principle invented by Dollond.

could not be ridded of its inherent "chromatic aberration" or constitutional colour defects, Newton had said it. Therefore, there was no arguing.

The elder son of Dollond, named Peter (born 1730), inherited his father's tastes. In 1752, this Peter Dollond, with the consent of his father, and, no doubt, with a little financial aid therefrom, set up an optician's shop in London, his father acting as mathematician and lens-computer to the business. Although, at first, his constructional skill was but small, he quickly developed it and became a recognised instrument-maker. Encouraged by the success of his son, John Dollond needed little persuasion to forsake the traditional silk-weaving of his forebears, and to join up in business with his son Peter.

A Joint Concern.

The two Dollonds, father and son, made a variety of lenses and instruments, optical, astronomical, mathematical and sundry. Optical instruments were in a pretty bad way at this time so far as their lens systems were concerned, for every lens suffered badly from the supposedly incradicable "chromatic aberration." Hence, no optical instrummment which depended upon its lenses could be made to give a clear, distortionless and colour-free image.

At the period with which we are dealing, there lived in far-away Sweden, a mathematician named Samuel Klingenstierna (1698-1765) who, after repeating some of Newton's experiments and finding them wanting, dared to challenge the validity of that authority. According to Newton, there was a fixed relationship between the refractive and the dispersive powers of a glass lens, which relationship was unalterable. Klingenstierna put forward the suggestion that Newton might easily be wrong in this matter and that, after all, it might be possible to correct a lens for its inherent colour defects.

The joint Dollond concern in London had not been going very long when John Dollond chanced to obtain access to some of Klingenstierna's writings. They appealed to him enormously, since they so intimately concerned his optical interests. If only it were possible, Dollond thought, to make a lens which would not suffer from the highly objectionable defect of chromatic aberration the whole face of practical optics and optical instrument-making would be changed.

Optical Experiments

Dollond plunged enthusiastically into the project. He began by closely investigating the optical properties of different glasses. Then he constructed a number of different prisms and found that if he made a solid glass prism and a hollow prism containing water the one prism would, in some way, neutralise or "correct" the defects of the other.

In this manner, Dollond was led to experimenting with glass-and-water lens combinations and he found that the same principle applied, i.e., that the defects of the water as a refractive medium for light rays were partially neutralised by the glass, and vice versa.

Applying the principle of the new discovery which he had thus made (i.e., that one medium can correct the optical defects of another) he proceeded to compute and to grind "compound" lenses, that is to say, lenses composed of two different components, the one component neutralising or correcting the chromatic defects of the other.

Dollond's final "achromatic" or colour-corrected lens comprised a lens of crown glass cemented to another lens of flint glass. Crown glass is a common glass. Flint glass is denser and has a better refractive power than the former. By combining these lenses so as to form a compound lens, the defect of chromatic aberration was, in practice, almost completely eradicated because, acting in combination, the two glass media showed themselves capable of reciprocally neutralising their individual colour defects and of thus giving a clear magnified image which was free from colour fringes and similar chromatic troubles.

The no-colour or "achromatic" lens had arrived. Achromatism was an accomplished thing. Newton, for once in a way, some 30 years after his death, had been proved to be wrong.

An early achromatic camera lens used for portraiture.

First Achromatic Telescope

At once, the optical world began to wake up and to survey the new possibilities which now lay before it. Dollond, in 1758, constructed his first achromatic refracting telescope. It was surprisingly successful, and although there were then being produced reflecting telescopes of greater power, Dollond gradually improved the power and the performance of the refracting telescope by using achromatic lenses each comprising three separate components cemented together.

A formal paper of Dolland's, entitled "An Account of Some Experiments Concerning the Different Refrangibility of Light," was read before a meeting of the Royal Society, London, on June 8th, 1758. It constituted Dollond's formal scientific announcement of achromatism and of the achromatic lens to the world. The lens principle was patented by Dollond. Its success was enormous, and, quite apart from more practical benefits, it earned for its inventor the award of the "Copley Medal," the Royal Society's highest honour, although, at the time, Dolland himself had not been elected a member of that body.

A modern outcome of the eighteenth-century invention of "achromatism"—the present day standard petrological microscope, specially designed for the micro-investigation of minerals and crystals.

Optician to the King

Indeed, it was not until 1761—three years later—that John Dollond was elected an F.R.S., and in that year he was also appointed optician to the King, an honour which was, in some ways, an official recognition of his fame.

Unfortunately, however, for John Dollond, the world's glory passed far too quickly, for the year of his fame (1761) was also that of his decease. During the few spare hours which he allotted to himself daily, it had, in latter years, been his wont to compute calendars and almanacs for various areas of the world, a task which necessitated a good deal of mathematical and astronomical reading. On November 30th, 1761, he was engaged in the close reading of Clairaut's celebrated "Treatise on the Motion of the Moon" when unconsciousness suddenly overtook him as the result of a stroke of apoplexy. He never rallied from this, and he died a few hours later, aged 55. Of his two sons and three daughters the elder son, Peter, succeeded to the family business, and subsequently attained a great deal of success and celebrity for himself, while one daughter married his best apprentice, one Jesse Ramsden, a Halifax lad, who became one of London's foremost instrument-makers.

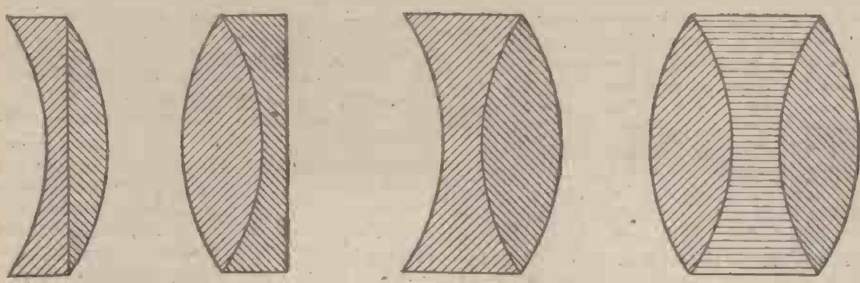
Although John Dollond was undoubtedly the "Apostle of Achromatism," his inventive and constructional powers were shown in other directions. He paid much attention to the improvement of telescope eyepieces, and by a system of some five or six lenses used in combination, he succeeded in widening the field of view of such eyepieces enormously. He invented, also, a "heliometer," a telescopic instrument whose function it was to make accurate measurements of the diameter of the sun. Dollond's heliometer quickly became the standard form of that instrument. It was used up to about the year 1868, after which time photographic measurements superseded it and rendered its use obsolete. The original Dollond heliometer now reposes as a cherished relic in the Cape of Good Hope Observatory. Essentially, it comprises a very delicate micrometer device attached to the eyepiece of the telescope instrument.

Other mechanical devices pertaining to the sphere of instrument-making, such as lens-holders, microscope mountings, and so on, were made by the Dollonds, but whether these were originated by John or by his son Peter are all moot questions.

Action for Infringement

After Dollond's death a curious sequel occurred. The firm of Champness, instrument-makers, Cornhill, London, was found to be making achromatic lenses, despite the fact that the original patent of John Dollond was still current. Whether this firm had obtained any prior knowledge of the startling set of circumstances which was now to be revealed it is impossible to say. At all events, Peter Dollond, son of John Dollond, sued the Champness people for infringement of the Dollond patent covering the construction of achromatic lenses. The case was regarded as an important one, and it was tried by one of the most famous judges of the eighteenth century—the celebrated Lord Mansfield.

A legal bombshell was dropped at the proceedings when it was revealed, *and proved*,



Typical sections of compound lenses constructed on Dollond's achromatic principle.

that the Dollond patent had been anticipated by a London barrister as much as a quarter of a century earlier. This barrister, Chester More Hall, by name, had, in his country residence, More Hall, in Essex, actually built an achromatic refracting telescope in which he had used compound or composite lenses which had been made to his own specifications. Chester More Hall was proved to have made his telescope in 1733, but he had never publicised his invention.

Clearly enough, therefore, pleaded the defendants in the Dollond case, the invention of the achromatic or colour-correcting lens had been anticipated. Hence, they contended, John Dollond's patent was null and void.

There was no disputing such facts. Nevertheless, Peter Dollond won his case.

Lord Mansfield, the judge, took a commonsense view of the matter, and uttered a pronouncement which for a long time afterwards influenced legal decisions in patent cases. To be brief, Mansfield held that "as Chester More Hall had confined the discovery to his apartment and the public were not acquainted with it, John Dollond was to be considered as the true inventor."

"For," went on the noble lord, "it is not the person who locks his invention in his desk who ought to profit from such an invention, but he who brings it forth for the benefit of mankind."

Peter Dollond was awarded £250 damages against Champness (a considerable sum in those days), and the validity and essential justice of Lord Mansfield's verdict has never seriously been disputed.

Without any doubt, John Dollond was the first to step-up practical lens and optical performance to anything like theoretical efficiency. His is a fame and a memory which should last, and be duly honoured as long as precision optical instrument construction counts for anything in this world.

Letters from Readers

Ultra-violet Ray Lamp

SIR,—Our attention has been drawn to an article headed "An Ultra-violet Ray Lamp," published in the March issue of Newnes' PRACTICAL MECHANICS. Your contributor states that: "The lamp used by the writer was . . . a 230v. 400w. mercury vapour lamp of Crompton manufacture." He also states: "A healthy sunburnt tan will develop, and a gradual toning-up of the system will result."

The 400w. lamps described are designed for illumination purposes, and not for medical use. In their proper sphere, e.g., street lighting, they give excellent service to the community, but whether the outer envelopes are removed or not, the lamps produce practically no health-giving ultra-violet radiations in the erythemal or sunburn wavelength range. The inner bulb is made from hard glass, and not, as stated in the article, from fused quartz. Outer envelopes are fitted to the lamps to ensure satisfactory working conditions for the mercury arc, and these conditions are not fulfilled when the outer bulb has been removed. A lamp working minus its outer bulb is unsafe optically, electrically and thermally, and we heartily deprecate such use.—CROMPTON PARKINSON, LTD. (London, W.C.2).

Engineer-built Houses

SIR,—I was interested to read Mr. Bentley's letter in the April issue, and pleased that interest is being taken in a vital subject.

May I be permitted to point out that unless machinery can be continuously employed it will not pay its way. I am doubtful if a trenching machine would be worth while on a housing estate except for digging drain trenches, the foundation trenches do not permit of sufficient run for the machine to be economical. A concrete mixer, I may say, hardly pays its way on housing work. There would, however, appear to be a future for various types of electric machines, and no doubt an electric cable will some time in the near future be laid on at the same time as the water pipe.

A gantry is definitely not worth while, as scaffold poles can be erected in half the time taken to get a gantry to the site, and are also more adaptable to site conditions.

We are all waiting with more or less interest to see the "factory" house prove itself. It has been tried on quite big lines in various parts of the world, but up to now people have shown a marked preference for the traditional building, and it is the people who must pay the piper.

May I point out that the engineer made a sorry mess of some of the air-raid shelters. "The concrete roof must not overhang or it will be blown off by blast." Quite all right. But they forgot in many cases to make provision for the rain which would fall on the roof. The failure of the "barrel" roof was blamed first of all on the builder, then, when the builders began to answer back, on to the use of lime mortar, in spite of the fact that buildings in lime mortar have stood for centuries. We must be very careful what we do.

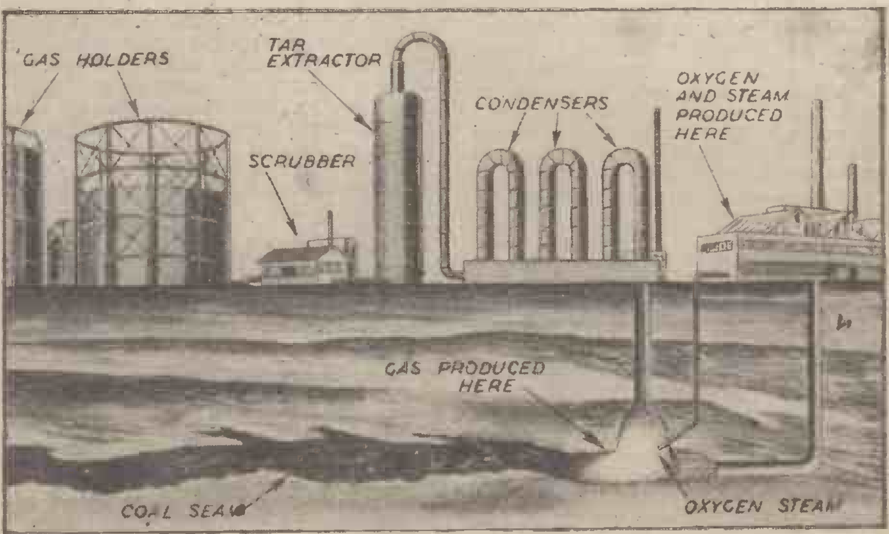
There is no trouble about manufacturing doors to an exact fit, nor is there any trouble about manufacturing "reach-me-down" suits of clothes; they are both on a par. Sliding doors are inconvenient.

I may further add that an inside wall is the best place for a chimney, as it is for the water pipes.

Between the wars the speculative builder brought housing costs down to a minimum, and without a doubt the majority of these people gave real value for money, and given the opportunity they will again.—DERBIAN (Mansfield Woodhouse).

Burning Coal Underground

SIR,—The following notes on Podzem gas may be of interest to your readers. In 1913 an English chemist, Sir William Ramsay, advanced the idea of burning coal underground. Underground burning—or more exactly, underground gasification of coal—consists in utilising air and steam introduced from the surface to convert coal into fuel gas directly at the coal seam (layer underground), without bringing it up to the surface. The gas obtained in this way may be used for fuel or as chemical raw material, for the synthesising of ammonia, liquid fuel, wood alcohol, and various organic combinations. It may be utilised at the spot where it is obtained, or easily conducted by pipe lines to factories, dwelling houses, hot houses for vegetable growing, etc. The underground gasification of coal makes it possible to utilise coal deposits which cannot be mined by the usual methods. The gasification renders superfluous all the cumbersome and expensive machinery which is used in coal mining, both under and above ground; it relieves the railway lines of millions of tons of coal haulage, and it affords opportunities for the large-scale supply of gas to plants, inhabited centres, and automobile transporta-



Pictorial diagram of the Gorlovka experimental mine for the underground gasification of coal.

tion. In 1931, at the initiative of Stalin, a Government commission on underground gasification was created in the Soviet Union. In 1933, a special trust, Podzemgas (Underground Gas), was organised. Experiments carried out on the Gorlovka Experimental Section in the city of Shaktz, Donbas, have shown that it is possible to gasify unworked seams of anthracite and to obtain a constant flow of fuel gas of sufficiently high thermic capacity (up to 2,600 calories per cubic meter), to make operations financially profitable. In experiments at a test station in Leninsk, Kusbas, 1,000,000 to 1,500,000 cubic feet per hour of underground gas were obtained for months. At the experimental mines in Lisinhausk, Donbas, by work on pit holes, generator gas as well as water gas (by application of a steam blast) was obtained. The most important results were met with at the Gorlovka experimental mines, where an especially productive method called "gasification by steam" was worked out for the utilisation of coal in untouched seams. The work in Gorlovka is remarkable for being conducted on an industrial basis. The experimental mine opens up a section of seam containing 10-13,000 tons of coal. It is supplied with oxygen for blast from the Gorlovka nitrogen fertiliser plant. The coal below the surface is ignited by the introduction of hot embers, and with the aid of the oxygen blast the fire is spread along the seam. Steam is introduced and the gaseous products are brought above the surface of the earth through suitable pipe connections to the condensers, tar extractor and scrubber. The gas of high thermal value is then stored in tanks to be used for industrial purposes. A pipe-line is now under construction to deliver gas to the fertiliser plant, where it will be used to produce steam, and many raw materials.—W. F. HALLIWELL, A.M.I.E.T. (Stamford).

Post-war Flying

SIR,—Your magazine has brought me much enjoyment and education during the time I have taken it, and now that I am out here with the usual shortage of reading materials your up-to-the-minute articles are causing a great number of "brains trusts" amongst the men of my unit. With the wide range of subjects in your unique magazine, there is always something of interest to all, and causes the thought-provoking arguments of my fellow servicemen. One thing especially is constantly being discussed, and that is the great possibility of post-war flying. This is partly due to the recent arrival of those marvellous "flying-jeeps," with their extreme simplicity of controls, making everyone itch with the feeling that "I could fly one of those!" Though many of the more interested persons remember those small "Flying Fleas," very few can recall anything of their design or capabilities; only one thing sticks in their minds, that being the widely publicised warning of their unsafety (due, I believe, in most cases to faulty or bad workmanship in their construction). I still have at home those books in which you gave the plans and working drawing of this small aeroplane, and distinctly remember your advice on the care with which the materials should be selected, and also the necessity of complete accuracy of measurements and workmanship in its construction.

This is not the 'plane which I have in mind as being the ideal for the "learner" or "ordinary man's" type, but another, the "Luton Minor" by name, was stated to be much safer in the air, and also seemed to conform more to the orthodox type of wing and tail assemblies.

Thanking you once again for the excellent standard to which you are maintaining your magazine in these difficult times, and I wish "Good luck" to you and your staff in their work.

There is no need for me to say how much I looked forward to the day of Victory and to the Peace; but if your magazine is of wartime standard, then it makes the peace doubly inviting!—C. G. PATRICK (South-East Asia Air Force).

"Phenomenon of Light"

SIR,—Further to the paragraph by R. H. Wallis on "The Phenomenon of Light," and in reply to your invitation to readers to spot the fallacy, I herewith submit the following:

Sight, we believe, is obtained through the bombardment of the retina by waveforms confined within what is popularly termed the "visible wave-band." If an observer recedes from a scene with a motion faster than that of light, his retina is never overtaken by the waveforms and consequently his outlook is complete darkness over an angle of 180 deg. at right-angles to the line of motion. Providing his motion was much in excess of that of light he could, if he wished, stop at a distant point and see the train probably before the passengers embarked and, as long as he remained stationary, or receded at a pace slower than light speed, the sequence of the train's movements would come along to him. Travelling at the exact speed of light would cause the scene to "freeze" into eternal sameness, but never could the observer see reversal of sequence as suggested by Mr. Wallis.—C. J. WILLIAMSON (Scalloway).

SIR,—*Re* your article on "The Phenomenon of Light," and the comment in the following issue, surely the writer has forgotten the work of Doppler, who, in 1842, suggested that a self-luminous body would be seen in a colour of greater or less refrangibility, according as its distance from us is decreasing or increasing.

The outcome of this was seen in 1868, when Sir William Huggins found a displacement of the F fine (hydrogen) in the spectrum of Sirius, and concluded from it that the distance is increasing. This would show that the speed of light is a constant, and that rapid movement from the luminous source does in fact produce a similar effect as a slower propagation of light.—G. PATRICK, F.S.M.C., F.I.O. (Mitcham).

Items of Interest

THE PHENOMENA OF LIFE

By Hereward Wake

THE writer, studying the "Crele Theory of Life" (W. W. Norton Co., N.Y., Publishers) formed the opinion that sensitivity of recording instrument for attaching to the human body is not yet available for the above purpose—if human "emotions" are to be thus analysed. Crele assumes that life is a difference of electrical potentials, and that the basic of life is *protoplasm* and the unit of life the *cell*, a small piece of protoplasm having a definite boundary surface. The cell is composed of the central nucleus and a surround of cytoplasm; the nucleus is primarily nitro-compounds. The nucleus is also the more active part and possesses the higher electrical potential; the essence of the matter concerning the life of the cell is the interaction between the nucleus and the cytoplasm, which is dependent upon the difference of potential between them.

Crele claims also that it has been experimentally demonstrated that in the living cell electrical p.d. is always present, and that in the dying cell it is approaching zero and *is* zero in the dead cell. If within a few hundreds of the crucial cells of the organism, the p.d. falls to zero, the whole body perishes; thus such an analysis defines the chemical origin of life and death.

If this theory is correct, it is obvious that sensitive "emotion-recording" apparatus of an electrical character has yet to be designed to satisfy conditions of analysis above criticism. Pulse-recording, heart-recording and possibly brain-recording apparatus can be understood and the resultant graphs used for visual diagnosis with some measures of accuracy, but the writer is very strongly of the opinion that any accurate recording (graphically) of the emotions of the human mind calls for a super-sensitivity of component not yet within the realm of scientific knowledge. Processing the life cells (without damage to them) to make them "radio-active" may be the ultimate, so that the body becomes an *active transmitter* of thought and impulse in aura of frequency that would be capable of being "received" and amplified by sensitive recording apparatus external to it.—*Proceedings of I.P.R.E.*

Sea Rescue Suit

LIFE-SAVING suits for shipwrecked people have been of varying types. One kind has been in the form of a garment which completely enveloped the wearer possibly with the exception of face, hands and feet. It comprised a hood and a trunk portion. Made of flexible waterproof fabric, it was usually lined or half-lined with kapok or similar material enclosed in a watertight manner in the wall of the garment between two thicknesses. Formed with a long access opening extending down the front of the trunk portion from the neck to the crutch, it was furnished with closure means, for example, a sliding clasp fastener.

In this garment there was a large gusset with plenty of fullness. This, designed to keep out the water, covered the opening on the inner side of the suit from the bottom of the opening up to the neck. At the latter it was generally supplied with a strong tie by which it could be drawn at the upper free edge tightly around the neck. This was done to seal off the interior portion of the garment from the entrance of water over the upper edge of the gusset, when the access opening was closed, and the wearer of the suit was in the water.

The contriver of an improved garment of this type points out that hitherto these suits have not been sufficiently watertight at the access opening. He states that, unless there is a very efficient fastener, the water leaks past it into the space in front of the gusset, whence it makes its way into the interior of the suit.

The improved garment has an auxiliary gusset extending along the upper free edge of the main gusset or along a line inset therefrom. This depends from the above-mentioned free edge or line in front of the main gusset, so as to form a pocket to trap any water which may attempt to enter.

MAP MEN OF THE ARMY

Mobile map lorries, each containing 40,000 maps in its racks, kept pace every mile with the Allied Armies.

There is a kind of leapfrog system by which maps of the actual battle area, as well as maps of the next objective—and even the one after that—are ready stacked in lorries.

Then, behind the front line, were the field survey companies who overnight printed maps for following battles.

One depot in France issued 4,000,000 maps in six weeks, exclusive of the printing carried out by the Field Survey Companies.

These companies attached to the Second Army alone, printed 1,000,000 sheets in a month. These show every hedgerow and corner to the gunners and infantry.

Hundreds of thousands of aerial photographs had to be taken.

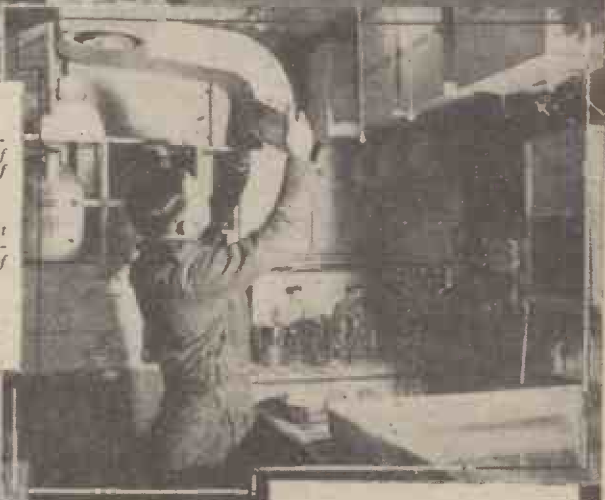
The plate for the next job arrives at the printing lorry. Inside, a copy of the map now being printed is being examined by the machine-minder, who momentarily looks away from his examination of the map now being printed, to tell the helio worker where to put the plate for the next job, which he has just brought.

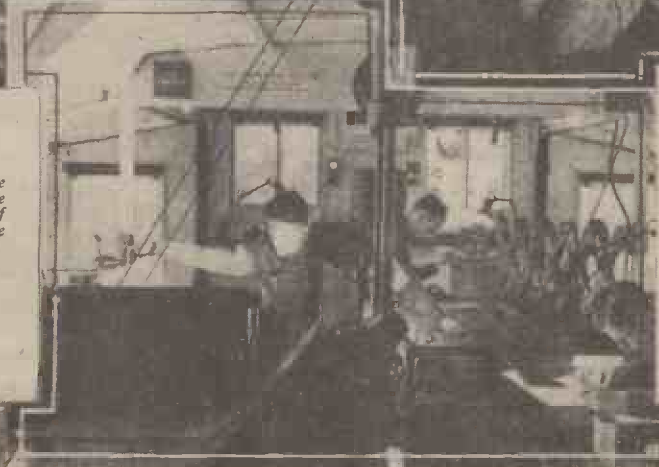
The field surveyor observing angles. The "booker" is alongside, writing down the readings, which when ready will be taken to the computing centre by the motor cyclist who has just arrived. The beacon, centred above the theodolite, is the target on to which the surveyors at other points observe.

(Above) The plane-tabler plots a point of detail with the aid of his sight-rule.

This is a most important task, for upon its accuracy the success of operations depended.

The Sergeant examines the work of one of his draughtsmen, to make sure that the drawing is complete and of good quality before passing it to the photographer or the printer.





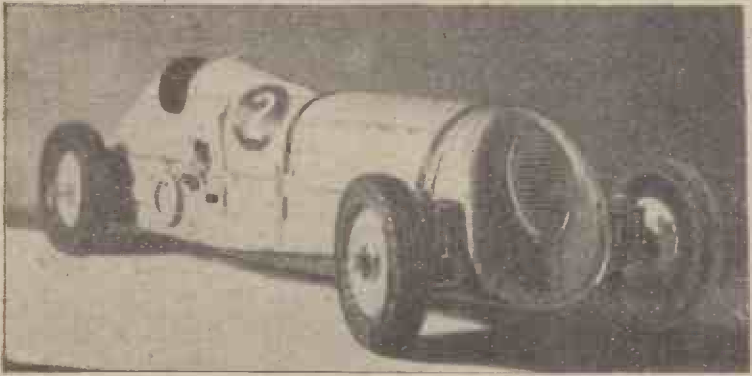
(Above) Development finished; the photographer examines the negative for any blemishes which may need touching up.

(Left) Interior of a photo-mechanical lorry, showing: exposure of sensitised zinc plate through photographic negative, by means of arc light; drying of zinc plate which has already been exposed and developed; touching up of negative ready for preparation of yet another plate.

Model Car Racing

Notes on this New Movement, and Constructional Details of a Petrol-driven Model Racing Car

By G. H. DEASON



Front view of the Leyland Thomas 10 c.c. petrol-driven racing car.

It is regrettable, but true, that in the past the motor car has been something of a Cinderella in the world of models. Indeed, until recently nothing has been done to foster interest in this branch of model making, nor has it received its share in the supply of parts, plans, accessories and text-books, which are the very breath of life to railway, ship and aircraft modelling. This is all the more surprising in view of the wealth of readily accessible data and choice of subject which the car world has to offer. Surely no branch of model engineering can provide a more fascinating array of prototypes, nor a wider scope for treatment and experiment.

It is true that in the past there have existed isolated groups of enthusiasts, notably the Cambridge Clockwork Car Club and, more recently, the Model Car Racing Association, who have operated model racing cars on organised lines. This latter club held its meetings in the Metropolis Garage (London), running straight sprint events for models classified according to overall length. The majority were rubber powered, and surprisingly fast, speeds of over 40 m.p.h. being reached over a short course. Of this form of propulsion more will be said later. The fact remains, however, that the car model made little general headway, as no sooner had motoring seriously challenged the railway in the public imagination than the aeroplane appeared to steal its thunder. Yet its technical appeal is undoubted, and nobody will deny its glamour who has stood at the fork at peacetime Brooklands and watched the lovely thoroughbreds, gay yet grim in their stark efficiency, come swirling down to the multi-coloured bunting at the turn, fighting it out to the very limit of tyre adhesion and engine revolutions in the last lap of a Mountain race.

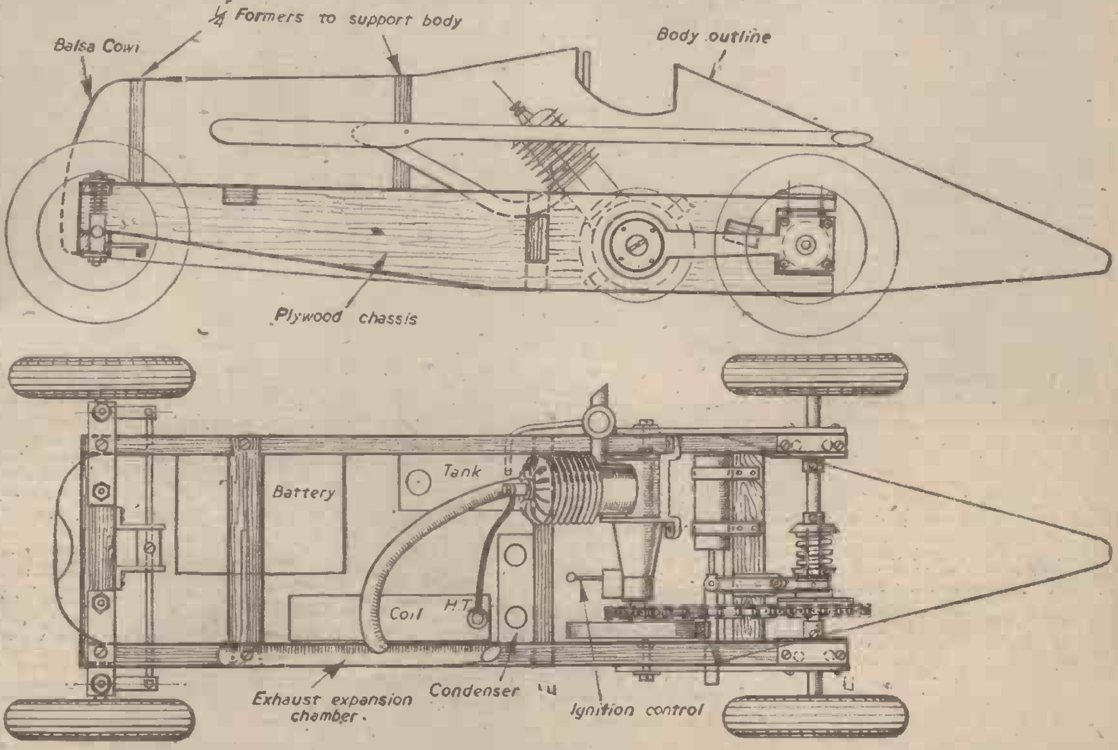
It was left to America, however, to put the model movement over in a big way. The U.S.A. had led the field for some years in the development of commercial petrol engines for model aircraft, and the model racing car was hailed as providing further scope for its activities. Miniature race-cars began to appear in fair numbers, kits of parts were marketed and with typical American enterprise the trade supported the new game. Banked concrete tracks were built, some as adjuncts to full-sized circuits, complete with pits and pit personnel, emblazoned sweaters and all the paraphernalia of partisanship. The cars were run on a circular course, tethered to a central pylon similar in arrangement to that used for model hydroplanes, and they tended for the most part to develop on the lines of the Doodlebug (pre-war version), a rather depraved type of dirt-track special, seen occasionally on English speedways. However much we may deplore the trend of design, the speeds achieved were certainly phenomenal, rivalling those of their full-sized brethren. Really accurate facts and figures are very scarce to date, but speeds of over 100 m.p.h. have been claimed. Based on data at present available in this country, and assuming these cars to be equipped with modified versions of "stock" aero-motors, and running on normal fuel, these speeds appear almost fantastic, and it is greatly to be hoped that after the war we shall have the pleasure of seeing some of these machines competing on English tracks, and have the opportunity of learning more of their construction.

Experimental Work

Meanwhile, in this country isolated enthusiasts had been experimenting with petrol-driven models for some time, and when the wartime ban on the flying of petrol-powered aircraft laid many engines idle, a considerable fillip was given to the movement. A competition for race-cars was organised in 1943, divided into categories of 6 c.c. and 10 c.c. capacity limits, with an additional limitation on track and wheelbase, and things began to get under way. As a result of the enthusiasm which greeted this step the British Model Car Club was formed last year, as a national body to foster and control the new sport.

Up to the present the more spectacular petrol model holds the centre of the field, to the exclusion of other types, but it is to be hoped that, if it is to live up to its title, the British Model Car Club will be expanded to embrace all phases of car modelling. Not everyone has the skill or resources to build and operate these admittedly temperamental midgets successfully, strong though their attraction may be. At least one other interesting and instructive field of experiment, which the writer can strongly recommend to a beginner, is afforded by the rubber-powered models referred to earlier. The writer has spent many hours in experimenting with this form of propulsion (commencing with some regrettably crude machines!) and has encountered some intriguing problems.

At first sight it would appear that there is

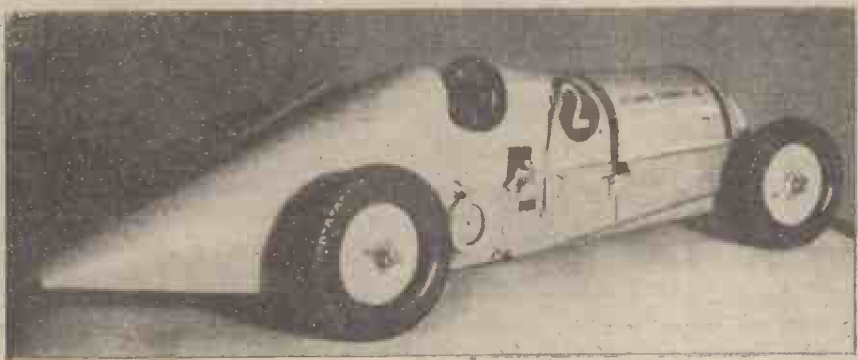


Figs. 1 and 2.—Side elevation and chassis plan of the Leyland Thomas 10 c.c. petrol-driven racing car. (One quarter full size.)

little scope for experiment; surely, if more power is desired, one simply applies so many more yards of "aero strip" to the rear wheels, in contrast to the consumption of midnight oil required to extract more b.h.p. from a miniature i.c. engine. Alas, a little experience soon dissipates this fallacy. The problem merely changes its ground, and becomes a question of applying the increased power effectively. There are many approaches to this problem, among them being the careful selection of final drive ratios, the adoption of 4-wheel drive, independent suspension, twin rear wheels, the pros and cons of employing large section, low-pressure wheels with hard springing or hard small section tyres with soft suspension, more axle movement and lower periodicity. And lastly, the all-important question of weight distribution. It will be observed that most, if not all, of these problems are also applicable to petrol cars, and for this reason alone rubber-driven cars form an excellent training ground for more advanced fields of competition.

Successful Rubber-driven Car

One of the writer's most successful rubber-driven cars was based on a light tubular backbone constructed from a rigid cardboard map-tube, well soaked in shellac, which contained the multiple rubber skeins, and carried balsa formers on which a single-seater body was constructed, aircraft fashion, being completed with 1/16in. stringers and planked with balsa sheet. The gearbox, bevel drive and axle were arranged to plug into the rear



The 10 c.c. Leyland Thomas racing car with body shell fitted.

end of the tube, the other end carrying the motor anchorages, axle beam and independently sprung front wheels.

Plans are now in hand to build a larger and more ambitious car on similar lines, embodying twin tubes and 4-wheel drive, in readiness for the happy days when rubber is again plentiful, and it is hoped that something really sensational will result. This car is intended for either straight runs or a tethered course, and over short distances should provide some interesting comparisons with its petrol-driven counterparts.

Before reverting to petrol models, a word should be said regarding the construction of static scale models. Much publicity and official encouragement has been given in recent times to solid scale aircraft, particularly as a medium of instruction in Service and Civil Defence units. Once again the motor car offers great scope for this type of modelling, and there is a vast range of prototypes, both modern and historic. Using scrap material and a minimum of simple tools, a collection of these miniatures can be built up, which will far surpass the pages of a scrap-book for realism and interest. The subject is practically inexhaustible, but perhaps a photograph of one of the writer's models, a 1/30th scale 4½ litre supercharged Bentley, built from odd scraps of wood, card, wire and Cellophane, will indicate what can be done in this direction, without soaring into the realms of super-scale modelling.

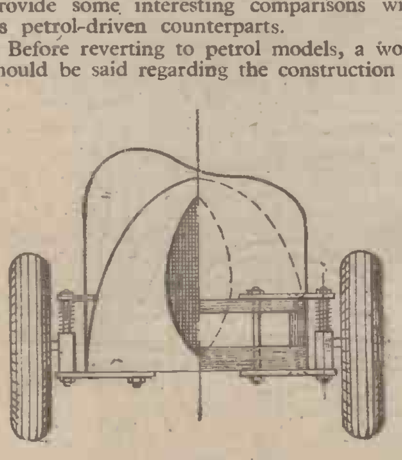


Fig. 3.—Part sectional front view of the Leyland Thomas 10 c.c. racing car.

Petrol-driven Model

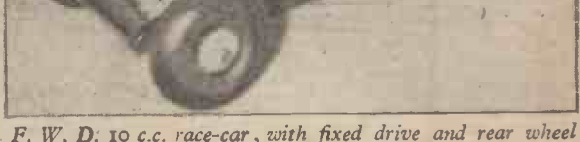
However, it is undoubtedly to the petrol-driven model that the more mechanically inclined worker will turn, for there is a powerful appeal in the idea of being designer, builder, mechanic and "owner-driver" of a racing car, even in miniature, which will be strengthened as the sport develops, and race-meetings and new centres increase, as they undoubtedly will. Before, however, proceeding to describe the construction of such a car, let us consider the conditions and requirements it will be expected to fulfil. Its primary object is to lap a circular course, tethered to a central pylon, at the maximum speed at which its engine is capable of driving it. It will not be expected to vary its course while running, nor will acceleration be at a premium. Brakes will not be needed, of course. The track will generally be fairly smooth, but a limited form of springing must be introduced if it is to hold a steady line and avoid wheelspin. It need follow no slavish fashion in layout or appearance, although it is desirable that it should resemble it's prototype in general outline as far as design considerations permit. One essential, however, is a flywheel of fairly generous dimensions, and another is some form of clutch between engine and rear wheels.

In laying out the model, which is based broadly on the old Leyland Thomas, simplicity has been made the dominant note, not only because materials and workshop equipment are scarce, but because success is more likely to be achieved by the omission of elaborate details.

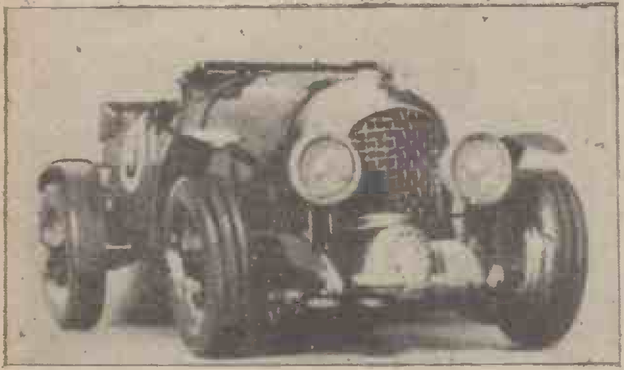
View of an unfinished model 4½ litre Bentley, showing instrument panel, tank, etc. Note headlamps made from bulbs of "Ephedrine" droppers.

Firstly, we must aim at transmitting as great a percentage of the power available from engine to road-wheels, and those familiar with a 10 c.c. power unit will know that there is not much to spare for unnecessary friction. With this in mind, chain drive has been adopted, and the engine set across the frame. This is admittedly a break from the usual practice, final bevel drive being almost universal, but the advantages of the chain greatly outweigh its academic disadvantages. Friction and thrust losses are avoided, difficult machining of gear or bevel-box parts is cut out, and with very little trouble or expense a wide range of gear ratios can be tried out. The number of ball-races is reduced to two and, finally, if our particular subject does not afford generous headroom, the power-unit may be inclined forward, thus avoiding the absurdity of having an obtrusive cylinder in the place where the driver's head should be. The sole complication involved is the necessity of fitting some form of radius arms to the rear axle.

There is a school of thought which holds that front-wheel drive is essential for pylon racing, but model racing car design is yet in its infancy, and much experimental work remains to be done before this fact is definitely established. In the meantime we have the precedent of the racing model hydroplane, which holds its course satisfactorily on a tether, under the influences of very similar forces. Neither does the writer offer any apologies for returning to the 'twenties for a subject. The majority of the big track cars of that time are very suitable subjects for



F. W. D. 10 c.c. race-car, with fixed drive and rear wheel steering.



Solid model of 4½ litre Le Mans Bentley, constructed from scraps of wood, wire, card and Cellophane.

models, particularly for the beginner, providing as they do ample accommodation for sensible electrical equipment and auxiliary fittings, carrying simple bodies, and in the case of the Leyland, disc wheels and a simple radiator cowl. Others that spring to mind as equally suitable are Campbell's 350 h.p. Sunbeam, John Cobb's Delage, and Eldridge's stupendous Fiat, "Mephistopheles," the latter car having final drive by outside chains. These cars would lend themselves admirably to modification for long-distance record breaking, a branch of model racing which is almost certain to develop in the future.

Chassis Construction

As will be seen in Figs. 1 and 2, the chassis side-members are of ⅜in. plywood, with a full depth central cross-member mortised into them, upper and lower front cross-members which carry the stub-axle swivel-pin plates, a "mid upper" cross-piece and a rearward member which serves to carry the clutch actuating arm. The joints of these members must be well made, glued and screwed. The metal under-pan at the forward end acts as an additional stiffener, and ply fillets may be added if required.

In the case of the 10 c.c. Hallam engine, at present fitted, this is bolted direct to the offside chassis member, the existing lugs being slotted into the frame at an angle, with an additional hardwood steady block under the near-side front lug.

The rear axle (A, Fig. 4) is of ¼in. mild steel rod, turned down for ⅜in. at each end, and screwed 2-BA at its extremities. The axle is carried in two ⅜in. ball-races (B), housed in blocks of ⅜in. hardwood, recessed with a ⅞in. bit to allow the races to fit flush (Fig. 6). The housings are then capped by the rearward ends of the radius arms, which pivot outside the frame, the inner faces having guide plates projecting forward to locate them in the frame, sufficient clearance being allowed to ensure that the radius arms swing freely. Radius arms, housings and guide plates are secured together by 6-BA screws and nuts passing through each corner. The rear ends of the side frames are cut away to form forks for the ball-race housings, allowing ⅛in. radial movement about the axes of the arms. Road shocks are taken by coilsprings housed in the top of the side-frame forks, the frames being drilled from the upper side to admit the springs, and capped with brass strip after the springs are assembled.

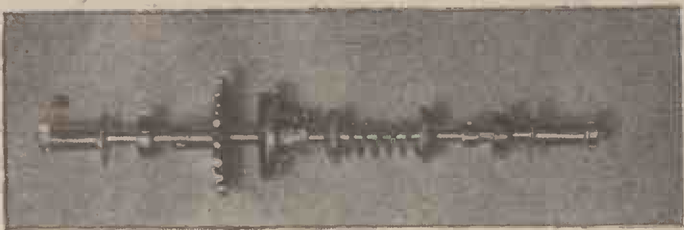
The lightest available chain was of 8 mm. pitch, and as no sprockets were available it was decided to attempt to cut these by hand. A drive ratio of 2/1 having been decided on, the sprockets were drawn out on paper, having nine and 18 teeth respectively, and the drawings pasted on to a piece of scrap door-hinge of approximately $^3/_{32}$in. thickness. The centre and points of intersection of the radii and pitch circle were marked with a centre-punch, and drilled out with a ¼in. drill. The surplus metal was cut away with a jeweller's saw, and the teeth formed up carefully to the drawing with a file. One side of the 18-tooth sprocket (D) was then accurately faced up, first by filing and then with emery cloth on a piece of plate-glass, as this face forms the driving side of the friction clutch assembly. The 9-tooth sprocket was then drilled to take the $^5/_{16}$in. engine shaft, and secured to a ⅜in. diameter brass boss (actually in this case the contact-breaker cam), by three 6-BA screws, well countersunk. In order to ensure concentricity it is advisable first to drill the three holes in the sprocket, slide boss and sprocket on to a length of $^5/_{16}$in. rod, and mark the boss through the three holes for drilling and tapping. A short brass sleeve of ¼in. bore was then sweated to the 18-tooth sprocket to form a boss (H).

Clutch Details

As already stated, owing to the critical nature of the settings required to obtain peak performance from a miniature engine after starting and warming-up, some form of clutch is essential. This enables the operator to make final adjustments with the car at rest, prior to a timed run. Some cars have certainly been built with a fixed drive, and are run-up in a special cradle, being hand-launched into the course with the driving wheels revolving at maximum revolutions, while others employ a centrifugal clutch designed to take up the drive at a pre-determined engine speed. The former method is not very satisfactory, and the latter also has its limitations, besides calling for machining operations beyond the scope of the writer's facilities. So, for the Leyland Thomas, a simple form of single-plate clutch was designed to operate on the rear axle, incorporating semi-automatic control via an oil dash-pot. A glance at Figs. 1 and 2 will show the general arrangement. The driven sprocket (D) and its boss (H) run free on the axle, lateral movement being checked by collars secured by grub-screws. On the offside, in contact with the trued-up face of the sprocket, is a friction ring (E) cut from an old shock-absorber disc, secured to a steel plate by countersunk screws. The latter is mounted on a ⅜in. diameter brass boss (J), which has a $^3/_{32}$in. recess turned in its circumference, wide enough to take freely the pins of the withdrawal fork. This friction member is free to slide laterally on a steel key, keyways being cut in the ¼in. diameter bore, and a key fitted through a slot which is drilled and filed up in the axle-shaft, and is kept in contact with the sprocket-face by a strong coil spring (F). A discarded valve spring is used in this case.

The spring is maintained in compression by a collar and grub-screw (G), a similar collar (C) adjacent to the inner guide-plate serving to restrict side movement of the axle when the clutch is withdrawn. The withdrawal fork is made by doubling a length of ¼in. by $^1/_{16}$in. steel strip, with steel pins riveted in position. As the driven member is at rest with the clutch withdrawn, it is unnecessary to harden the pins. The fulcrum pin hole is drilled as shown, also the hole for the dash-pot plunger yoke-pin, and the arm is mounted on a small plate attached to the rear chassis cross-bracing, being spring-loaded on its pivot to allow a small amount of vertical movement with the sprung axle.

The dash-pot barrel was made from a short length of tube cut from an old cycle saddle-stem, a filler-plug hole being drilled and tapped O-BA, and an end-plate soldered in position. The plunger is simply a section of cork of suitable diameter, sandwiched between two washers of slightly smaller diameter, and mounted on a short length of rod which



The rear axle for the 10 c.c. Leyland Thomas racing car, showing the sprocket wheel and clutch components.

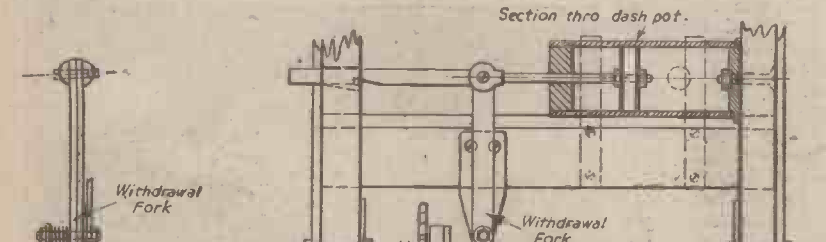


Fig. 4.—Part sectional plan of rear axle and clutch assembly, and detail of clutch withdrawal fork. (Half full size.)

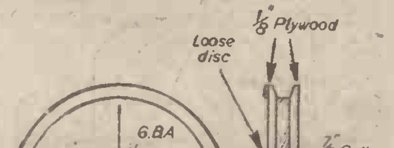


Fig. 7.—Wheel and hub details. (Half full size.)

was once a cycle brake rod, already equipped with a yoke at its other end. As an experimental measure only the barrel was then plugged with another length of cork, drilled to be a tight fit on the plunger spindle, and well anointed with shellac. This contrivance works quite well, the barrel being filled with light oil, although it is intended, when time permits, to fit a non-return valve in the plunger to facilitate resetting, and a proper end-cap with a packing-gland.

A hand-operated lever protrudes through the chassis, by means of which the clutch may be withdrawn and held by a ratchet while preliminary warming-up operations are carried out. When the engine is run-up ready for a speed-test on the track, the ratchet is released, and the clutch-spring, operating against the oil-submerged plunger, brings the friction-disc gradually into contact with the already revolving sprocket face, giving a smooth progressive get-away. It will be seen that the thrust under working conditions is self-contained and that no undue wear is thrown on the withdrawal pins, as these merely float in their recess while running. External lubrication of the chain must be avoided, however, to prevent oil finding its way to the clutch faces. It would also be an improvement to fit a second friction ring to the sprocket.

The steering arrangement is straightforward, as a glance at Figs. 2 and 5 will show. The front wheels pivot on king-pins, of 3/32in. steel, and have a limited vertical movement, controlled by coil springs. The steering arms are of brass strip sweated to the sliding bushes, and are joined by a track-rod. In order to lock the steering, the track-rod passes through a fibre block and is secured by a grub-screw. This block is free to move vertically between two guide-plates, which are in turn screwed to the lower front cross-member. One point which should be noted is the securing of the stub-axles in the sliding bushes, these being screwed 2-BA, then sweated securely after being screwed home.

Wheels are made up of ¼in. ply discs as shown in Fig. 7, with brass bushes, the rims being chamfered to a snug fit for the 3¾in. miniature Firestone tyres. An outer plate and three 6-BA screws and nuts serve to clamp the discs securely together on to the tyre beadings. In the case of the rear wheel hubs, these are drilled with a ⅛in. drill from the back to midway through their length, to form a shoulder on which the wheels are tightened by the hub nuts. These latter are fixed by a spot of solder to prevent movement after final assembly.

The mounting of engine and auxiliaries will best be left to the builder, who can arrange these to suit the particular power-unit to be installed. The layout of the chassis described, however, should prove adaptable to any 5 to 10 c.c. unit, with minor modifications. It will be noted in the photographs showing the off-side of the complete car that the connection from mixing-valve to tank is not shown. The original "Hallam" tank was discarded, and a modified separate tank was fitted, fed as will be seen in the chassis view, the mixture control remaining outside the body for accessibility.

It is advisable to distribute the weight of coil and condenser, battery, etc., low down amidships, and positioned laterally to counteract the off-set weight of the flywheel and transmission assembly. The position of the two tethering points is again a matter for experiment, according to the positioning of the auxiliaries. A sound plan, however, would be to make a stout adjustable wire rack for each half of the bridle, on the lines of that fitted to Mr. F. J. Camm's hydroplane "Jildi Junior" described in his book, "Model Boat Building."

Every builder will doubtless have his own ideas for a body, possibly on free-lance lines. The writer realises that he is probably in a minority in preferring the "vintage" type of racing car. Any beginner would, however, be well advised to avoid for a start the sleek and seductive Grand Prix single seaters of the immediate pre-war era, as their bodies are composed mainly of double curvature panels, ticklish to model; nor are they over-generous in the matter of space, necessitating the use of coils, batteries, etc., of model aircraft dimensions which do not make for reliability, or the easiest of starting. The layout of the Leyland will, in fact, allow the use of a 6v. system if any difficulty is experienced in obtaining a 4v. coil.

The body of the car was made in three sections, of light gauge tin, the tail being formed as a "funnel," and worked to follow the curvature of the seat-squab former, and the bonnet and scuttle of two separate sections, screwed to formers as shown in the drawing. The radiator-cowl is of block balsa, sanded to shape and fitted with a wire-mesh grille, which will horrify the purists, but provide a more finished air. The whole superstructure is detachable in three sections, to give access to the transmission, engine and electrical gear. A normal switch is at present fitted in the cockpit, but when time permits this will be incorporated in the outside handbrake, with an auto-timer in circuit. The chassis and body are finished in dark and very light grey respectively.

In conclusion, the total weight of the car, all-up, is just under 6lb., which could be substantially reduced by the use of less Utility material and the judicious use of drill and joiner's brace. The job was produced with the simplest of tools, any necessary turning being done with a hand-

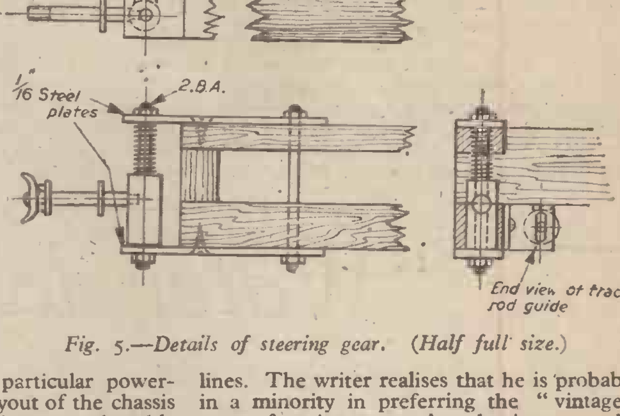


Fig. 5.—Details of steering gear. (Half full size.)

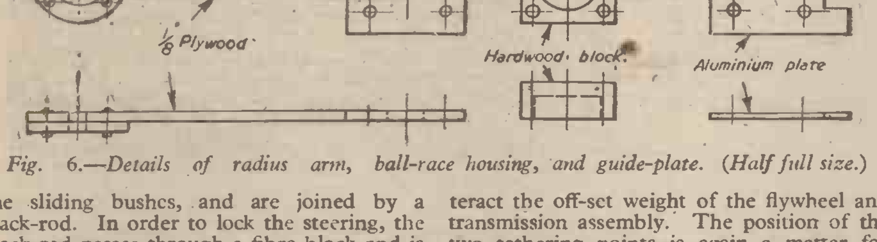
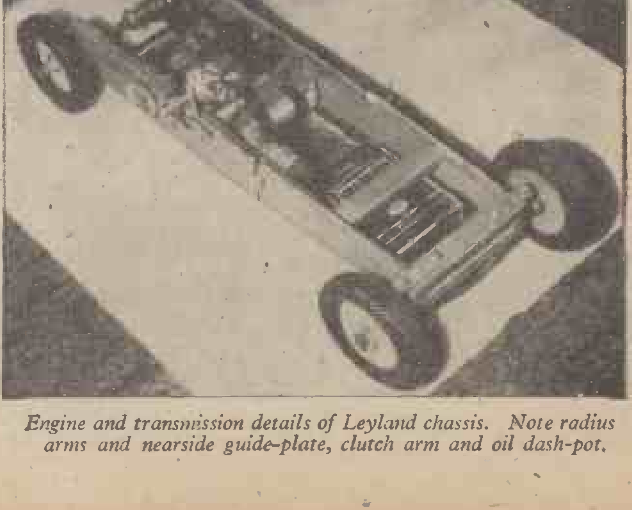


Fig. 6.—Details of radius arm, ball-race housing, and guide-plate. (Half full size.)


Showing layout of 10 c.c. G.H.Q. engine and transmission to orthodox F.W.D. car.


Engine and transmission details of Leyland chassis. Note radius arms and nearside guide-plate, clutch arm and oil dash-pot.

drill. Tyres are admittedly a problem, the Firestone replicas used being now unobtainable. Quite satisfactory substitutes can be produced, however, by building up laminations of plywood rings over the main discs, interleaved with rings of sheet rubber cut from an old car tyre inner-tube, the rubber rings being cut to stand about 1/32in. proud to form a ribbed non-skid tread. Alternatively, the writer has constructed a set of very satisfactory wheels shod with ⅜in. pram tyring. To fit this to the small diameter wheels it was found necessary to remove the spiral inner wire, leaving about 1¼in. only for the joints, and inserting a wedge-shaped piece to fill the gap which unavoidably remains. The joint is then reinforced with rubber solution, and the wheel trued up with a grinding wheel, after clamping firmly between the wheel-discs. As an added refinement, a section of cycle tube may then be stretched over the tyre, and clamped by the discs, thus leaving no visible joint.

Another satisfactory makeshift is the use of a light cycle spindle with its cups and cones, in place of the rear axle and ball-races described. The cups are then carried by the radius arms.

Those interested in petrol racing cars, and intending to take part in this absorbing and rapidly growing movement, need not be deterred from making a start with the construction of a model chassis, as there will undoubtedly be a wide choice of engines and castings available after the war. And since engine dimensions vary very little for a given capacity, the chassis may be completed with confidence, in readiness for competitions in the better days ahead.

The "Water-donkey"

A Nazi Invention Used to Draw Off Allied 'Planes and Ships when Attacking U-boats Near the Coast

NOW that the war in Europe is over, it is interesting to recall one of the ingenious decoy devices used by U-boat commanders with the object of diverting Allied 'planes and warships from the real target.

The decoy device, known as a "water-donkey, takes the shape of a submarine hull, but much shorter, and constructed in such a way that it floats just beneath the surface of the sea. On this hull is mounted the exact reproduction of the superstructure of an actual U-boat, as shown in the accompanying illustration.

By means of a cable the "water-donkey" is towed by the U-boat about a mile away. The U-boat and decoy are also connected by an electric cable.

How It Works

The method of operation was as follows: When the U-boat commander spotted an Allied 'plane he started the sound-producing machine in the decoy. An aeroplane or warship would be likely to detect this sound. If the aeroplane, for instance, proceeded to attack the decoy, thinking it was a U-boat, air would be released from the compressed-air cylinders, and at the same time a quantity of oil would also be released, which would be noticeable on the surface of the water.

Should any bombs be aimed at the decoy, bits of lifeboats and other wreckage were released to make the result of the attack more realistic. The decoy was then sunk by flooding the tanks, while the U-boat escaped —perhaps!

In spite of the ingenuity displayed in the construction and operation of these decoys, they do not appear to have been very successful in deceiving our vigilant U-boat hunters.

"TRADER" HANDBOOK

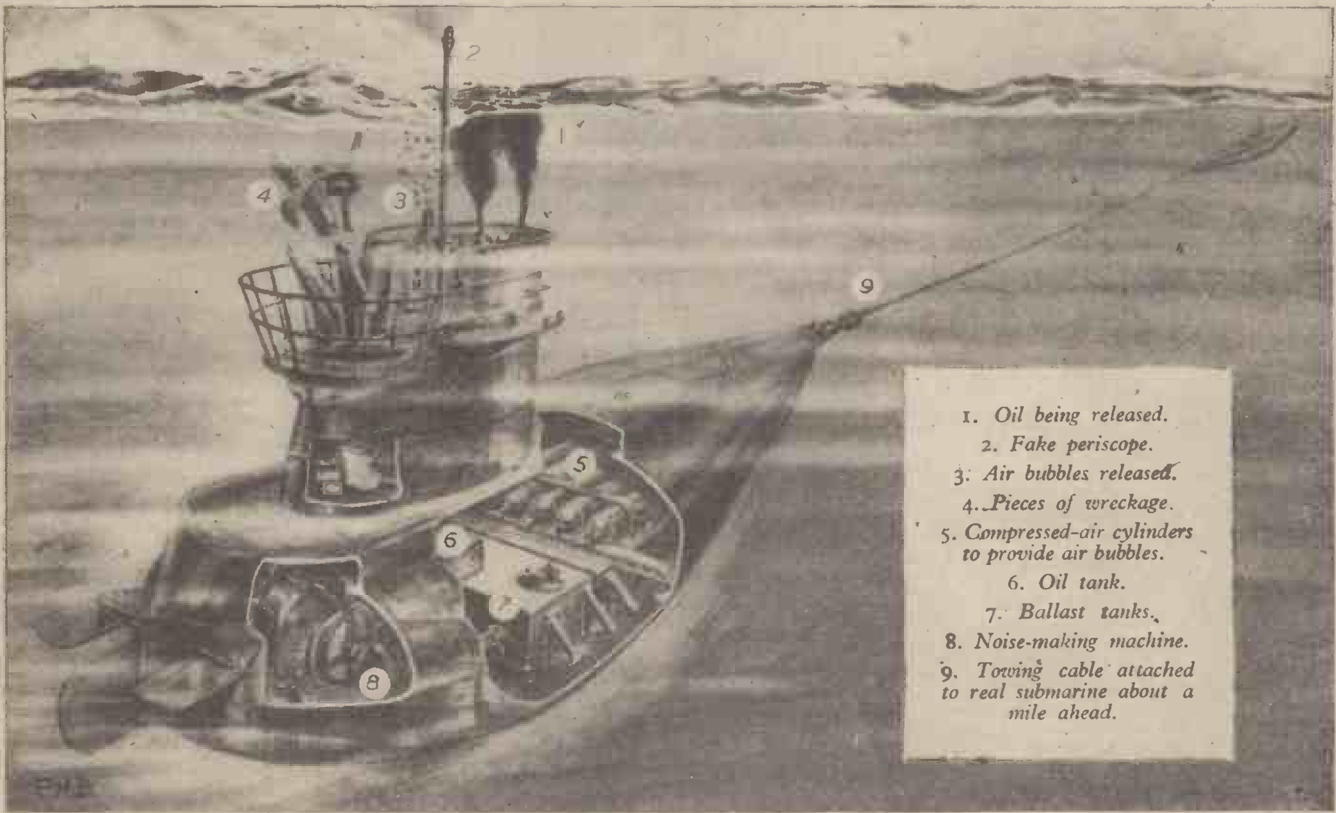
COMPILED specially to be of use to motor and cycle traders during the early days of the transition to peace conditions, a new edition of the "'Trader' Handbook" has just been issued. Although paper restrictions have called for modifications, most of the usual features which made the volume invaluable for reference purposes have been retained.

Classified lists of all the Government departments, including regional offices, with which the motor and cycle trader is likely to have dealings are included, as well as information about the various controls, purchase-tax, Liabilities (Wartime Adjustment) Acts, and the Location of Retail Businesses Order.

The encyclopædia of general law affecting the trader has been completely revised to include wartime legislation. A new feature is a complete directory of all factoring firms, with their branch addresses, which are on the approved lists of the trade organisations, the firms handling motor goods being grouped in the classes of goods in which they specialise.

The classified buyers' guide, and the directory of manufacturers and wholesale suppliers are retained, as are also the list of named and branded goods.

The "'Trader' Handbook" costs 10s. 6d. post free, and is published by the Trader Publishing Co., Ltd., Dorset House, Stamford Street, London, S.E.1.



Our artist's impression of the water-donkey, or U-boat decoy in action. Note the air bubbles, streams of oil, and pieces of wreckage being released to give the impression that a U-boat had been hit, and damaged.

Rocket Propulsion

Further Rocket Motors Tested by the American Rocket Society : The Wyld Sounding Rocket

By K. W. GATLAND

(*Continued from page 267, May issue*)

ANOTHER test type produced by Truax was an uncooled propulsion unit developed under the auspices of the U.S. Naval Engineering Experimental Station, Annapolis.

Steel was used throughout in its construction, the convergent-divergent steel formed nozzle being protected by a refractory lining of alumina. Unlike the other Truax rocket units, this motor—designed to burn petrol as fuel, with oxygen obtained from compressed air—incorporated no cooling system.

Despite the lack of coolant, however, the motor proved highly effective under test; the efflux velocity being in the region of 5,000ft./sec., and during the most successful firings this resulted in a thermal efficiency of 40 per cent.

The Piecewiez-Carver "Nozzle-less" Rocket Motor

There was, too, a further concentric-feed motor developed jointly by N. Carver and C. Piecewiez. The former will be remembered for his work in connection with the concentric-feed propulsion unit of the Greenwood Lake mail-carrying aircraft. (PRACTICAL MECHANICS, February, 1945, p. 158.) In fact, the Piecewiez-Carver motor bore much resemblance to Carver's earlier design.

In the developed type the oxygen enters the combustion chamber through an axial opening in the motor "head," while the fuel alcohol is fed as a surrounding spray. The motor was actually designed to investigate the function of a liquid-fuelled reaction unit having no nozzle of the conventional tapering type, and the comburent efflux simply ejects through a length of constant section monel tubing, 8in. long by ½in. diameter.

The fuel and oxygen feed, particularly the method of supply control, is achieved both simply and effectively. The propellant components are introduced to the chamber through two lengths of copper tubing, each with a different bore, and so designed to provide just the required combustion ratio. Other than the variations of tube section, and the provision of inlet valves, there are no other devices or constrictions on the feeder lines, the injection ports being so proportioned as to provide a full tube-bore area.

Test Results

The motor's initial firing took place at Midvale on June 8th, 1941.

As there was no provision for internal ignition, the motor was fired by an internal fuse and an alcohol soaked asbestos strip. Prior to the firing, the supply pressure was adjusted to 300lb./sq. in., although, when the firing had commenced, this modulated to 260lb. sq. in., and remained constant. This was presumably the result of pressure drop in the feeding lines and regulating valves; no allowance having been made for the rapid flow.

When the motor was fired in testing the jet appeared as an enormous flame emanating from the "mouth" of the tubular orifice, and instead of the deep throated roar associated with the trials of more efficient types, the Carver-Piecewiez motor emitted a loud hissing noise. Clearly, combustion was largely effected as the mixture was leaving the nozzle; the combustion chamber merely acting as a mixing space.

According to "Astronautics," August, 1941, combustion lasted for eight seconds on a charge of 5.5lb. liquid oxygen and 9.8lb. alcohol. The reactive thrust was spasmodic at first, but settled down during the latter half of the testing run to about 42lb., when the jet velocity was approximately 600ft./sec. After the test the motor and feed lines were found to be frosted; confirmation that burning had not taken place inside the combustion chamber.

The Africano Refractory-lined Rocket Motor

Although many details of the refractory-lined motor, designed and built by A. Africano, are not available for publication, the data as derived from proving stand test is of particular interest. The Africano motor, in fact, achieved a record for the American Rocket Society during proving tests at their Midvale, N.J., testing grounds, in June, 1941, when a maximum thrust of over 260lb. was recorded.

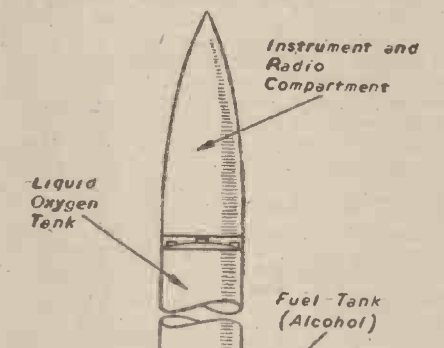


Fig. 24.—Diagram of the Wyld sounding rocket (1938).

The motor, which has a total weight of 23.5lb., incorporated a refractory liner of 8.5lb. Actually, in this instance the weight has little significance as the test motor was unnecessarily bulky and, in any case, intended purely for ground experiment. It has been estimated that only 4.5lb. of base structure was required to withstand combustion stresses with a reasonable factor reserve. The nozzle has a cone angle of 6 degrees; the "throat" being 15/16in. diameter, and the "mouth" diameter, 1.5in.

The designed chamber pressure was approximately 172lb./sq. in., for expansion to atmospheric pressure at 14.7lb./sq. in.

Test Details

On test, the Africano motor employed liquid oxygen, with denatured alcohol (11,000 B.T.U.) as fuel; the feeding being arranged through a gas system functioned by a nitrogen charging bottle.

Although it was reported that the test resulted in a maximum thrust in excess of 260lb., the true figure is not known because of the limitations of the recording instrument on the Society proving stand, which had provision for only 200lb. thrust. When the thrust gauge was later examined it was found that the mechanism had been badly strained, and was inaccurate for further work. A fair estimate for the maximum thrust figure was given by the designer as 280lb.

Upon ignition, the motor fired with a terrific roar, and immediately the gauge needle began to rise on the recording dial, falling back momentarily before continuing under pressure from the motor. This peculiarity, common to several motors tested by the society, is accounted to an initial explosion, which produces a pressure wave, temporarily cutting the fuel input. At only 2½ seconds of firing, the motor recorded a thrust of 85lb. The duration of combustion, which was limited by the amount of fuel available for test, was 12 seconds and the average thrust reaction, 184lb.; the amount of propellant consumed under these conditions being one gallon of denatured alcohol, and approximately 7lb. of liquid oxygen. The best performance was recorded in the ninth second of combustion; the jet velocity at that time being estimated at 7,050ft./sec., and the average flow about 5,140ft./sec.

At the period of maximum thrust, the jet flame could be observed at a distance of 150ft. from the nozzle "mouth," when a standing wave form was apparent near the nozzle, each being 4.6in. apart.

It was unfortunate that, just as the motor recorded maximum reaction, a portion of the refractory lining cracked and a great deal of the ceramic material was forced out through the nozzle. The figures given above cannot, therefore, be taken as highly accurate as the performance was affected by the increased nozzle area, which resulted in an increase of the jet flow. It was therefore impossible to gain any truly conclusive evaluation of the motor's performance.

The M.I.T. Liquid-oxygen Cooled Rocket Motor

Following the Africano motor test, a reaction unit developed by the Massachusetts Institute of Technology Rocket Research Society was bolted on the proving stand. The M.I.T. research group, then newly formed, is composed largely of students, some being connected with the institute in a research capacity, while a very few are entirely independent of the M.I.T. The rocket group, which carries out its work independent of the institute, was founded by Mr. E. C. Doyle in 1940.

The motor under review, which was designed by Mr. R. Youngquist, employed liquid oxygen as cooling medium and incorporated a jacketed lower chamber portion and nozzle. The liquid oxygen, after its passage through the coolant jacket, is finally injected for combustion as an annular gas spray toward the motor "head." The alcohol fuel, which is fed direct, is introduced in similar manner.

To aid starting, an alcohol soaked rag was tied in way of the nozzle and ignited. The propellant feed valves were then operated, and the motor fired effectively, emitting a loud roar.

The motor functioned for 13 seconds, returning a thrust of approximately 35lb. constant for the entire testing run. Unfortunately, however, just as the feed supply became exhausted, an explosion occurred which tore a large hole in the side of the motor and broke off the feed lines. A possible explanation of this was the detonation of an internal fuse, which had been left in the chamber from an earlier attempt to initiate combustion. This theory is substantiated by the fact that no part of the brass fuse casing was found after the incident.

The combustion chamber pressure throughout was 125lb., and the feeding pressure 250lb.

A.R.S. Rocket Motor

Concluding the day's experimentation, a replica of the motor which had powered the early American Rocket Society rockets, Nos. 1 and 2, was fitted for testing.

Designed jointly by H. F. Pierce and G. E. Pendray, the unit consists of a small egg-shaped combustion chamber, with inlet ports situated near the nozzle to inject toward the motor "head."

The motor is completely encased by a steel sheet-formed water jacket.

On test, firing was accomplished by an external fuse; the motor operating for fully 48 seconds—a duration record for the society—while developing a maximum reactive thrust of about 35lb. Apart from slight erosion close to the nozzle "throat," the motor was found to be undamaged.

Tests of the original motor in November, 1932, resulted in a maximum thrust of approximately 60lb., with a firing duration of 20 seconds, without injury to the chamber or nozzle.

Conclusions

From the foregoing it will be readily appreciated that the American Rocket Society has contributed much towards the development of liquid propellant rocket units, and remembering that the research was financed entirely by membership dues, and small sums donated by the experimenters themselves, what they have accomplished is truly remarkable.

These small test motors, which have now been developed to the stage when they can be operated repeatedly without burning out, are now considered to be sufficiently durable to power meteorological rockets for purposes of routine soundings of the upper atmosphere. The greatest height yet achieved by any man-made device is 98,000ft.—prior to the advent of "V2"—and this altitude, reached by a small Regener sounding balloon, is not likely to be much bettered by any device dependent on the atmosphere for lift.

The Wyld Sounding Rocket

Working from data obtained from the tests of his "regenerative motor" (see Fig. 24 PRACTICAL MECHANICS, May, 1945), J. H. Wyld published in 1939 the designs of a new sounding rocket. From the diagram, Fig 25, it can be seen that the projectile is of the tail-drive type; ballistically streamlined, and gyroscopically stabilised.

The rocket shell is cylindrical, with an ogival nosing and a conical tail fairing, the overall length being 9ft., and the maximum shell diameter, 5in. Four elliptical stabilisers—6 in. wide and 8in. overall length—are fitted just above the tail fairing, which incorporate movable rudders functioned by the gyros. These stabiliser fins are of ¼in. plywood, and pick up on studs attached to the rocket body.

The weight of the rocket empty is approximately 17lb., but this figure is increased to 35lb. when fully charged with propellant, 11.25lb. of liquid oxygen, and 6.75lb. of ethyl alcohol. Both tanks are filled, under complete loading, to a little more than half their full volumetric capacity.

Layout of Components

The propellant tanks are arranged in tandem; the upper tank, containing the liquid oxygen, being of monel, while the other is built of chrome-moly steel. The oxygen feed line, it will be observed, passes through the fuel tank.

As a precautionary measure, a safety disc, designed to fail at a certain critical pressure, is fitted in the oxygen tank.

For feeding the propellant, nitrogen gas is initially fed into both the oxygen and fuel tanks until a tank pressure of 250lb./sq. in. is reached. The inlet valve is then closed, and the feed lines disconnected. The tanks are, of course, pressurised on the launching, or test, apparatus, and the projectile fired immediately upon the attainment of the specified pressure.

The Gyro-stabiliser

The gyro is so designed to hold a true course within 10 degrees. It has a diameter of 4in. and is mounted at its centre of gravity on small gimbals. The complete unit has a weight of ¾lb.

Prior to a free flight test, the gyro is run up to an initial 10,000 r.p.m., and at this speed its momentum is sufficient to serve effective control for the entire flight period. In consequence, no integral driving motor is required.

According to the designer, the control device is made up as follows: The lower end of the gyro axle carries light valve rods. These connect to small slide rods, which, in turn, control the motion of servo-cylinders sliding on stationary piston rods, there being two such cylinders fitted at right angles. Each of these control one of the rudder shafts through rudder levers and they are supplied with pressure via two flexible tubes leading to the gas-space in the fuel tank. A small auxiliary tank (not shown in the diagram) is employed to supply pressure after firing has ceased and the pressure in the main tank is exhausted.

Another novel feature is the parachute ejecting method. As can be seen from the diagram, the parachute compartment is located at the rear of the rocket—just above the gyro—and by this arrangement the rocket is brought to the ground nose first.

The gyro itself acts as the parachute release. An insulated ring is fitted about the vertical axis of the gyro, so that when the rocket curves at the zenith of its trajectory, the ring deflects and makes contact, so closing an electrical circuit which fires an ignition fuse embedded in the powder charge of the ejecting device. This is simply a short tube, containing the charge, separated from a small pilot 'chute. The pilot 'chute, is, of course, attached to the main supporting parachute, which it pulls out through an access door in the containing compartment. This method of release, incidentally, was first suggested by Mr. Street, of Providence, and Mr. H. F. Pierce (A.R.S.), both working independently.

As a safety measure, an auxiliary device, which functions under tank pressure, is also provided, being so designed that release cannot occur until the propellant is exhausted.

Although no details of any flight trials are available—presumably the war caused a postponement of construction—the rocket is estimated to be capable of an upward range of a minimum of three miles.

Payload

There is provision for a payload of 2lb., which would consist of meteorological recording apparatus, and possibly a light radio transmitter. Whether a suitable apparatus, effective, yet sufficiently light and compact, is available for a rocket of this size is questionable, but, in any case, transmitters will be a very necessary fitment in the larger sounding projectiles now under development. These rockets will be located by radio, making use of two ground receivers, the position being calculated by triangulation.

Operating Costs

The cost of each firing has been estimated to be in the region of 25 shillings; this being the cost of propellant.

Manufacturing costs, too, would not be great for such a small rocket, but it is obvious that if we are to produce the larger rockets, which are the sole means of charting the upper reaches of the atmosphere, such development cannot be achieved through the sheer enthusiasm and technical ability of "amateur" investigators alone. The rocket has now reached a point where no appreciable gain can result from "private enterprise" that is not backed by substantial funds, and we can conceive no rocket society whose membership would yield the huge sums required. It now remains for State subsidy to provide the necessary financial support for this further important development.

(To be continued.)

One of the V2 rocket bombs captured intact by the U.S. First Army in Germany.

The "Hyperailion"

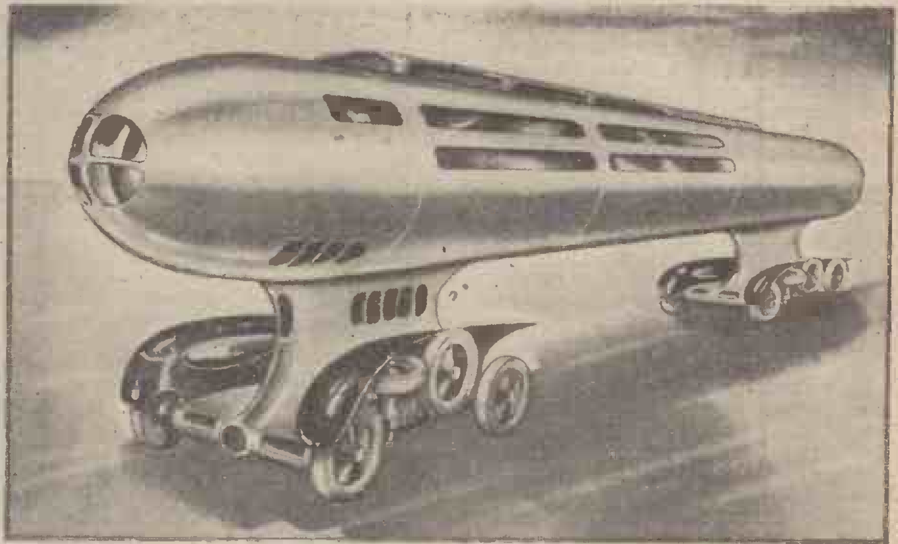
A Suggestion for Safe Post-war Land Travel at 150-180 m.p.h.

By G. K. COOPER

A NEW form of transport may fill in the gap between the express train and the aeroplane in a few years' time.

This new travel medium relies upon a special form of reinforced concrete track upon which super-aerodynamically designed vehicles will run. This special track is so formed that the speeding vehicle cannot leave it at any speed, and has continuous inset surfaces upon which hard rubber or pneumatic-tyred wheels run and obtain 100 per cent. adhesion.

Unlike the unnecessarily heavy steam locomotives, often weighing 100 or more tons in themselves without tender or passenger vehicles, and relying entirely upon this mass weight over the driving wheels to give the necessary adhesion, the "Hyperailion" is built as lightly as possible, using the technique of light ribbing and stressed multi-skin construction developed for aircraft.



An impression of a "Hyperailion" vehicle removed from its track.

Streamlining

Complete streamlining is effected by using only single vehicles of 50-passenger capacity and the head resistance is cut to nearly half that of a normal steam or electric train. In addition, the vehicle body is elevated sufficiently from the track to give clean lines underneath, eliminating the under-drag which affects all other low-built transport trains, buses and motor-cars.

The complete transport system is primarily intended for long-distance, high-speed travel, each track only one way, as existing rail tracks for express travel, or the proposed new motor roads.

Taking into account the speed of nearly three times the present express rail travel, it will be seen that great economic savings can be effected. In the first place, the power used is electricity collected from conductors concealed in weather-proof recesses at the sides of the track, and since this has to move only one-fifth of the total weight per passenger that an electric train of the present type would have to move, it will be cheaper on current.

The track would be comparatively economical to build, either by using concrete sections in lengths of 6ft. or by laying *in situ* with sliding metal "forms." It can be laid upon existing rail tracks or embankments if desired, but it is expected that it would be laid separately upon new point-to-point routes and treated as a system supplementary to other forms of transport.

Technical Advantages

Amongst other technical advantages it has the merit of being able to ascend and descend with the contour of the land in the same way that a motor road can, and can be banked on steep bends if desired.

Fog, which holds up normal train services, would not affect the "Hyperailion."

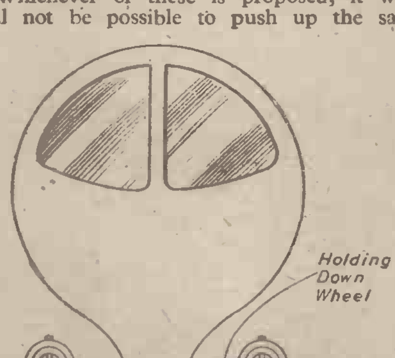
Savings can also be effected as compared to existing rail travel by having completely automatic "block" circuits permitting only one vehicle to take up current in each section; vehicles will thus be able to follow each other at five-minute intervals with perfect safety. This is a much more economical way of using a track, both from an electrical distribution point of view and also in its demand upon feeder traffic at either end of the system.

At present, 300-500 persons have to congregate in termini at the same time and proceed over long distances at perhaps three-hour intervals, causing a peak demand upon feeder transport. By having one fifty-passenger vehicle on the route at ten-minute intervals, twice the number of persons can be carried; there will be less rush to catch a particular train, waiting time much less, and end transport demands spread out over the whole period.

Travel by this means will be as silent as by a luxury coach on the roads, certainly as comfortable, much safer—since the passengers are not at the mercy of the man at the wheel. The system can run into tunnels right to the centre of cities if desired, and being smokeless and silent, this would be much better than either steam or electric train connections to the centre of cities.

It is true to state that no serious attempt has been made to speed up rail travel for the last 50 years and the matter is seen in its true perspective, now that the railway companies are faced with vast expenditures on obsolete engines, stations and vehicles on the steam services, or have the alternative of introducing diesel-electric vehicles or going "whole hog" for electrification at a cost of something like £300,000,000.

Whichever of these is proposed, it will still not be possible to push up the safe maximum speed for long-distance travel owing to the limiting effect of the flanged wheels operating upon the present type of "bull-head" rail. The height of the flange is only 1½in. and with the 4ft. 8½in. gauge, it is essential to retain a considerable weight in the engine and vehicles to permit of speeds on large radius curves with safety.



End view of a "Hyperailion" vehicle, showing the arrangement of running wheels and track.

The real speed limit on steel rails has not been determined, but the prospects of safe travel on the present systems at above 90 miles per hour does not seem possible. Certainly trains on steel rails will never bridge the wide gap at present existing in land transport speeds. In France, for example, the government imposed a maximum of 75 m.p.h. (120 km.) as an indication that they did not consider much greater speeds on steel rails to be safe or desirable. The "Hyperailion" system seems to challenge even the aeroplane for inland travel, its point-to-point speed potential eliminating changing at air-ports to reach city centres being a great advantage.

Laid down in Britain and confined to the main routes linking the larger towns and cities this system would skim the cream off express passenger travel, would show such a saving in time that more people would travel over the longer routes, and should permit of 50 per cent. cut in fares by its practical economies and the scientific application of "power conservation."

"Ring" Circuits

For shorter distances at lower speeds, the system may be applicable to "ring" circuits to link the suburbs of large towns or to join up the proposed new satellite towns around London. In such "ring" systems it would be possible to have completely automatic operation without conductors or drivers. With one ring constantly running one way and another in the other, it should be possible to go to a stop and press a button so that the next vehicle round slows up at the stop. Another button would send it off on its circular route again, much as in the case of automatic lifts in skyscrapers.

The "Hyperailion" transport system is covered by British Patent No. 566,049 and has been taken out by the author, a Nottingham engineer and industrial designer.

THE WORLD OF MODELS

A Scale Model T.B.D. Made by Schoolboys, and a Miniature Liberty Ship

By "MOTILUS"

THIS is the time of the year when model ships are in the news. In the long pre-war summer days of peacetime places where there were lakes and pools were crowded with model ship lovers, from tiny toddlers to scale model makers and expert model yachtsmen.

In pre-war days, too, the building of model boats always had a great appeal, and even to-day enthusiasts occasionally manage to overcome "material" difficulties, and here is a fine description of the making of a T.B.D. model in wartime by schoolboys, and shows the interest that can be created by a sympathetic headmaster.

A Fine Model T.B.D.

In August, 1943, the senior boys of Cartmel C. of E. School, Grange-o'-Sands, became interested in some old catalogues, and in particular one of Messrs. Bassett-Lowke, Ltd.

The boys were 15 in number, and were fired with the idea to make a model—a common desire of schoolboys—and they were warned that they would learn at least the value of, and the reward to be gained from, continuous and prolonged effort.

A start was made on a model T.B.D. (Figs. 1 and 2) from the design of Mr. H. A. Underhill, obtained from Bassett-Lowke, Ltd. Each of the sheets supplied—detailed plan and elevation, body lines and sheer plan—was redrawn twice its size, making final plans for a 4ft. model having a beam of 5in., drawing 4½in. and displacing 22lbs.

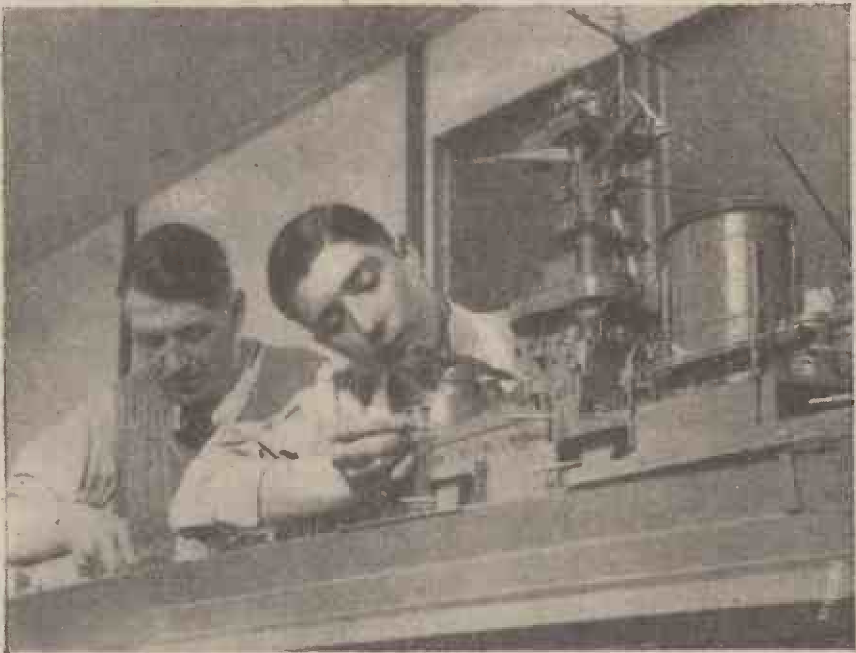


Fig. 4.—Model-making craftsmen putting the finishing touches to the assembling of a 3/16in. to the foot model of H.M.S. "Hood," made by Bassett-Lowke, Ltd.

Figs. 1 and 2.—Two views of the model T.B.D. made by the boys of Cartmel C. of E. School, Grange-o'-Sands.

It was decided to make the hull bread-and-butter fashion, and eight planks 4ft. 3in. by 5½in. by ¾in. of gaboon mahogany were obtained. The sheer plans were transferred to card templates—a fine exercise in technical drawing—and a start was made on the hull. The work was divided among the boys, some transferring the drawings to the planks, others doing the necessary end paring, while others learnt to use a power fret-saw in taking out the surplus wood. Only one plank was spoiled, and the mistake in drawing which caused this was not repeated. The cutting of the various sections occupied the handwork lessons (1½ hours weekly) and a good deal of spare time after school for some six weeks, when the boys were very thrilled to see that they fitted together perfectly. They were then glued with waterproof glue, screwed together and left for a week. The process of smoothing and final shaping took a further week.

Odds and Ends

By this time several large boxes were filling with junk of various kinds—old dismantled wireless parts, tins, three-ply bits, pieces of bakelite, perspex, wire of all kinds, bits of brass rod, dowelling, an old alarm clock, cotton reels, meat skewers, beads; these, together with a supply of solder, flux, an electric soldering iron, Durofix, cellulose enamel, various files, a bench drill, an old dental foot drill, pliers, a flat iron and panel pins, comprise the materials with which the model was made.

Fig. 3.—Model " Victory" ship photographed realistically by the Carlton Studios, London. Scale 1/200th actual size. Pacific camouflage.

The various parts to be made were allotted to small groups of boys, to be finished in their own way, and judged by all of them as to suitability for inclusion. Several parts were made five or six times before they were pronounced satisfactory. One group took three weeks to make the larger of the funnels, but by this time they had mastered how to draw the development, to deal with tinplate and to solder neatly.

The motor was made from a magnet from an old Bosch magneto, with an armature from a 6 v. rotary car horn. The biggest job for this group was the laborious filing out (from two solid pieces of mild steel) of the tunnel. Eventually, however, they were rewarded and spurred on by seeing it revolve briskly in the tunnel, using temporary brushes, and a 6-v. car battery.

The propeller shaft, a motor-cycle wheel spoke, was lapped to fit a piece of tubing from an old Pyrene fire extinguisher, making a very effective stem tube. The propeller itself was built up from sheet brass, and hexagon nuts, involving careful use of a hacksaw, and tinsnips, and the process of sweating with a petrol blow-lamp.

The deck and fittings presented few real difficulties, but needed patience and ingenuity. The one feature of interest is the working model of a searchlight, with an American 3.5 v. spotlight bulb, and reflector, built into a gimbal mounting on a tripod, whose top platform was a worn halfpenny. The capstan serves as the starting switch.

The two boats were plank built, as a result of many experiments in carving, all of which ended with a perforated hull.

The rigging is wire and strong linen thread, with minute brass wire eyelets piercing the deck. The port holes are boot eyelets sunk in the wood. The bridge is built up from tinplate, soldered and bolted to the deck. Its windows are microscope cover-slips cemented with Durofix.

The bollards and ventilators were cast in type metal, and the ventilators bored out and finished with penknives. They are pinned to the deck, which is of three-ply, in three sections, two of which are removable to give access to the motor and the batteries.

Painting presented the next problem. They wanted to mix their own, and also required cellulose enamel. Eventually three small pots were forthcoming—one red, one black and one white—and with these and a small quantity of amyl acetate, the Admiralty grey was achieved.

The hull was given five coats of paint, being carefully sandpapered between each coat. The deck fittings were sprayed, using an old scent spray and a car foot pump.

When the batteries—three 2 v. Varley dry-type accumulators—were with great difficulty obtained, the boat was taken to the nearby beck, where it drove against the current, splashed so much that it became half-full, and was taken out and trimmed afresh. After this, it was taken to a smooth weed-free pond, where it lapped continuously at 1.34 m.p.h. for two hours, and never shipped a drop of water.

The batteries will actually give a run of 2½ hours without recharging.

To me this is a very good example of the way in which an extremely wide range of skill can be cultivated on a problem of common interest, and I feel that it has been of definite educational value. Particularly is this so when the shortage of conventional handwork material is so acute. It has further stimulated the boys to engage in constructive hobbies in their spare ttime. It was better that they chose a boat rather than, say, a model aeroplane, as boys of this age—11 to 14—would have great difficulty, with the equipment available, in making an aeroplane which would fly, whereas they were more or less certain that a boat would at least float, and probably move in the water. Improvements then naturally follow. The character training involved in sticking to this project until its completion—in 10 months—was not inconsiderable.

Model " Liberty " Ship

With the great strides made in prefabricated shipbuilding in the U.S.A. during the war, various new types of cargo ships have appeared under names like the " Liberty " and " Victory " ships.

Fig. 3 shows a model of this kind of vessel featuring the rapid cargo-handling equipment which is a big point on their efficiency. It has often been necessary to load and unload ships like this without the assistance of complicated dock-gear, and in shallow water.

The model is shown with Pacific camouflage, and is 1/200th actual size, which is slightly less than 1/16in. to the foot. It is one of several ships modelled for the Japtor exhibition sponsored for the Ministry of Information.

Those interested in model photography will notice the sea is formed by ripple glass, which, with the addition of strong back lighting, gives a very striking effect. The picture is by the Carlton Studios, London. As a contrast is the straight picture, Fig. 4, showing model shipbuilders putting the finishing touches to the 3/16in. to the foot model of H.M.S. *Hood*, made by Bassett-Lowke, Ltd., for the British Empire Exhibition at Glasgow.

Destroyer's Model Yacht Club

MEN of one of H.M. destroyers have their own model yacht club. The commanding officer of the destroyer is the commodore, and the models are all constructed by members of the ship's company. One of their notable model yacht races was held at Bizerta, a few hours before the ship took part in the landings at Salerno.

Members of the crew overhauling their model yachts on the fo'c'sle of their ship.

QUERIES and ENQUIRIES

A stamped, addressed envelope, three penny stamps, and the query coupon from the current issue, which appears on back of cover, 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.

Removing Scale from Hot-water Pipes

CAN you please inform me if there is a practical method of removing scale from the inside of the pipes of a domestic hot water system other than breaking down and reamering?

The pipes in question are from the heater located behind the grate to the hot storage tank.

Access can easily be made to both ends of the pipes, which are 1in. diameter wrought iron.—A. Halliwell (Chislehurst).

THE only means of removing pipe scale is by the use of some "boiler compound," all of which materials are based upon caustic soda. Caustic soda solutions have the property of dissolving away the scale. The problem in your instance is to get the caustic soda into the boiler water. We can only suggest that you place a quantity of the soda into the supply tank of your hot water system, and allow it to dissolve itself slowly. Owing to the possible action of strong caustic soda solutions upon the jointing compounds used in your pipe system you should take care not to have too great a concentration of caustic soda in the system. About 2 ozs. of the caustic soda to every 15 or so gallons of water is ample. The treatment should be repeated several times at intervals of a few days. It is not likely that this treatment will remove all the scale, but it will certainly remove some of it.

Colouring of Metal: Etching Glass

I WOULD be pleased if you would enlighten me on the following queries:

(1) How can I colour steel, copper and brass by some chemical method? I believe a good range of colours can be obtained by a certain oxidising process. I require permanent colours, including green.

(2) What kind or kinds of acids do I require for inscribing glass, and how do I carry it out?—Dawson (Portsmouth).

(1) COPPER and brass can be stained permanently any colour from light brown to blue black by immersing them in a sulphide solution. This solution can be prepared by boiling up equal quantities of lime and sulphur in a pan for about half an hour. The liquid is cooled and filtered. The filtered liquid is added to cold water at the rate of about 1 oz. of the liquid to 1 quart of water. The brass or copper articles are immersed in this liquid for colouring. The time of immersion varies from a few seconds to a few minutes, depending upon the precise shade and depth of the colour desired. The solution can be used stronger if desired.

Steel can be coloured blue black by placing the objects of this metal in a bath of molten sodium nitrate (temperature 700–800 deg. F.) for two or three minutes, or, alternatively, by immersing the steel objects for 15 minutes in the following solution:

Copper sulphate, $\frac{1}{2}$ oz.; iron chloride, 1lb.; hydrochloric acid, 4 ozs.; nitric acid, $\frac{1}{2}$ oz.; water, 1 gallon.

After immersion in the above bath allow the objects to dry out for several hours. Then repeat the process.

Green colours cannot be obtained satisfactorily upon steel, but they can be produced on copper or brass by simple immersion of the articles in either of the following baths—the second bath being the better of the two:

Bath 1.—Ammonium chloride 25 per cent. solution, 50 parts; ammonium carbonate 25 per cent. solution 50 parts.

Bath 2.—Copper sulphate, 8 ozs.; ammonium chloride, 4 ozs.; sodium chloride (common salt), 4 ozs.; zinc chloride, 1 oz.; acetic acid, 2 ozs.; water, 1 gallon.

The addition of 1 oz. glycerine to the above bath is said to improve the evenness of the green colour produced on the metal, but the use of glycerine is not essential.

Give the articles several immersions in either of the above baths, drying out thoroughly between the successive immersions, which latter should be each of about one hour's duration. The green colour develops on exposure to the air during the drying periods following the immersion.

A special bath for producing bright green on brass is:

Iron nitrate, 2 ozs.; photographer's hypo, 8 ozs.; water, 1 gallon.

Use this solution *boiling*, and immerse the articles of brass in it for 15 minutes. The solution is not very effective with copper articles.

(2) In order to etch glass you require to use dilute hydrofluoric acid. A film of wax or varnish is spread over the glass, and, when dry or set, the desired lettering or pattern is inscribed on the film with a sharp stylus. Dilute hydrofluoric acid (1 part acid, 4 parts water) is then spread over the lettering or pattern and allowed to act for about 10 minutes. After this time the acid is washed away with water, and the wax or varnish film removed. The lettering or design will be found to have been permanently etched into the glass.

You should note that hydrofluoric acid is a very dangerous chemical to handle. Since it dissolves glass, it has to be contained in lead or cerosine bottles. If dropped on to the hand the acid sets up painful sores. The acid can be obtained from any firm of chemical wholesalers; as, for example, Messrs. Harrington Brothers, Ltd., Oliver's Court, City Road, London, N.1.

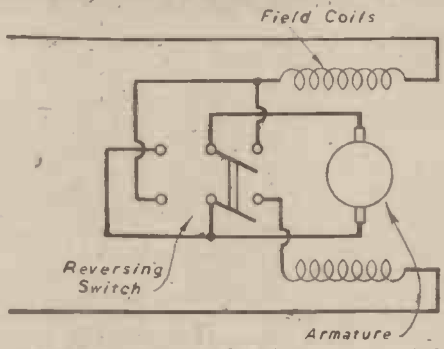
Much commercial glass engraving is done nowadays by sand-blasting processes, not by hydrofluoric acid engraving.

If you cannot obtain hydrofluoric acid you can make use of the corrosive vapours given off by heating a mixture of concentrated sulphuric acid and powdered fluorspar. This gives a similar etching effect, but the method is less positive.

Reversing an A.C. Motor

I HAVE an A.C. 20-volt electric motor and I wish to reverse it. Could you please tell me (by diagram, if possible) how to reverse it electrically? It has three coils on the armature.—B. F. C. Larke (Birmingham).

PRESUMABLY the motor is a series machine and it may have one or two field coils. Such a motor can be reversed by reversing the current through the armature, which may be done by means of a double-pole two-way switch as indicated in the diagram.



Connections for a double-pole two-way switch for reversing an A.C. motor.

You may find the motor runs better in one direction than the other, if so, this indicates the brushes have been fixed a little back from the neutral position, and you may be able to obtain equal running in both directions by moving the whole of the brushes about 16 degrees forward in the original direction of rotation.

Silver- and Gold-plating Baths

CAN you tell me how to make up the baths for silver- and gold-plating, as I wish to silver and gilt some small brass and copper articles? If possible, can you give me the price of materials, and where I am likely to obtain them?—E. R. Stroud (Battersea).

THE following is a good silver-plating bath:

(A)	Silver nitrate	2.5 grams.
	Potassium cyanide	2.8 grams.
	Water	50 ccs.
(B)	Potassium cyanide	7.5 grams.
	Water	177 ccs.

Mix the above solutions. Use a silver strip anode, the article to be plated being the cathode. Operate the bath at a temperature of 77 deg. F. and plate for half hour at 1 to 1.5 volts.

A suitable gold-plating bath is as follows:

Gold chloride	6 parts (by weight).
Hydrochloric acid	10 parts.
Water	100 parts.

Work this bath at room temperature, using a gold anode, at 2-3 volts. Gold chloride is very expensive, costing about 5s. per 15 grains. Silver nitrate costs about 3s. per oz. Potassium cyanide is cheap, but is extremely poisonous and you may not be able to obtain it.

Your best plan is to use ready-made plating salts, which, we understand, can be obtained from Messrs. W. Canning and Co., Ltd., Great Hampton Street, Birmingham, 18. Another firm of suppliers is Messrs. R. Cruickshank, Ltd., Camden Street, Birmingham, 1.

Cellulose Varnish

CAN you supply me with a formula for a good cellulose varnish or lacquer for brushing on to polished metal parts (steel and brass)? It is essential that it should have a good high gloss and dry hard.

Would a mixture of amyl-acetate and acetone serve as a solvent—if so, in what proportions?—D. V. Duyen (London, N.).

QUITE a good cellulose varnish may be made by dissolving scrap celluloid in a mixture of equal parts of amyl-acetate and acetone. To each half-pint of the resulting solution add about 5 drops of castor oil in order to "plasticise" the varnish, i.e., in order to render it more plastic and less liable to cracking or peeling.

The proportions of the two solvents can be varied somewhat. If more acetone is used, the varnish will be quicker drying, but, unfortunately, if it is allowed to dry too quickly, it will tend to dry with a dull film. Hence, any semblance of dullness should be counteracted by increasing the proportion of amyl-acetate in the mixture.

Acetone is extremely difficult to get hold of at the present time. In place of the acetone-amyl-acetate mixture you can, however, use cellusolve, which is a clear, almost odourless liquid. It costs about 3s. 6d. lb. from Messrs. A. Boake, Roberts and Co., Ltd. (Emergency address), "Ellerslie," Buckhurst Hill, Essex.

The metal parts must, of course, be quite free from dirt and grease. The varnish is best flowed on to the parts, which are then hung up to dry in a dust-free situation. Glassware and pottery can be varnished in the same way, also.

Modelling Clay: Duplicating Ink

I SHALL be glad if you will give me the composition of modelling clay, such as children use. How is it made? What is the formula for making ink for a duplicating machine?—Thos. Hill (Bury).

I—MODELLING clays are usually made to secret formula. They are, however, in most instances, mixtures of china clay, sulphur, pigment and a suitable grease. Here is a formula which you can work to with good results:

(a)	China clay or kaolin	67 parts (by weight)
	Flowers of sulphur	33 „
(b)	Wool fat or lanoline	60 parts (by weight)
	Glycerine	40 „

Take a quantity of the mixed china clay and sulphur and incorporate with this sufficient dry pigment (red oxide, ultramarine, green oxide, etc.) to colour it to the shade required. Then work the resulting dry mixture into the "grease" made by mixing wool fat and glycerine. The "grease" will be found to absorb a very considerable quantity of the dry pigment mixture, and the latter must be added to the "grease" in small amounts at a time until the right consistency and plasticity of the final product is obtained. The job is one which calls for a good deal of kneading, and considerable pressure must be used to work the mixture together. The function of the sulphur is to act as a preservative and antiseptic to stop bacterial and mould growth.

2. Duplicating inks vary somewhat according to the exact nature of the duplicating process for which they are to be used. A standard formula for an ink of the "stamp pad" type is the following:

Aniline dye	3 parts (by weight)
Water	15 „
Alcohol (surgical spirit)	15 „
Glycerine	50 „

If an oily ink is required, the following formula may be used:

Oil soluble aniline dye	2 parts
Oleic acid	3 „
Castor oil	20 „

Dyes for the above purposes may be obtained from Messrs. J. W. Towers and Co., Ltd., Chapel Street, Salford.

Reducing Speed of A.C. Motor

I HAVE an electric gram-motor (Universal 100-250 v.) which I would like to run at a speed of 320 r.p.m.; at present it runs at about 4,000 r.p.m. Can you please tell me the kind and length of resistance wire I shall require to cut down to this speed; also where I can buy it? I am running the motor from a 230 v. A.C. supply and it is about ¼ h.p.—E. Dransfield (Barnsley).

THE speed could be reduced by means of a series resistance, but it should be understood that, as the safe full load torque of the motor is practically constant, the safe full load horse power will be reduced in at least the same proportion as the speed. The actual speed will depend on the load. We suggest you use about 230ft. of 39 s.w.g. Ferry resistance wire as manufactured by Henry Wiggin and Co., Ltd., of Grosvenor House, Park Lane, W.1. The full load speed can then be adjusted as required by varying the length of resistance wire in circuit.

Wear on Records : Graphite Lubricant

WILL you please tell me the composition of commercial gramophone records, with suggestions concerning a lubricant to minimise wear of groove walls, without deleterious effect?

I use a light-weight pick-up, yet wear on present-day recordings is appreciable.—H. Gellatly (Worthing).

THE precise composition of gramophone records has invariably been maintained a close secret. They are, however, complex mixtures of shellac, carnauba and other waxes, inert fillers and metallic stearates. Modern records sometimes make use of synthetic resins.

The only practical lubricant which you can use on the surface of your records is very finely-powdered graphite or plumbago, which you should be able to obtain from any good gramophone shop, or direct from The Gramophone Exchange, Shaftesbury Avenue, London, W.C. Alternatively, this material can be obtained from a firm of chemical suppliers, as, for example, Messrs. Harrington Brothers, Ltd., 4, Oliver's Yard, 53A, City Road, Finsbury, London, E.C.1.

Despite statements to the contrary, there is *always* record wear when steel needles are used. The whole solution of your record wear lies in the use of fibre needles which do not scratch records and which do not wear them. If your pick-up will not accommodate a fibre needle, you can obtain a pick-up adaptor to take such needles from the gramophone concern above mentioned. Alternatively, you could use "thorn" needles, which have round shanks and which fit into any ordinary pick-up or sound box.

Adhesive Patches for Clothes

I BELIEVE that there is some sort of adhesive with which patches may be put on clothes without stitching. Can you give me any information about this, please?

I particularly want to stick strips of chamois material round the worn edges of the pockets of a raincoat—not a rubber one.—G. Holloway (Runcorn).

THE adhesive which you mention usually consists of finely powdered silica mixed with rubber latex, but, unfortunately, as rubber latex is at present unobtainable, it seems useless for you to pursue this matter further.

We see no reason why you should not be successful in applying ordinary zinc sticking-plaster for the purpose which you have in mind. Such repairs might possibly be effected without the sticking-plaster being rendered visible. If this suggestion is not acceptable, then your only recourse is to make the sticking-plaster adhesive yourself. The following is a suitable formula for this purpose:

Olive oil (*not* substitute) ..	10 parts.
Lead oxide (litharge) ..	4 parts.
Water	2 parts.

Keep the ingredients gently simmering for about 6 hours by means of a steam bath. Stir constantly until the mixture thickens up. Then add sufficient zinc oxide to colour it white. Store it in shallow screw-capped jars.

The above composition, if carefully made, is extremely sticky and tenacious, and since it does not in any way affect or deteriorate cloth or other fabric, we think it would serve your purpose.

Priming Paint : Black Crackle Finish

I SHALL be glad if you will supply me with the following information:

(1) The name and composition of the material used as a primer, or filler, preparatory to painting or enamelling mc/s, castings, etc.; also the name and address of firms from whom supplies may be obtained.

(2) The material or paints used, and method employed to obtain the black crackle finish so often seen on small tools.

(3) The title of any book or books you can recommend dealing fully with the above subjects. —A. F. Ruddy (Southgate).

ANY firm of colourmen or wholesale paint suppliers will be able to supply you with suitable primers for your purpose. These are often composed of white or red lead, slate flour, barytes, or one of the many forms of iron oxide. All these materials may be obtained from any large paint dealers.

(2) Black crackle finishes are obtained on surfaces which have been painted with cellulose enamels or paints by incorporating with the lacquer a "crackle base," which consists essentially of a solution of a metallic soap. A suitable crackle base is the following:

Aluminium stearate ..	25 parts.
Ethyl acetate	75 parts.

Dissolve the stearate at a temperature *not exceeding* 40 deg. C., otherwise the stearate may set to an insoluble gel.

This crackle base is added to the black cellulose lacquer in the proportion of 2 of lacquer to 1 of base. The mixture is then sprayed or painted on to the articles, which are then dried in a gentle heat. If the paint requires thinning, use ethyl acetate for this purpose, since this produces a quicker rate of drying which latter favours the production of "crackle."

(3) You require a modern book on paint technology, such as N. Heaton, "Outlines of Paint Technology"; F. Sproxton, "Cellulose Ester Varnishes"; A. E. Robinson, "Application of Cellulose Lacquers and Enamels."

All of the above might possibly be obtainable on loan through your local library. For secondhand copies, you might also try Messrs. W. and G. Foyle, Ltd., Charing Cross Road, W.C.2.

Charging Circuits

I HAVE a ½ b.h.p. motor, A.C., single-phase, revs. 1,450, rating continuous 2.9 amps., run on the power supply at 1d. per unit.

I wish to connect a dynamo to it to charge small wireless accumulators of 2 volt, 40 amp. type. I should charge about 10 at a time. What I would like to know is, would it pay to run the motor for this purpose? Also, would a 12-volt car dynamo do, or could you suggest a suitable one?

Could you give me a diagram for a charging circuit?—S. Shorter (Hyde.)

YOU could charge 10 2-volt accumulators of the type mentioned from the 12-volt car dynamo; the accumulators being connected in two parallel sets of five accumulators in series. The dynamo would be driven at a practically constant speed, and the third brush could be removed, the shunt field coils being connected across the main brushes in series with a regulating resistance used for control of dynamo voltage and charging current. Assuming you are to charge the 40-a.h. accumulators on a 10-hour rate, you would require a dynamo capable of giving 8 amps. at about 13 volts, and this could be driven by the ½ h.p. motor mentioned. The total input to the motor during the charging period would be in the region of 3.5 k.w.h., so the total cost of power consumed in charging the 10 accumulators would be about 3½d.

You could use two charging circuits as indicated in the diagram. Circuit X could be used for accumulators requiring about 5 amps. current with a variable resistance of 0 to 3 ohms capable of carrying 5 amps., whilst circuit Y could be used for accumulators requiring 0 to 5 amps. controlled by variable resistance of about 0 to 6 ohms capable of carrying up to 5 amps. In this way the charging circuits can be independently controlled.

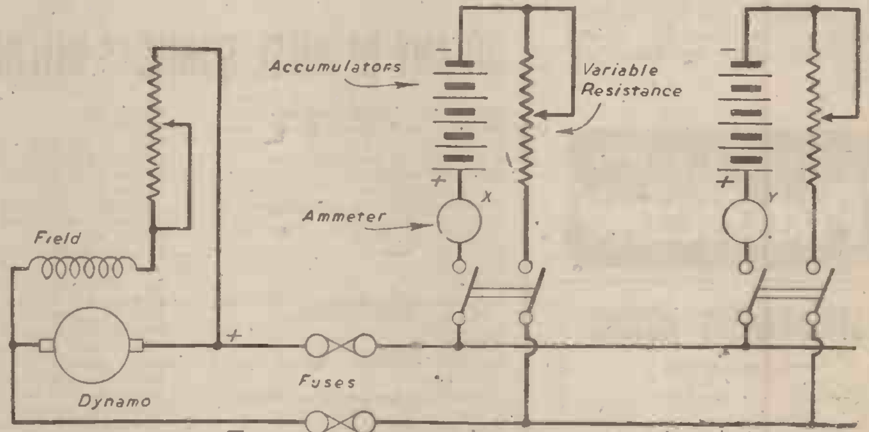


Diagram of two charging circuits with independent control.

Recoating a Cinema Screen

I HAVE a section of a cinema screen. It is of rubberised fabric and the surface has become soiled. All attempts to clean it have failed and I would like your advice. I wish to coat the surface again to get a pure matt white effect. Could you advise me what kind of paint to use, the method of application, and where materials needed may be obtained?—W. G. McKendry (Glasgow).

YOU do not say whether your cinema screen is of the portable, folding type, or whether it is one which is permanently in position. For your purpose, however, you require a flat, oil-bound distemper of a white colour. A distemper containing a titanium white would be the most suitable, since this has a high degree of reflectivity. Such material may be difficult to obtain these days, and we can only suggest that you make inquiries from Messrs. Macpherson, Ltd., Paint Manufacturers, Manchester, or from the well-known Walpamur Company, Ltd., Darwen, Lancs. Possibly, also, Messrs. Lewis Berger and Sons, Ltd., Morning Lane, London, E.9.

You could also use one of the white flat *oil* paints manufactured by the United Paint Co., Ltd., 73, Bishopsgate Street, London, E.C.2.

Solution for Watch-Cleaning Machine

I HAVE constructed an electrically-driven watch-cleaning machine of the rotating basket type, in which the watch parts are contained.

I should be grateful for any information you can give on the solutions used in these machines. Also, if there are any other types of watch-cleaning machines used, and, if so, what principle do they work on?

Can you also supply me with the addresses of the makers of these machines?—W. L. Harvey (Swansea).

YOU can use ordinary carbon tetrachloride as a watch-cleaning fluid for removing grease, etc., but a fluid having a more detergent action is usually preferred. Such a fluid is made as follows:

Solution A.—Dissolve 1 oz. oleic acid in 1 quart water (hot).

Solution B.—Add 4 ozs. household ammonia to 1 quart of water. Add 2 ozs. acetone. Bring solution just to the boil, and then slowly stir in solution A, prepared as above. Stir the mixed solutions until uniform. Then store in clean bottles.

Watch-cleaning machines all operate on principles similar to that to which you refer in your letter. Such machines can normally be obtained from any of the following firms: Messrs. S. Lanzetter, 35, New Brown Street, Manchester; Messrs. E. Gray and Son, Ltd., 18-20, Clerkenwell Road, London, E.C.1; Messrs. A Short and Co., 85, High Street, Whitechapel, London, E.1.

"Hand Jelly" : Photo Developer Solution

WILL you please answer the following two queries:

(1) Could you suggest a formula for a "hand jelly" based on ingredients other than tragacanth? I require a jelly which will rub in well.

(2) Should photographic developer chemicals be dissolved in hot or cold water? I have a packet of developer chemicals which have to be dissolved in 8 oz. of water, but I am not certain whether the chemicals should be dissolved in hot or cold water.—W. E. Savidge (Blackpool).

(1) YOU do not inform us of the precise purpose for which you wish to use a "hand jelly." However, we assume that you require such a preparation for protective use, in which case the following material, which does not include gum tragacanth in its make-up, will suit your needs:

Gum arabic	20 grams.
Best white soap	80 grams.

Soak the above materials in a little water until the gum swells up. Then heat and stir until the soap and the gum are dissolved. Cool and finally add water, little by little, until the required consistency is obtained.

(2) Photographic chemicals may be dissolved in either hot or cold water. Usually, however, it is better to dissolve them in cold water, since, at the higher temperature of the hot water, the solutions are liable to oxidise and thus to deteriorate.

Cementing Solution for Microscope Slides

WILL you please give me the formulæ for setting and cementing solutions for making permanent microscope slides of some timber sections which I have made?—J. Kennett-Page (Guildford).

WE take it that you have mounted your timber sections dry, in which case a satisfactory ringing cement to hold the cover-glasses down on the slide consists of a thick solution of shellac in methylated spirit. Alternatively, a solution of bitumen in benzene may be employed, although this is sometimes apt to spread and stain the specimen.

Another good cement is celluloid varnish. Use the thick variety, which is sometimes to be had from large stores. Alternatively, make it yourself by dissolving scrap celluloid in a mixture of equal parts of acetone and amyl acetate (or butyl acetate).

Gold size makes an excellent cement, but it is slow drying.

Use all cements in the thick state. If they are used thin with a dry-mounted specimen, they are apt to be drawn under the cover-glass and to stain the specimen. Thick solutions, however, will not do this.

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Phone: Temple Bar 4363
Telegrams: Newnes, Rand, London

Comments of the Month

By F. J. C.

A Massed-start Critic Answered

THE following paragraph, written by G. H. S., recently appeared in a cycling journal:

". . . The massed starters . . . made representations to the Home Office and the Ministry of Transport with a view to putting massed-start racing 'officially' on the map, and this naturally led to similar approaches being made to the authorities by opponents of the sport; hence the present imbroglio."

This statement, briefly, means that the B.L.R.C. was the first to approach Government Departments, and that the N.C.U. and the R.T.T.C. were compelled to take defensive measures. It is not surprising therefore to find that an official of the B.L.R.C. "*indignantly declares that I (G. H. S.) am guilty of a deliberate misstatement.*"

This official points out that the B.L.R.C. did *not* approach the Government in the first place. The comment of G. H. S. is: "*well, nobody has yet suggested that it did.*" If the original paragraph does not mean that the B.L.R.C. set the ball rolling, what does it mean?

G. H. S., in his original paragraph accusing the B.L.R.C. of being the aggressors, makes no reference to "supporters" of the B.L.R.C. Now note his justification: "*The B.L.R.C. is in the curious position of having a number of keen supporters who, for reasons best known to themselves, prefer not to become members of that body. Their sympathies are with the League, but their attitude is one of non-belligerency. Such persons were, to my knowledge, in contact with the Home Office before any approaches were made from the opponents of massed start racing.*"

Why the B.L.R.C. should be considered as being in a "curious" position because it has supporters who are not members is even more curious. One would have thought that there is no better support than that obtained from those who are quite impartial. Are all opponents of massed-start racing, and therefore supporters of the N.C.U. and the R.T.T.C., members of those two bodies?

We ask G. H. S. to name those "supporters" who "to his knowledge" were in contact with the Home Office. It is observed that he does not give any evidence in support of his statement, and to *our certain knowledge the first people officially to approach any Government Department on this controversial topic were the N.C.U. and the R.T.T.C.* It is just fatuous to suggest that anyone would want to get massed-start racing officially recognised, for such recognition is not necessary, as it is quite legal. *The position is that the two rival bodies, for obvious reasons, wished to get it banned.* It is perhaps unfortunate for them that we were able to unearth the damning fact that they had endeavoured to do so.

Had they not made the initial approach to the Government the latter would not have interested itself in the matter at all. G. H. S. goes on: "*The point is not of any particular importance, however, for the real mischief was done at an earlier stage. The police were brought into the sport as soon as the misguided scheme was launched (by insisting that) no massed start race should be held in any circumstances without the approval and co-operation of the police in the locality.*"

This is a further piece of inverted reasoning, for cycling clubs which promote time trials often give prior intimation to the police of important cycling road races. Even the M.C.C. which runs the famous motor cycling road trials always does so.

The curious fear G. H. S. and others seem to have of the police force, because 50 years ago they persecuted cyclists, is difficult to understand in these enlightened times. The police are far too busy in peacetime trapping motorists to bother about cyclists. The police were wrong 50 years ago, so why continue to adopt the hole-and-corner methods of present road sport, and thus lead them to believe that they were right? The methods adopted to keep cycling sport secret suggest that time trialists are breaking the law, and indulging in a sport of which they ought to be ashamed.

If the national body of the time, the N.C.U., had not caved in to the attitude of the police, but had defended cyclists against the malicious persecution to which they were subjected, instead of abandoning road sport and road records, things might have been different today. We, however, do not intend to encourage this furtivity which seems to permeate cycling sport and cycling politics.

The facts, we repeat, are as follow: After the Home Secretary's note to the Chief Constables in September, 1943, to the effect that massed-start racing was "undesirable," the B.L.R.C. approached the Home Office and the Ministry of War Transport asking that the League side of the case be heard. This request was granted, and on December 8th, 1943, a deputation comprising Mr. W. J. Mills, Mr. J. Kain, and the Editor of this journal were received by the M.O.T.

Three important facts emerged from that meeting:

1. No complaint had been received by the police or from the police concerning massed-start racing.
2. No complaint had been received from any member of the public.
3. *The only complaint against massed start racing had come from the N.C.U. and the R.T.T.C.*

Noel Baker at the Roadfarers' Club

MR. P. J. NOEL BAKER, M.P., Parliamentary Secretary to the Ministry of Transport, recently addressed members of the Roadfarers' Club, and explained the Government post-war road policy, as outlined in the Interim Report, with which we dealt last month. The president, Lord Brabazon of Tara, was in the chair, and guests included Sir Alker Tripp, an expert on traffic problems, and many others representative of various road interests.

Mr. Noel Baker made it clear that all road users would have to make sacrifices now that the war in Europe is over in order to make the roads safe, and he gave no promise that any particular section of road users were to enjoy immunity from regulations.

Roadfarers' Club Memorandum

THE Memorandum On the Design and Layout of Roads in Built-up Areas, submitted to the Ministry of Transport by the Roadfarers' Club, has recently been published, and copies may be obtained for a 2½d. stamp from The Secretary, The Roadfarers' Club, 50, Pall Mall, London, S.W.1.

Our Census

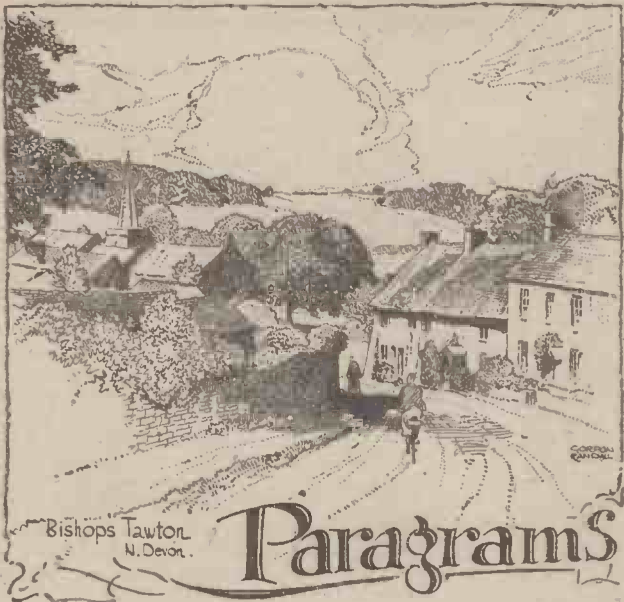
APROPOS our invitation in last month's issue to C.T.C. and N.C.U. members to state whether they are or are not in favour of rear lights we have to date received 53 replies. Not all of them have stated whether they are members of these two bodies, but of the 53, 38 are in favour of rear lights, and 15 against. Of those against only two quote their C.T.C. membership numbers. They are Mr. E. J. White, C.T.C. membership No. 318, and Mr. W. R. Harris, membership No. L3987.

"The Wheels of Chance"

H. G. WELLS'S famous cycling novel "The Wheels of Chance," which was first serialised in this journal just before the war, was recently broadcast as a radio play. Dealing, as it does, with the real roads and inns of Surrey, we have always enjoyed this novel, but we think it makes better reading than as a play. As far as we have been able to trace, Wells did not write any other cycling novel, although he did write one short story entitled "A Perfect Gentleman on Wheels," which appeared in a collection of cycling stories entitled "Cycling Humour," published by Chatto and Windus. The last edition—the fifth—appeared in 1905, and this volume contains stories by J. K. Jerome, A. A. Lawrence, Barry Pain, and many others.

Note to Cycling "Historians"

THE copyright of H. H. Griffith's famous book on the History of Cycling originally published by George Bell and Co., Ltd., was purchased by the proprietors of this journal just before the war. Those who write articles on the history of bicycles are reminded of this fact, and that extracts may not be made from it either in articles or in broadcast talks without the special permission of the Editor of this journal.



Lengthy Service

S. HARNIMAN has been elected hon. secretary of the Comet Cycling Club for the 41st consecutive year.

Twice Decorated

F/O R. L. C. LASHAM, Crouch Hill and Finsbury Park Clubs, has been awarded a bar to his Distinguished Flying Cross.

Fine Ride

V. DIGHT, Somerset Road Club, did a fine ride to win the Adriatic Wheelers "25" in 1 hr. 6 mins. 21 secs. It was the first event of its kind to be held by the club in Italy.

Upton Manor's Coming of Age

THE Upton Manor C.C., comes of age this year. It is holding an Open 50-mile fixture to celebrate the occasion.

Another Forces Club

THE latest club among the Forces is the Star Road Club which operates in the Forli area of Italy.

Southgate Man Returns

"BOB" ACUTT, Southgate C.C., has returned from a German prison camp. He had been in captivity since the fall of Tobruk and previously was reported missing following the evacuation from Greece.

Killed in Action

SERGEANT PILOT L. HAYES, South Western Road Club, has been killed in action.

Cakebread Returns

AMONG the many liberated cyclist prisoners of war is Flight Engineer John Cakebread, Finsbury Park C.C., who owes his release to the Soviet Forces.

Nearing the 1,000

IT is stated that membership of the Buckshee Wheelers is almost 1,000.

Highgate Jubilee

THE Highgate C.C.'s 100-mile event this year will be the 25th consecutive event.

Seeing the World

DENNIS CLAMP, Doncaster Wheelers, now serving with the Forces, has seen service in Africa, Italy, Palestine, Belgium and Germany.

S. A. Orrell Killed

S. A. ORRELL, well-known member of the Norwood Paragon C.C., has been killed in action.

"Ching" Allen Home

AFTER over four years' service in the Middle East, during which period he was mentioned in despatches, "Ching" Allen, noted member of the Norwood Paragon's National Polo Championship team has made contact with his club at home.

Looking Ahead

BOURNEMOUTH ARROW C.C., progressive Hampshire Club, are specialising in encouraging youthful members.

Wounded

GEORGE CARRIER, Wolverhampton City C.C., was seriously wounded while serving in Germany.

Wedding Bells

MISS GRACE STIRLING, Rickmansworth C.C., has married the club's hon. gen. sec., D. S. Moor.

Notts Castle Loss

J. H. SCOTHERN, president and founder of the Notts Castle C.C., has died.

Alex Taylor's New Post

ALEX TAYLOR, chairman of the Scottish Amateur Cycling Association, has been appointed organising secretary of the Glasgow and District Co-operative Youths Clubs.

Midland Defence Association

A MOVE is afoot to form a Midland Cyclists Defence Association.

Camden Wheelers

ALTHOUGH 75 per cent. of its members are in the Forces, the Camden Wheelers are still carrying on. The secretarial work is being undertaken by T. G. Jacoby—a discharged ex-Serviceman.

Fred Stock Dies

FRED STOCK, well-known Hampshire trader and rider, accidentally lost his life while boating. He was a member of the Portsmouth C.C. and of the Charlotteville C.C.

More Hostels

THE Devon and Cornwall Group of the Y.H.A. has opened several new hostels.

Three Years a Prisoner

AFTER being in German hands for over three years, Fred Gilham, Wisbech C.C., is home. He was released by Soviet Forces.

Meeting in Rome

TWO members of the Wisbech C.C., P. Percival and G. Taylor, met each other in Rome.

Manchester Race Track

PLANS are in hand for a £35,000 indoor stadium at Manchester.

Broad Oak Man Home

LAC CHARLES BROUGHTON, Broad Oak C.C., who formed the Canal Roads Club—a Middle East organisation—has returned to this country.

Archer R. C. Wedding

DORIS MARRABLE, Rickmansworth C.C., and William Perryman, Archer Road Club, have married.

Lost over Hamburg

D. FORBES, a rear gunner in a R.A.F. Lancaster, has been reported missing following a raid over Hamburg.

Leicester Loss

SERGEANT FRANK WEBSTER, Leicester Clarion C.C., a Paratrooper of the 6th Airborne Division, has been killed in action. He went to Normandy on "D" Day and was awarded the Certificate of Merit by Field-Marshal Montgomery.

S.C.C.U. Unpaced Handicap

FASTEST times in the 25 miles unpaced handicap organised by the S.C.C.U. on May 6th were made by D. Perrin, Kingston C.C. (1.5.44), R. Waters, S.L.R.C. (1.6.5), and D. A. London, Norwood Paragon (1.6.14).

Bramley Wheelers 25

FASTEST times in the above club event were made by L. Dexter (1.7.52), R. Driver (1.9.50), E. C. Matthews (1.11.27).

B.L.R.C. Handbook

THE B.L.R.C. Handbook for 1945 has just been published and copies may be obtained for 8d. from the Hon. Sec., 24, Disraeli Road, Ealing, W.5. The handbook is attractively produced, and gives, apart from the list of officials, details of the club fixtures and programmes, list of 1944 results, articles by F. J. Camm (Editor of *The Cyclist*), Charles Fearnley, S. Hemmings, P. T. Stallard, Wally Summers and A. H. Clarke. There are some excellent action pictures of B.L.R.C. events.

New Publicity Secretary

MR. R. F. ORGAN, of 27, Kenton Road, Hackney, E.9, has been appointed publicity secretary of the London section of the B.L.R.C. in succession to Mr. R. Boyden. Phone number Amherst 3858.

More Clubs Affiliate

THE following new clubs have recently affiliated to the N.C.U. :—Trinity Youth C.C., Skerne C.C., Westville C.C., Billingham Co-op Youth Club, Harton Wheelers C.C., John Barran C.C., Cyclone C.C., Winbourne C.C., Glacier C.C., Fareham Youth Centre, Wednesbury C.C., Mansfield Road Club and the Enfield and Dist. Y.H.A. Group C.C.

Bicycle Polo Championship

THE Bicycle Polo Association of Great Britain National Championship has attracted an entry of 11 teams. This necessitates a preliminary round of three matches and the draw for this is as follows: South Wales *v.* The Wrens; Rugby B.P.C. *v.* Exiles B.P.C.; Kynoch B.P.C. *v.* Woolwich B.P.C. Match to be played on ground of the first-named club.

East Budleigh Devon. The lovely church dates from the 13th century.

Around the Wheelworld

By ICARUS

Return to Freedom

NOW that the war has come to its inevitable end, and liberated the peoples of Europe, we can look forward to an early liberation of the English! Cyclists, particularly, know what freedom means. Tens of thousands of cyclists gave up theirs to fight and are looking forward to an early return to the joyous freedom of the wheeling fraternity. It cannot be long before the Japanese war is over and we return to the week-ends awheel, a full programme of sporting events, cycle shows, and the annual festive board of pre-war calibre. I hope, too, that when those times arrive we shall be free from the pettiness and the intrigues of those who sought to control the cycling movement for their own ends.

N.C.U. Touring Handbook

THE N.C.U. Touring Handbook for 1945—the third wartime issue—has just been published. It contains a great deal of useful information, and it costs 9d. post free from the N.C.U., 35, Doughty Street, London, W.C.1.

N.C.U. Opening Meet—June 23rd

THE following is the programme for the N.C.U. opening meeting at Herne Hill, on June 23rd, although not necessarily in this order:

Inter-Allied Event. Distance not yet fixed. If travel permits can be arranged, invitations will be sent to continental riders when distance of event is fixed.

10 *Minute Invitation Pursuit Race for Roadmen.*

1½ *Laps Scratch Race for Resmat's Cup.* Service and ex-Service riders.

5 *Miles Scratch Race.*

5 *Miles Course des Primes* for riders not chosen for 5 Miles Scratch.

Ladies' Omnium. 3 miles Pursuit; ½ mile Handicap; 550 yards Scratch.

¼ *Mile N.C.U. National Championship.*

½ *Mile Handicap.*

Four-a-side Match for Juniors, i.e., 4 leaders of Herne Hill and 4 leaders of Paddington Medal Competitions.

N.C.U. Appeals

THE National Cyclists' Union announce that the appeals of Messrs. P. A. Baker and E. H. Seager, of the Lion Road Club, against the sentence of the London Centre suspending these two gentlemen from acting as promoters until December 31st, 1945, was before the Appeals Committee of the Union on Monday, April 30th, 1945. The appellants were represented by Mr. C. S. I. Scott.

After hearing the evidence from all parties concerned, the following was recorded:

"That the appeals of Messrs. P. A. Baker and E. H. Seager be not allowed, and the fees forfeited."

The decision of the committee was unanimous.

Champions at the Albert Hall

ARRANGEMENTS have been made for the presentation of trophies and awards to the Champions and Best All-Rounders for 1945 to take place at a Grand Variety Concert in the Royal Albert Hall, London, in the evening of Saturday, November 24th.

R.T.T.C. Championship Medals

THE design for the Council's medallions has been approved. These will be struck in silver and in bronze, and will bear the title of the particular championship with the Council's initials in the form of a monogram in the centre.

The National Committee has accepted an invitation to be represented on the Central Council for Physical Recreation.

Road Accidents—March, 1945

DURING March, 396 people died and 8,722 were injured as the results of road accidents. The figures show a reduction, compared with the previous March, of 126 in the number of deaths, and of 1,065 in the number injured.

Accidents to adults were fewer during hours of darkness and also during other hours—an encouraging sign of increased awareness of road dangers.

The high accident rate among children unhappily continued, and the total of 115 fatal accidents to child cyclists and child pedestrians was the same as in March, 1944, and in March, 1943. About half the child victims were within the age group of four to six inclusive.

Type of Vehicle.	*Number of Persons Killed.*
Service (British, Dominion, and Allied of the three Services)	81
Civil Defence	1
N.F.S.	1
Public Service and Hackney	89
Goods Vehicles	103
Private Cars	45
Motor Cycles	16
Pedal Cycles	47
Others	13
Total	396

Bicycle Polo Championship

THE National Championship of the Bicycle Polo Association of Great Britain, to be held this year for the first time since 1939, will be very much a wartime competition. Where before the war the championship attracted more than 60 entries, this year the B.P.A. is not expecting more than 16.

Norwood Paragon, who were the champions in 1939, have notified the B.P.A. of their intention of defending their title.

Suggested N.C.U. Journal

I SEE that once again the suggestion has been made that The National Cyclists' Union should publish its own journal. At one time they did publish such a journal but it was a poor effort, and an ignominious failure. The argument in support of such a journal is based on the fact that another cycling organisation having a smaller membership runs its own house journal. The point is overlooked, however, that this house journal runs at a considerable loss; the postage bill alone is an enormous item, for the journal is not distributed through the normal trade channels, but to members only by post.

Another argument is that it enables the N.C.U. to possess a friendly organ which can put its case, for it is often said that the press has been unfriendly. The obvious argument here is that such a journal would only be preaching to the converted, whereas it is to those outside the Union that the appeal should be made.

If such a journal is to be made a success it cannot be run by amateurs. It would need to be produced by a skilled editor, and skilled editors are not cheap. To endeavour to run a journal on the cheap, as was the case with the previous venture, is to court failure.

I record the following facts in connection with this matter. In 1927, when my editorial office was in Maxwell House, Arundel Street, Strand, I accorded an interview to the late Bartleet, the self-styled historian, who wanted me to start a cycling journal. He said that such a journal would have the full support of the N.C.U. I pointed out to him that if a journal was to appeal to the cycling public it would have to be independent, and that we were not prepared to risk our money and to do propaganda work on the nebulous promise of N.C.U. support. I also pointed out that in view of the damage which that body had done to road sport and road records I could not see how a cycling journal would be of benefit to the N.C.U. Of course, Bartleet had no knowledge of the technical side of periodical production.

I rapidly formed the opinion that there was a spiteful attitude behind the suggestion. He was severely critical of a cycling journal and wanted me to run one to fight the N.C.U. battles and apparently to give Bartleet an opportunity of exercising that splenetic and phrenetic pen which made him so many enemies. I turned the proposition down.

When we started *The Cyclist* as an entirely independent journal Bartleet came to see me again, and reopened the discussion on the same lines as hitherto. Again I had to tell him that I proposed to run on independent lines, and asked him whether he was approaching me with the knowledge and support of the N.C.U. He replied in the affirmative, but I did not take the trouble to check the matter as I was not interested in Bartleet's private quarrels. If the N.C.U. does decide to proceed with its journal, I wish them and it well. If they have funds to sink on such a project, that is their affair. As an organ for the distribution of N.C.U. news, it may fulfil a useful function, but more expensively than the present method of distributing such news.

B.L.R.C. News

MR. R. F. ORGAN, of 27, Kenton Road, Hackney, E.9, has been appointed Publicity Secretary of the London Section of the B.L.R.C. in succession to Mr. R. Boyden. His 'phone number is Amhurst 3858.

Services Supporters Club

AT the National Executive Council meeting of the B.L.R.C. held at Holborn Hall on April 22nd it was decided to form a Services Supporters Club in order to cater for the very large number of Services men who regularly write in wishing the League continued success in their fight for the recognition of road sport.

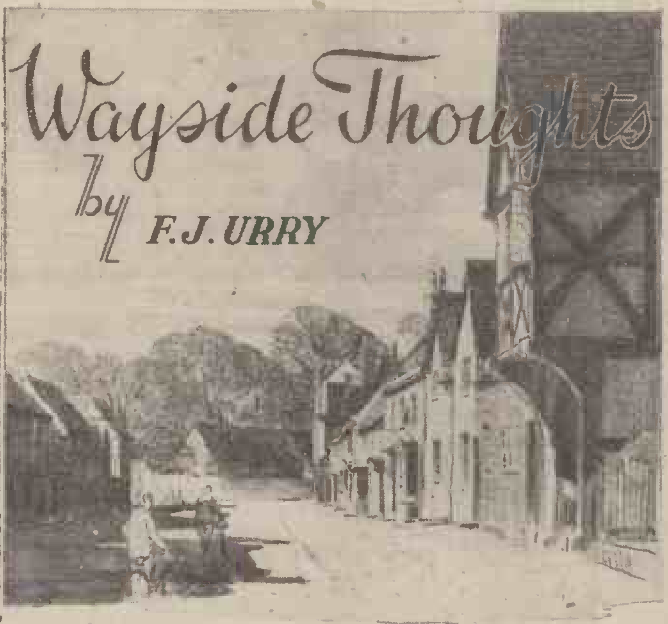
Registration, and a regular supply of all League publicity matter, will be free to all members.

Applicants should clearly state regimental number, name, unit, rank, etc., and applications should be addressed: Hon. Secretary-Organiser, British League of Racing Cyclists, 24, Disraeli Road, Ealing, London, W.5.

The National Executive Committee met on April 22nd at the Holborn Hall, when satisfactory progress was reported. The present registered racing membership is 577, with eight more months of 1945 to run. The Handbook will shortly be published, and it will probably be on sale on the bookstalls. It is proposed to prepare a fighting statement for circulation to the national press on the subject of massed start.

Wayside Thoughts

by F. J. URRY



Point of View

OVERTAKING a fellow-working cyclist riding to town on a dismal morning, we changed a word on the weather and the way, and I was not astonished to find my casual companion was disgusted with both, and not particularly in love with his mode of travel. He was not well mounted and, when I told him so, admitted the fact, but excused the condition by saying that, like most of us, he could not buy the goods he wanted and was waiting until the better type of bicycle was back on the market. "But," he said, "I can't understand you. Every morning your boy passes your door in a car; he could pick you up easily and drop you again in the evening, so why you do this daily journey passes my comprehension." That notion by the casual acquaintance emphasises the line of least resistance that sticks in the minds of most people; but is it quite true? Even supposing I forewent my daily ride, the little troubles consequent on a scheduled going and coming would rob me of that perfect personal freedom of departure and return which, to me, is high among the values of cycling. But it would do much more than that, for I should lose, perhaps for ever, the daily exercise that I imagine keeps me so fit and well, and despite all its handicaps and disillusionments makes of life a very interesting procession. I am not exaggerating when I aver I get a lot of quiet enjoyment from my town journeyings. I like to see the people along the route, their solemn faces when the bus is running late or the wind and the rain are making them bow their heads, and grin; to listen to the high note of laughter from the school-going youngsters, to watch the smiles, ah! and the dainty ankles, of the office girls, to await the quiet pip of my motoring friends as they slip past me, and change a word of greeting with the old inhabitants at the factory entrances, the bobbies on point duty, the postmen and women, and the various people who seem to occupy the pavements as I do the road at almost identical times. So I am never lonely, there is always something to interest me, and although there are bad days (less uncomfortable for me than the people in the bus queues, I think) there are also very good ones when the brave skies above me are reflecting their own loveliness, and shining on places I know, not many miles away, and which perchance I will go and see again before the sunset burns. No, I would not change my mode of travel for powered perambulations; at least I know when I am well off, free, fit and, in my little way, supremely happy. Most of the discontent in life springs from covetousness; why encourage it when your way of travel gives you the things most worth while, and gives them so cheaply and simply?

Common sense and Regularity

I HAVE just received a letter from a correspondent resident in Oxfordshire asking for the make and specification of my favourite machine. In it the writer wonders why I ride easily and comfortably at the age of 65, and presumably imagines something concerning this gentle activity is due to the bicycle. True enough. Haven't I been saying so for the past 30 years? Isn't it one of the reasons why I have always insisted on quality on the principle that only the very best is worthy to take a pleasure cyclist pleasuring? But the fact is that, however good the machine, the rider must sit on it correctly, pedal the right gear and use the right tyres, not be in too great a hurry, but treat the pastime as a space in life when joy is the dictator of those fleeting hours. Unfortunately the best of bicycles cannot be bought to-day, and I am afraid will not be available until the war is won, and the quality goods return to the market. My youngest bicycle was made in the spring of 1940; all the others are pre-war, but the difference in specification between them is very tiny, amounting only to types of rustless rims, open-sided tyres and change-speed gears. If it is of any service to my readers here is the specification of the "baby" in the shed: All-black finish, 21in. frame, 69 deg.; 26 by 1⅜ in. wheels, Dunlop Sprite open-sided tyres, alloy rims, four-speed S.A. hub gear giving 43in., 52in., 60in. and 69in. (roughly), strong alloy mudguards, Brooks Military saddle, good-class pedals 4½in. fitted with Cooper's felt blocks, good caliper brakes, ordinary nuts (no wing nuts for me), a Challis pattern bell, and to complete the ensemble, a generously sized touring bag. Weight all on, but not loaded with macs, 31½lbs. The "set" of the position is as follows: Saddle height giving an easily flexed knee when seated with the pedal at its lowest point, the top level with the ground, and fixed 2½in. behind a vertical line drawn through the centre of the bracket to the nose of the seat. Handlebar grips set level with the saddle, giving an easy inclined position with the whole body flexed for comfortable pedalling. To me all that advice seems elementary, but observing other people awheel it is astonishing to find how very few conform to it. I am not pretending to suggest this specification or positioning is ware for the speed-merchant. He can look after himself and learn by his own experiences and his confreres' advice; but I do definitely aver that if more people bought quality (when it is again available) and used that quality in the manner suggested, pleasure riding would increase until it was in undisputed leadership of all the happy games men and women play.

Happy Anticipation

WHAT an adventure this life is if only we can be content to live it from day to day and never cast our rosy thoughts too far ahead, and thereby engender disappointment and disillusionment. Like most ordinary people I look forward to the chance of a holiday when the condition of duty allows, and I was so engaged one night last week in the company of a friend of mine willing to go my gait, and prepared to take all the small inconveniences that may assail the wanderer in these days of difficult accommodation. We had a week coming to us in the early part of spring; our families were content we should be allowed full advantage of our nomadic desires, so we were at liberty to "make arrangements." Actually we have not made them except in the very tentative fashion of choosing our area of wandering: we are going to risk the question of accommodation, and if need be rely on our grey hairs to help us out of any such difficulties. Country people are very kindly. Our main argument resolved around the district to be chosen, and with Wales on our doorstep, as it were, that was our first thought. But we both know our Wales fairly intimately, and when I suggested the Yorkshire Dales my friend fell for it as new ground over which to urge his wheels. So Yorkshire it is going to be if the fates are kind, and it was over the maps of that gargantuan county we pored, hearthrug fashion, one evening, decided as we were a couple of easily satisfied oldsters, to leave the matter of accommodation and the itinerary on the knees of the caterers and the lap of the weather god, and just go touring. Perhaps I may have something to say about the little adventure later on; but just at the moment I tell you there is a genial spirit of mild excitement as the passing days bring the holiday nearer.

Many Inventions

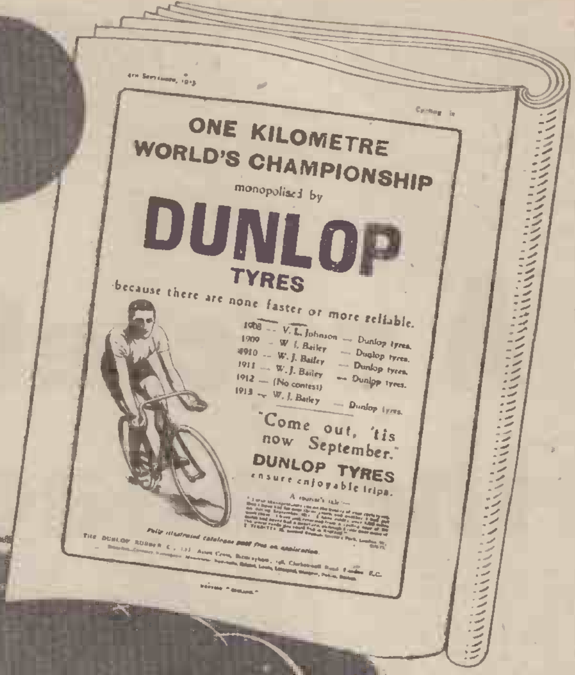
I AM told that among the numerous improvements the bicycle and its equipment is likely to undergo in the immediate post-war years, touring bags will come in for a big volume of attention. And to be blunt, about time too. I'm afraid our touring-bag manufacturers designed their products without the aid of personal experience of them in service, or surely we should never have seen such remarkable failures in the performance of their duties. Now we are promised better ones, and I saw a model a few days ago that combined a generously-sized touring bag, quickly detachable, with a rucksack—the very thing for a Youth Hosteller with a penchant to mix his riding with a little mountaineering. And another common item of cycle equipment that has certainly been improved is a fixed pump, with a cross-swivel handle one end and a ball joint the other, which makes tyre inflation easy. It is an ordinary 15in. inflator with a "T" piece folding handle; the base is fixed to the bracket frame tube, carries a ball-joint which allows the barrel to be swung at any angle either side of the frame, has an extension carrying a small box in which is housed a long connection to reach the valves of either wheel, and with the exception of the connection itself is thief-proof. The pump I examined and tested was experimental, but it struck me as being good, reasonably cheap, and very easily worked. I am told too that we might see a revolution in frames, something of an entirely new character as compared with present practice, the development of an idea resulting from war work evolution; but I'm not allowed to say anything about it at the moment. I have, however, been promised a first trial when the frame has been evolved in its final form; and then perhaps I may be allowed to give my experiences as a rider.

The Simple but Important Things

THERE are many other improvements the good class bicycle needs. Rustless steel rims at a reasonable price, for instance, and chain wheels truly machined for perfect chain engagement, flat, and definitely concentric. And better pedals. I am informed that a revolution in finishes will be certain, and the flamboyant bicycles of 1939 will be cast in the new colour schemes. That will be attractive to many more people than the younger generation, and if only the industry could guarantee the lively life of such finishes would rival my all-black neatness after a decade of wear, how we should welcome them. We also want better plating. The chrome on the high-class bicycle, especially on the small parts like nuts, bolt studs, head clips, etc., was no better than that on the cheapest models. Chrome plating will last and weather well if it is properly applied, and I'm sure for the people who like the bright parts, an extra charge for the finest work would be likely to attract and not deter. It is the old story of spoiling the bike for a ha'porth of plate. As far as tyres are concerned, once we have returned to pre-war quality, I do not think there would be much to criticise; but even in this essential it may be that nylon will play a part and help make an even more dainty tyre than the pre-war Sprite. In brakes and guards I imagine we shall use new metal alloys, and possibly also in bells and lamps; indeed I have seen some experimental models. The celluloid guard, that good-tempered fellow that has served us so well for so many years, will need stiffening, and this it seems to me could very well be done by incorporating a steel strip in its moulding. Perhaps that suggestion is not practical; but I know a riveted steel strip between seat stay and the first rearward guard stay has carried the weight of my bags for years without the aid of a bag support.

The old Gatehouse and Refectory — RAMSEY ABBEY HUNTINGDONSHIRE

SCRAPBOOK OF 1913



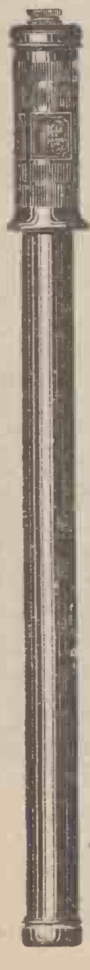
A PAGE FROM THE PAST

Those were the days—when international rivalry was expressed in terms of sporting events, in which DUNLOP monopolised the cycling honours. Notice the unbroken spell from 1908 to 1913 in which the one kilometre championship was won on DUNLOP Tyres for five successive times.

DUNLOP

MAKERS OF HISTORY IN RUBBER

4H/320



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Light of Weight but of robust construction

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LASTWEL (Celluloid) 15" 4/-
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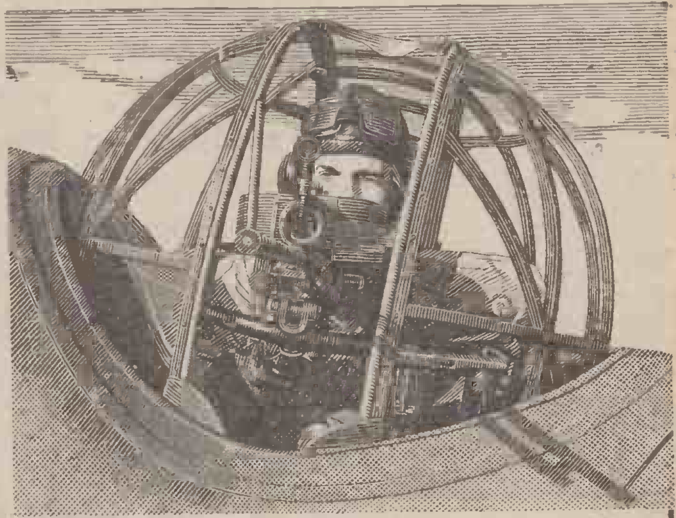

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CYCLORAMA

By H. W. ELEY

Spring and the Cyclist

"THE time of the singing birds has come"—and all Nature invites us insistently to get out of doors and join in the carnival of spring. To the real cyclist the call is ever welcome, and never disregarded. These are the days when the cyclist "sees to" his machine, makes all those little adjustments which make for easier riding, undertakes repairs, and sees that his tyres are in good condition for any road surface. And the saddle, too—that should come in for some attention; it always amazes me how some cyclists, keen on the efficiency of their mounts, neglect the saddle! But, assuming that our spring overhaul has been thorough and complete, we can set off . . . away from the chains of desk and bench out into the lanes where the "bread and cheese" is now green on the hedges, and away into the good countryside where, in this England of ours, everything speaks of new life, of the return of the flowers and of Nature in her fresh green garb—smiling after the long winter, and inviting us to make merry with her in the eternal carnival of springtime.

Stiles and Gates

WHILST taking a short cycling holiday recently I saw a bit of my beloved Derbyshire, and was again fascinated by its grey stone walls, and by those stone steps which do duty as stiles on the bleak moorlands. And in an inn, in the evening, I was lucky enough to fall in with a wayfarer who had made rather a special study of stiles and gates. How interesting it is that each county seems to have specialised in its own type of stile. There is the "ladder" stile of Essex, the "squeezer"-shaped "V" stile commonly found in Hertfordshire—a good type this, allowing for the passage of human legs but not permitting the passage of a sheep. Then there is the turnstile—a good example of which may be found at Godstone, in Surrey. With the passing of so many of our footpaths across fields and commons a good many stiles have disappeared, but plenty remain to remind us that the countryman has to protect his lands from straying cattle. Quite a lot could be written about the architecture and design of stiles; and some day I must make a study of the subject.

More About Inn Signs

MY recent references to inn signs has brought me quite a bit of correspondence indicating that the sign of the inn is a subject which fascinates many people. One lover of inn signs suggests that the Brewers' Society ought to be asked to institute a competition to stimulate the painting, by really good artists, of better signs for our inns and taverns. Of course, we have many fine examples of sign painting, and I would quote the "Green Dragon" at Barnet, with a spirited representation of a dragon, painted, I believe, by Mr. H. N. Easthaugh. Then there is the good sign of the "Two Brewers" at Chipperfield, painted by Mr. Eric Newton. It is a pity we have not more of these well-executed and colourful signs, for they not only add interest to the inns they adorn, but do something to restore romance to our countryside and towns.

Roadfarers All

NOT everyone has heard of the Roadfarers' Club . . . but those who have the privilege of belonging to it, and who attend its happy meetings, are acutely conscious of the fact that there can be few organisations so truly representative of *all* road interests. At a Roadfarers' luncheon, one may sit by a keen cyclist, or an ardent motorist, or a man who just walks . . . and finds, in pedestrianism, the best of all ways of seeing our incomparable countryside, and enjoying the myriad delights of the passing seasons. And that is what I like about the Roadfarers' Club; it is not sectarian; it represents divergent views, and in a spirit of friendliness endeavours to solve road problems for the good of all road users. The President is Lord Brabazon . . . and that fact alone is a guarantee that the Club will ever have broad visions, and work for the good of all.

A "Housing Programme"

I REFER to the housing programme of the birds . . . and not to the ones about which Government departments are so vocal, but so indecisive. In the trees, in the hedgerows, in the eaves of houses and barns, in the holes of old tree trunks, birds are busy indeed, making, in their own wondrous ways, little homes in which to rear their families; and how perfectly these homes are constructed! How marvellously tiny birds entwine wisps of hay and straw, leaves, grasses, twigs; how expertly they make their own brand of cement with mud and saliva from tiny beaks! The making of a bird's nest—particularly the small birds—is truly a work of art, and I never tire of examining these little structures. They vary enormously, and English birds use an infinite variety of building materials. How different is the structure, for instance, of the perfect little nest of the chaffinch from the loose, ungainly affair of the jackdaw! Jackdaws, by the way, are particularly active and numerous around my home just now, and a small boy proudly showed me an egg he had secured from a jackdaw's nest high up in an old tree . . . but he assured me that he was a "good" collector, and did not take more than one egg from any nest, and refrained from injuring young birds. Egg-collecting is one of those things we can never stop, but we can do much to ensure that youthful collectors keep to the rules.

And Now for Japan!

IN those little inns of which I am so fond, and which constitute the "clubs" of the countryman, there has, of course, been tremendous talk recently about the swift conclusion of the war in Europe . . . and the possibility of soon turning on Japan "with all we have got." And among cyclists, and other users of tyres, this talk has led to much speculation about the possibility of the retaking of Malaya . . . the "rubber land." Well, we shall get Malaya back, no doubt, but I fear that it will be some time before we get all the good crude rubber we need for tyres. Meanwhile, let us make the most of the tyres we possess; they are precious; they are the product of much skill and enterprise. A little extra care will make them last longer, and we may be sure that as soon as practicable the tyre manufacturers will again give us tyres made from natural rubber.

The "Lady of Cathedrals"

THAT is the designation given to the lovely cathedral at little Lichfield in Staffordshire, and I am reminded by friends there that this year the cathedral plans to celebrate the 750th anniversary of its rebuilding in the year 1195. What a wondrous record of endurance and stability! Those graceful spires, towering heavenwards with a beauty unsurpassed by any cathedral feature I know, have weathered the storms of the centuries; they mercifully escaped destruction when German bombers roared over to nearby Coventry, and did their worst to the cathedral there. And Lichfield may well be proud of her graceful edifice which has endured so long. It suffered great spoliation in the reign of Henry the Eighth. It was the scene of shocking profanity by the Parliamentarians during the sieges in the Civil Wars. In the twelfth century noble men began the great work of rebuilding Lichfield Cathedral, in the Early English style . . . and we should not regret that the original Norman style disappeared, for, by common consent, Lichfield is unsurpassed for grace and slender charm. A week ago I met a little party of American soldiers, cycling to Lichfield, and I rode for some distance with them, and told them something of the glories of this ancient place, where the spirit of old Doctor Johnson still lingers, and where, in ancient times, the good St. Chad sanctified the area. He died at the neighbouring village of Stowe in the year 672.

A Bike, A Pipe, and a Book

WHAT a happy trio! The other day, when the sun kissed the meadows, and the skylark soared high overhead, I enjoyed all three . . . riding out on my cycle to a typical English village. On the outskirts, found a green dell, and lay down for a rest, lighting an old and favourite briar pipe, and watching the blue smoke curl up from the charred bowl. And from my pocket I took out that evergreen volume, "Rural Rides"—and found that Cobbett was as readable as ever. For an hour or more I browsed in that delightful spot, reading, musing, and smoking . . . and then, to crown my enjoyment, I rode slowly into the village, and drank ale in an old inn called "The Bay Mare."

The Weather Pessimists

ACCORDING to reliable records, the very warm spell in April was about the warmest ever; certainly I cannot recall April days so hot and sultry; it appeared as if we had slipped into August unawares. But how the pessimists enjoyed themselves! They all reminded me that we "should pay for this too-early heat," and predicted frosts in May which would destroy all the fruit. No apples; no pears; no plums; no damsons . . . that was the melancholy vision I had after a conversation with one of these weather pessimists on an evening in April, after a truly perfect day of sunshine, with a wonderful chorus of bird song, and a feast of colour in the fields where the golden dandelions flamed in the meadows. Now, I know that sometimes the merry month of May can bring us very severe frosts, which do great damage. But why anticipate such disasters? Let us revel in the sunshine while it lasts, and believe that, as far as weather is concerned, everything in the end seems to work out well. And, by the way, I wonder how many of these pessimists have ever known a year when there has been no fruit?

Last Farewell to "Faed"

I WAS sorry that I was unable to attend the Memorial Service to that great and big-hearted man, A. J. Wilson, held at Holy Trinity Church, Marylebone, early in April. But there was a truly representative gathering, and many were the tributes paid to "Faed," who had a host of friends, and whose good work will constitute his best memorial. The world of cycling and advertising were both well represented, and beyond these spheres "Faed" was known and beloved. In the many notices I have seen about his life, I have not noticed much said about his intense love of the countryside . . . and his expert knowledge of rural things. "Faed" loved the green meadows, the whispering of trees in a wood; the ragged hedges where the birds pour out their song, and all the delights of the open road.

Notes of a Highwayman.

BY LEONARD ELLIS

Britain's Touring Grounds (7)

THE Peak District may be regarded as that area to the north-west of the Derbyshire Dales, although its generally accepted limits are somewhat elastic. The Peak is, of course, the Great Peak of Derbyshire, 2,088ft. high, and the most southerly of the Pennine Hills. It gives its name to this delightful touring area, yet strangely enough it was for many years the physical feature least visited. This was not the fault of the tourist, as Kinder Scout and the surrounding hills were a private shooting ground. The area can almost be defined by drawing a straight line from Congleton in Cheshire to Chesterfield in Derbyshire, and then drawing a semi-circle northward. With all respect, the towns on the edge are better avoided. There is little in Glossop, Congleton or Macclesfield to attract a tourist, although the Snake Pass may compel him to pass through or near the former. The twisted spire at Chesterfield would not attract me to the town, and the outskirts of Sheffield, although very fine, are better than Sheffield itself. In this semi-circle we can find a vast array of touring interest and tremendous variety. It is not of the pretty kind, that is best sought farther south in the Dale country, but if you want wild moorland at its wildest, and caverns at their finest you cannot choose a better district. The Snake Pass from Glossop over Featherbed Moss to Sheffield is a grand road of its type, if you like windswept solitude and colourful moorland.

Overflowing with Interest

TO my mind there are two particular areas where I like to linger. One is around Castleton and the other, strangely enough, lies almost outside the district we have been at pains to define. This is the country just south-west of Buxton and may be called the Dane Valley. Castleton as a village or town is not particularly attractive, but in close proximity there is an amazing quantity of interest. The old Castle of the Peak dates from Norman times and guards the town that existed in the time of the Romans. Almost under its walls is the tremendous tunnel-like entrance to the Great Peak Cavern, one of the seven wonders of the Peak District. Its huge mouth belies the low passages one must traverse in order to see all the wonders of the cave. The Speedwell Cave is partly man-made and follows an underground stream to where the waters plunge into the so-called Bottomless Pit. The Blue John Mine is interesting as the source of the beautiful and eagerly-sought Blue John Spar, a translucent crystal shot with purple streaks. At one time they say the stone was so rare that only four tons a year were removed from the workings, but this story may merely have served to enhance the value of the beautiful little spar ornaments that can be bought in the local shops. Away to the north-west can be seen the scree face of Mam Tor, or Shivering Mountain, so called because of the constant movement of the broken shale on the screes. Mam Tor stands above Winnats Gorge, a wind-swept chasm between the hills and one which most cyclists include in their route in spite of the existence of a better road.

Where Counties Meet

THE other area of particular interest includes Axe Edge, from which spring many rivers including the Dove. On the hills around will be found the Cat and Fiddle Inn and Flash Bar, the second and third highest inns in this country. This is a wild and interesting country, including the Three Shire Head, a lonely spot marked by a tiny waterfall and where the counties of Cheshire, Derbyshire and Staffordshire come together. Hereabouts, also, is the valley of the lovely little river Dane. Near Swythamley is Ludchurch Gorge, a queer little chasm in the hillside, difficult to find but most interesting. It is said that the Lollards used to hold services here in the days of the religious persecutions, and that they were betrayed by their singing. The Goyt Valley, although some of it is now denied to travellers, is a beauty spot, and Eyam, a little village near the gorge-like Middleton Dale, is famous in the history of the Great Plague. Realising that the plague had reached them in a parcel sent from London, the villagers voluntarily segregated themselves from the world while 300 of their 350 died. Buxton must, of course, be included in the area, but although an excellent centre its spas and crescents are rather an anti-climax to the tourist in search of the wilderness.

Three Shire Head, in Derby, Cheshire and Staffs.

My Point of View: By "Wayfarer"

A YOUNG friend of mine recently had the opportunity of acquiring a practically new pair of Dunlop "Sprite" tyres. It meant buying the bicycle to which they were fitted—so he bought the bicycle as well. This is a fact. Rather drastic action to secure a pair of first-class tyres, but conditions set up by the war are a desperate disease for which a desperate remedy is needed!

My Preference

SPEAKING of tyres reminds me that the question arose, the other day, as to which wheel should carry a defective tyre, presuming one had to be used. My first impulse was to say "Neither!" for the simple reason that I, personally, feel that I cannot afford to run defective tyres. I hate the thought of being held up along the road, with all the inconvenience and annoyance that such an event might bring in its train. And so, under pressure, I reiterated the word "Neither!" The point was then developed on these lines: Supposing that, during a tour, one of your tyres began to suffer from ill-health and a temporary repair was effected. If not readily able to replace the "invalid"—or not wishing to do so because of the stock of tyres you carry at home—on which wheel should the defective tyre run? No doubt a great many cyclists would plump for the front wheel, because of the much heavier wear the back wheel tyre normally experiences. I, on the other hand, would prefer a defective tyre to be on the back wheel. Little harm would accrue if the tyre were suddenly to decide to end its career by bursting, whereas a front tyre burst, especially at speed, is a thing to be avoided. So the foregoing, in some little detail, is my answer to the question posed—though I prefer to stand by my original reply of "Neither!" In practice, I "scrap" my tyres long before they reach the danger zone.

Almost a Dream

A WEEK or two ago one of my local newspapers carried an advertisement concerning an auction sale ("By direction of the Chief Constable") of unclaimed property, "including cycling capes" and "about 50 Ladies' and Gent's Bicycles." One can almost imagine the auctioneer being trampled to death by the rush of people desirous of buying those "cycling capes"—without coupons, too! It would be interesting to know what manner of cyclist it is, in these days, who loses his cape and apparently takes no steps to retrieve it; while, as to those half-hundred bicycles—well, before saying anything about them one would prefer to see what they are like. Some of the bicycles I have noticed deserve to be lost, and not reclaimed! Still, the whole transaction is almost a dream, in the light of present-day scarcity of bicycles and cycling capes.

Wasted Energy

ON a recent evening I travelled with a brother cyclist through suburbia for about a quarter of a mile. At each of the three road intersections we encountered, he dismounted—at the first and third to allow traffic to roll by, and at the second because there was a "Halt" sign. What wasted energy was involved by those dismounts and remounts, thanks to the fact that my companion's bicycle possessed too high a bracket, and too much frame-height. As for me, following my invariable practice, I dropped one foot to the ground at each of the three stops and pushed off again without any perceptible loss of energy. Owing to the fact that I am properly mounted, it is never necessary for me to "get off it" because of traffic conditions, etc. A low bracket, and a frame of reasonable height—preferably on the small side—is the secret.

Well- (and ill-) Named Places

HOW well-named are some of the places any cyclist of experience can call to mind—and how unfitting is the nomenclature in other instances! In the former category I would put such villages as Long Compton, Long Eaton, and Long Buckby. "Long," indeed—especially when you are at the wrong end on a wet night! Hilltop, near West Bromwich, is admirably named, particularly at the close of a long day's journey and you cycle over the stone setts of the Black Country, and climb the steep bank on which Hilltop stands. The Downs are sometimes well-named, and sometimes otherwise: it all depends on your direction! If you go down the long slope which falls into the village, Downhill (Co. Londonderry) seems to be a suitable enough appellation, but you may have other views if proceeding in the reverse direction, against a strong wind! Funtown (spelt Fintown), in Co. Donegal, is a misnomer—or was when I visited the place—for punctured tyres and heavy rain and deplorable accommodation were the order of the day. My comrade and I were not conscious of experiencing any fun! Prosperous, only about 30 miles from Dublin on the route west, is anything but that—in appearance, at any rate—and the Grand Canal, on which the village stands, struck me as being completely lacking in the attributes which comprise grandeur.

One Bicycle

IT being necessary for a young relative of mine, on going away to college, to have a bicycle—I think the college must have been in league with the cycle manufacturers!—I had a thoroughbred built for her, and the machine turned out to be one of the best, from the ease of propulsion viewpoint, in the establishment. Other girls, having tried the "bus," were inclined to be dissatisfied with their own; and my relative, sampling the latter, noticed how marked was the difference, and understood. Sometimes, during the holidays, I would ride the girl's machine for short distances, but I could do nothing with it, thanks to the position adopted by its owner. I never did like upturned handlebars, with my elbows sticking themselves into my ribs, and I am left wondering how much better the bicycle would have been had a flat or slightly dropped bar been fitted. Position awheel is of great importance, especially if effective "work" is to be done, and it is always worth while experimenting with handlebars and saddle until the right posture is discovered.

The Intelligentsia

ON a recent Sunday afternoon, as I was nearing home in good time to have tea in comfort and to keep an evening appointment, my back tyre decided to give out, and in an instant it had flattened. The puncture was of such a nature as not to be repairable straight away, in the half-hour available, and I decided that there was nothing for it but to ride home in discomfort, disregarding the damage which would accrue to the tyre. The point I want to make in this connection is that the performance seemed to tickle the risibilities of groups of people here and there. At any rate, they found something excruciatingly funny in the sight of a cyclist bumping along on the rim.

One supposes that the alleged sense of humour in the case of these people is in inverse ratio to their capacity for thought, and probably—despite all that has been done in the way of what passes for education—such folk are more to be pitied than blamed.

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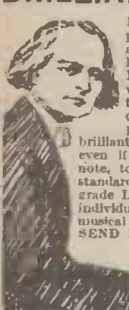

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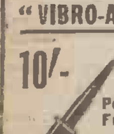

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