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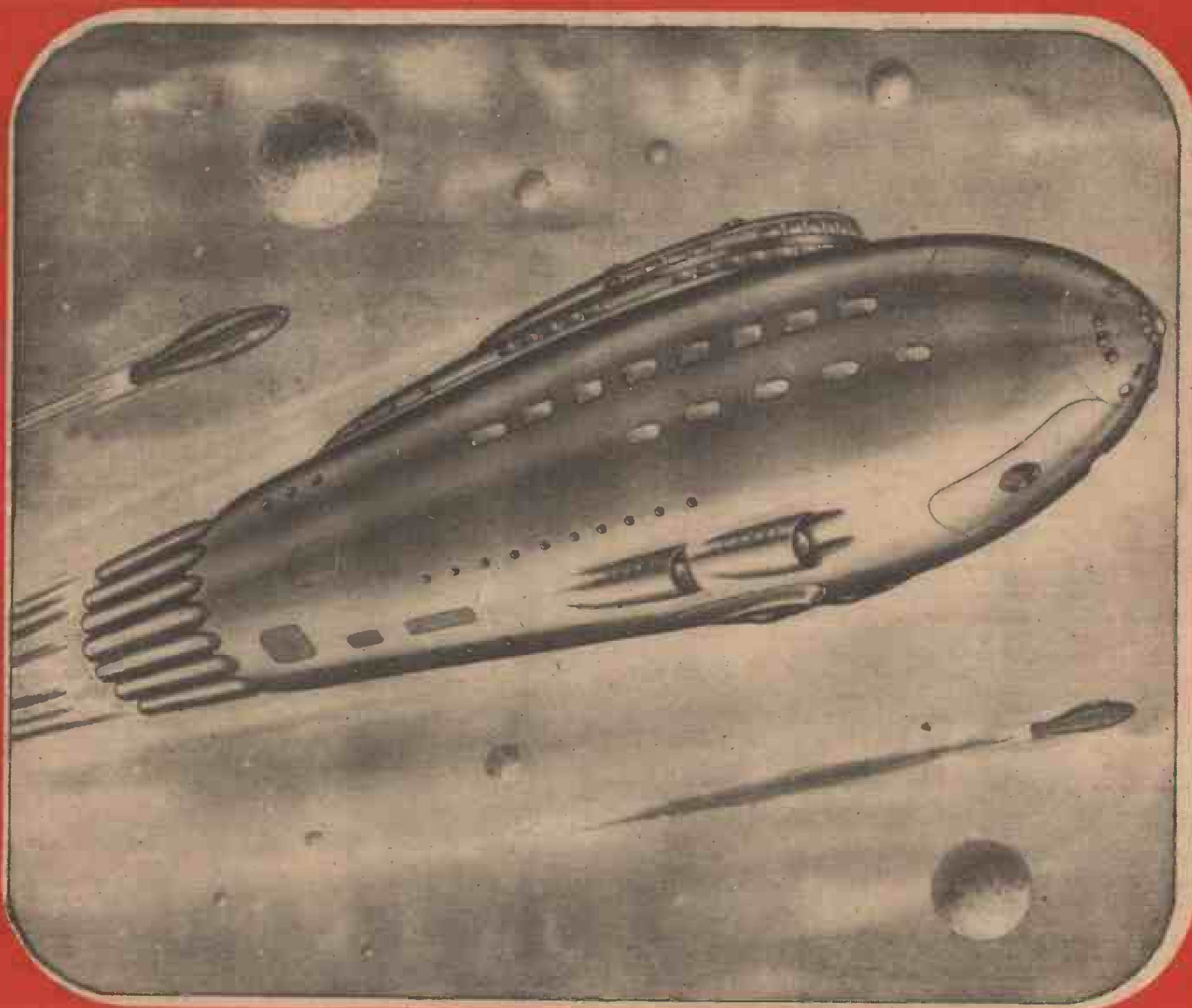

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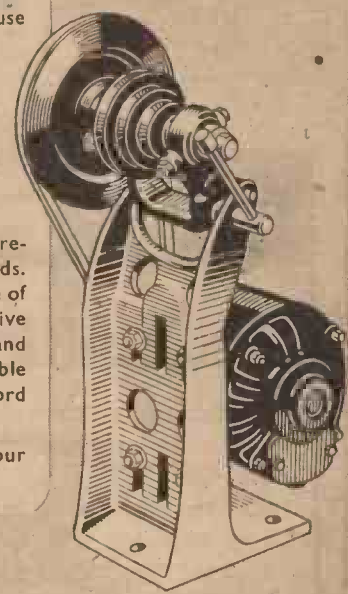

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Editor: F. J. CAMM

VOL. XI. APRIL, 1944 No. 127

FAIR COMMENT—BY THE EDITOR

Electricity Supply and Distribution

ELECTRICITY supply is a question interwoven with all post-war plans, and naturally there have been many schemes for its reorganisation, and its development. Most of these are concerned with questions of ownership and control, but there are many questions of a more technical and less controversial kind which will arrive after the war.

Standardisation is one of the most important, for without it it is impossible to simplify and standardise electrical equipment. Many of the older electricity supply systems have not yet been standardised. Some operate on A.C., and some on D.C., and this complicates the manufacture of consuming devices, and considerably adds to the cost. As electricity supply is an essential public service it directly affects the convenience of consumers who to-day represent practically the whole community.

Wireless has made the public electricity conscious. Before standardisation is possible technical developments must have reached a sufficiently high standard to permit it. In electricity this stage was reached many years ago, and accepted standards of voltage and system are already in existence. So far as high-voltage systems are concerned, these standards are being generally observed. The adoption of 4-wire 3-phase 400/230 volts at 50 cycles per second frequency as the standard for low-voltage distribution in Great Britain is now generally accepted, and it is in the interests of the industry and the consumers if its use could be extended throughout the country.

The Electricity Commissioners have recognised this and have taken steps to see that wherever practicable it is adopted in new areas. The owners of many non-standard undertakings have already adopted it for extensions of their systems, but many of the older undertakings are still expanding under the non-standard systems, and this is one of the urgent problems which face electricity supply undertakings, for until it is solved many of the advantages of standardisation cannot be brought to fruition. The difficulty is that many of the non-standard undertakings would be involved in substantial costs in effecting the change-over. The cost of standardisation can usually be justified on a reasonable estimate of its future benefits to the undertaking, but there is often reluctance in private undertakings to incur expenditure which does not promise immediate reward.

During the war, network extensions and the growth of domestic supplies have been drastically curtailed, but the vast building programme in prospect arising from wartime arrears, the reconstruction and replanning of urban areas, and the urge towards a higher standard of living will result in rapid expansion of electricity supply and of the manufacture of appliances.

The decision to standardise for future systems, voltages of 230 for lighting, and 400 volts for 3-phase power, was taken by The British Standards Institution in 1925, and was generally accepted by the industry. Shortly after this, in 1927, the Council of the Institution decided to investigate the problem of securing the general adoption of these voltages. They found that the cost of standardising voltages below 230 might range from £10,000,000 to £16,000,000, and above 230 between £1,000,000 and £1,500,000.

Many undertakings give supplies at different voltages in different parts of their areas, and the capital expenditure on distribution has been continually rising. In 1926 it was £117,000,000, and in 1937 £294,000,000.

Substantial progress has been made in recent years in changing over D.C. systems to A.C., but in 1938 there were still 1,117,000 D.C. consumers in this country, representing 12 per cent. of the total. D.C. systems are not only uneconomic, but cannot be developed effectively to meet load densities such as are now experienced.

A preliminary non-standard of A.C. systems has disclosed, according to a report of the Institution of Electrical Engineers, that most of these undertakings provide 3-phase supply for their large power consumers. It therefore has been recommended that the standard of voltage and system on all low-voltage systems throughout the country should be treated as a national industrial plan so as to evoke the enthusiasm and goodwill of the consumer, the undertaker, and the manufacturing industry in co-operating to complete the plan in the minimum possible time. There would be no technical difficulty in carrying out the work, and it could be completed in a period of about five years.

The first Electric Lighting Order was issued in August, 1883, and this gave power for the supply of electricity in 12 towns. From this date the number of statutory authorities has increased and had reached 668 in 1930. The number is now approximately 590, the reduction being due to amalgamation. The area covered by supply powers in 1921 was just under 11 per cent. of the total area of Great Britain, representing 73.6 per cent. of the population. In 1935, 86 per cent. of the area of Great Britain was covered, and this area contained 99 per cent. of the population. Obviously the areas with the highest population density were developed first. Of the 621 Supply Authorities in existence in 1936, 53 per cent. together sold less than 3 per cent. of the total units, whilst 13 per cent. supplied approximately 72 per cent. of the total units. Undertakings vary considerably, not only in their outputs, but also in size, some operating an area of a few square miles, whilst others have areas of 4,000 square miles. The population density also varies. Some operate an area with a population density of 130 persons per square mile, whilst others have areas in which the population density is over 13,000 per square mile.

A difficulty which tends to retard the development of electricity supply in rural areas is the cost of making connections to isolated premises remote from transmission works. These connections often involve constructing long spur lines, sometimes including transformer stations, in addition to low-voltage service works. Difficulty has also been experienced in obtaining way leaves for overhead lines and underground cables, and this has tended to retard development in urban and rural areas. Amenity objections are often troublesome, and are sometimes unduly stressed.

A further difficulty is the objection which many owners and occupiers have to undertakings to make use of under-eave construction, that is, the attachment of cables under the eaves of houses from a central distribution point. The owner or occupier of premises may demand a supply of electricity if the premises are within 50 yards of a distribution line, but if the length of service line necessary to connect the premises is greater than 60ft., then the consumer may be required to pay the cost of the excess length, and he may also be called upon to pay for so much of the service line as is situated on private property.

The wide variation in the cost of electricity throughout the country still remains a major problem, and it will have to be solved in the immediate post-war period.

The Development of Jet Propulsion

A Brief Account of the Early Experiments With Rocket and Jet-propelled Aircraft

By B. D. RICHARDSON

BRITAIN'S sudden leap into the limelight with the announcement that she is leading the field in a remarkable race to discover new, more efficient and speedier ways to hurtle through space fills us with a glow of pleasure. Great credit is undoubtedly due to Group Captain Whittle (the designer of the engine) and his staunch friends for their perseverance and faith through long and trying years; praise, too, to W. G. Carter, who designed the 'plane around it—and no little condemnation, perhaps, on the aviation industry as a whole on their somewhat tardy recognition of the implications and significance of their struggle.

With newspaper and radio blaring trumpetings, the public are at one and the same time getting both the truth in the form of an actual *fait accompli* and an erroneous impression that it is a principle we have discovered. It is the latter that this article is designed to correct. The jet-driven engine is only yet another application of the old principle known to many student of sciences, other than aerodynamics, that forward progress can be obtained by kicking sufficiently hard against something in your rear equally as well as by the more accepted method of chewing off large chunks of whatever lies in front by the use of a propeller (whether tractor or pusher) and heaving the body forward by these teeth.

Even the least scientifically minded of us must admit the wonder with which we regarded the little toy the Christmas hawkers at the kerbside familiarised us with for so many years; I refer to the miniature ship (or duck), consisting of a mere outline on a light flat base, the rear of which supported a small piece of sodium (or sometimes "Meta" fuel) whose emanations in the water drove the little craft forward in a seemingly amazing manner.

This new engine is indeed a marvellous invention, and its advent entirely eclipses for at least a decade the approach made in the last eighty years to arrive at a similar satisfactory stage from quite a different angle; I refer to the attempts to achieve rocket flight. I think that we cannot fail to recognise that flight attained by these means has as valid a claim to the title of jet-propulsion as its more recent rival. In fact, we can call the principle what we will, "compression reaction," "bottle power," what fits one, sits fair and square on the other!

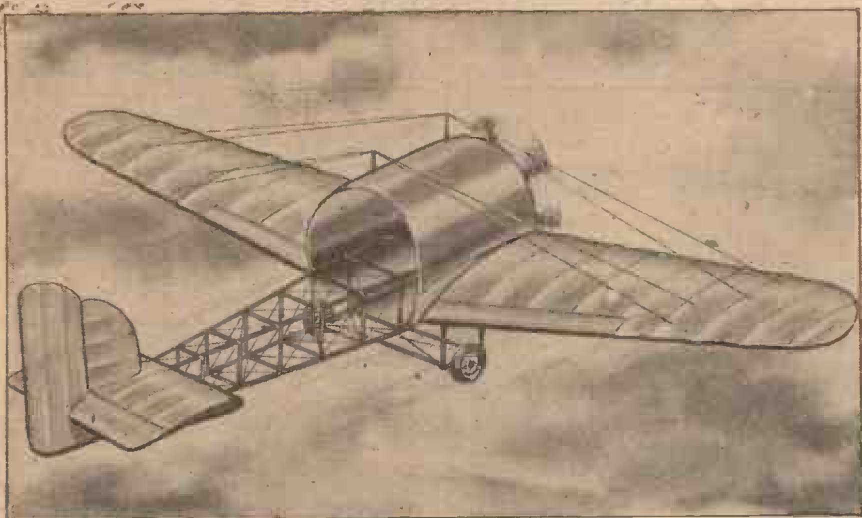


Fig. 1.—A historical flying machine, constructed about 1911 or 1912 by a Frenchman, M. Jourdan.

Early Pioneers

Let us trace within the limits of this short article as many of the steps as space will permit that interweave the destiny of this new motivation. An acknowledgment must be made to Alexandrine Hero, who is credited with the invention in 150 B.C. of a steam-jet apparatus, which utilised the consequent reaction of an escape valve to revolve a sphere; though there is no evidence that this "æolipile" was ever constructed. For our purposes, the experiments directed towards harnessing the reactionary force of the rocket commenced with a suggestion proposed by an Italian, Fontana, about 1520, that it could be used to propel a vehicle, and a similar theory propounded some 200 years later by the Dutchman Gravesande, to use power jets of steam towards the same end. Later, in 1784, two Frenchmen, Janinet and Miolan, are reputed to have projected a hot-air balloon which was to direct its excess through vents, and so obtain some help in the steering and propulsion by reason of the reactive force obtained.

With the discovery and focusing of interest on aerial navigation, and the first hankering towards controlled and powered flight, it is only natural that this method of impulsion should once again be explored, and so, about the mid-nineteenth century, a minor crop of plans enjoyed a brief, mushroomlike existence, only to disappear overnight with the advent of the spirit- and oil-driven motor. They ranged from suggestions to use power jets of steam forced through propeller blades to lift helicopters, to the grandiose scheme of the American Betty in 1860 to propel a semi-rigid gasbag by rocket force. There is on record a project of a M. De Louvrier in 1863 for an "aeroscaphe," vaguely described as "a kitelike machine driven by an airscrew or directly by an engine whose detonations cause reactions in the air." Later, in 1871, a design was put forward for a powder rocket-engined heavier-than-air craft by de la Pauze.

Little can be traced of any practical application of these neoteric ideas until we gain the present century, unless we digress in an acknowledgment of the far-reaching development of the life-saving rockets used in shipwrecks. Then, early in the 1900's we hear of Parkinson patenting a turbo-powered airship of one man-power, the engine providing pressure in the gasbags, with outlets from the sides of the envelope to be used for steering or propulsion, and of a model rocket 'plane being shown by an F. W. Thomas at the Alexandra Palace Exhibition organised by the *Daily Mail* in 1907. With the opening of the century we discover first-class scientific brains directing their energies towards harnessing reactive expulsive force.

The names of the Russian Ziolkowsky and the Rumanian Oberth leap to the memory as associated with the research into the properties of liquid fuel as a propellent, and the hunt was on. A bewildering galaxy of names representing a variety of countries can be presented now as typifying the scientific interest that has been brought to bear on the absorbing problem. It is not the purpose of this article to give a categorical and full list of these pioneers, but, having roused interest, a slight acknowledgment and tribute

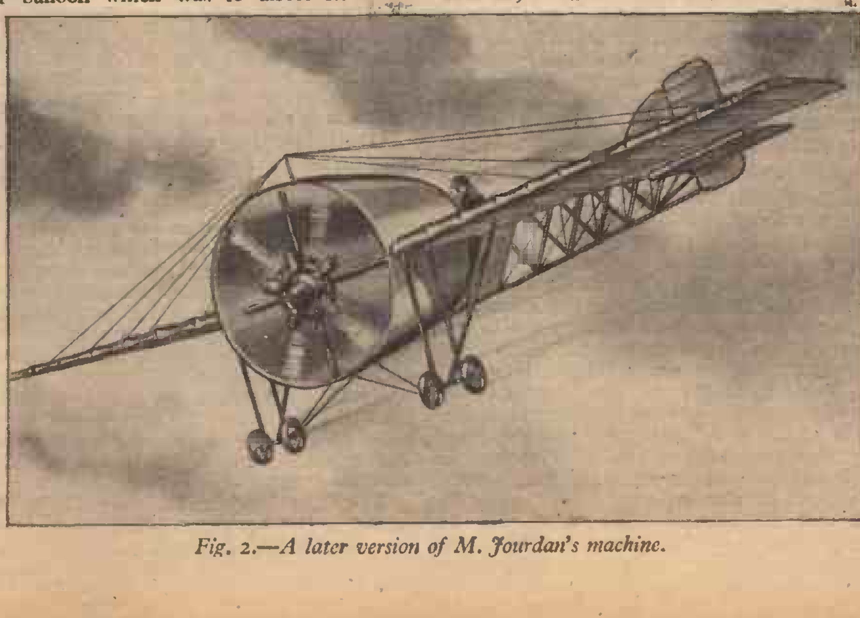


Fig. 2.—A later version of M. Jourdan's machine.

to the following men will prove useful to those who wish to pursue their studies further. Germany contributed Drs. J. Winkler and V. Mandl, Willy Ley, F. Opel and Max Valier, R. Tiling and G. Zucker (the latter two mentioned being powder enthusiasts as opposed to the more accepted liquid fuel). The United States of America produced Drs. Greely, Abbot, A. C. Erickson and D. Lyon, Prof. R. H. Goddard and D. Lasser. France: Dr. Robert Esnault-Pelterie, Andre Hirsch and M. Konstantinoff. Italy: L. Gussalli. Austria: Dr. E. Sanger and F. Schmiedly (another powder enthusiast). Czechoslovakia: Ludvik Ocenasck. Holland: Roberti in association with Thollen; and Russia has given us in addition to K. E. Ziolkowsky (already mentioned) the name of Dr. Nikolai A. Rynim. In this country, too, we have had contributions from the well-known Prof. A. Low and P. E. Cleator. Necessarily a veil has been drawn across the progress of their work of recent years, but we can all remember their contributions prior to the war.

Rocket Flight

The first man-carrying rocket flight is credited to F. Stahmer in 1928, and the second to F. von Opel in 1929 (Fig. 5), both taking place in Germany. It cannot be claimed that they were successful expositions of controlled powered flight—one is left with the impression that it was the rockets that took control and that these early pioneers were fortunate to escape with their lives. These flights were closely followed by another essay, this time on the part of another German, Espenlaub, in a rocket-firing 'plane designed by Max Valier; but again there is nothing conclusive to record. In 1934 W. G. Swan performed similar service in New York.

Most rocket experiments since then have been of a less ambitious but more practicable nature, and generally have taken the form of sizable craft for mail-carrying purposes. If it would appear that this country lags behind, it is only fair to our potential inventors to point out that they are severely handicapped by the dictatorial attitude of the Home Office, which, even in peacetime, actively discourages private experimenters. This position is in direct contrast to Germany, who encouraged and fostered the development of this form of research, and as early as 1930 placed a specially established experimental flying field at their disposal on the outskirts of Berlin, complete with hangars and workshops. Over here experiments were frowned upon and rendered almost unattainable on the plea that we were such a small country it was unreasonable to find a place where they could be conducted without danger to lives and property (except, of course, on Government firing ranges, in which case there was little likelihood of a civilian obtaining permission to make use of them for all the long preliminary experimental work that would necessarily precede an official test).

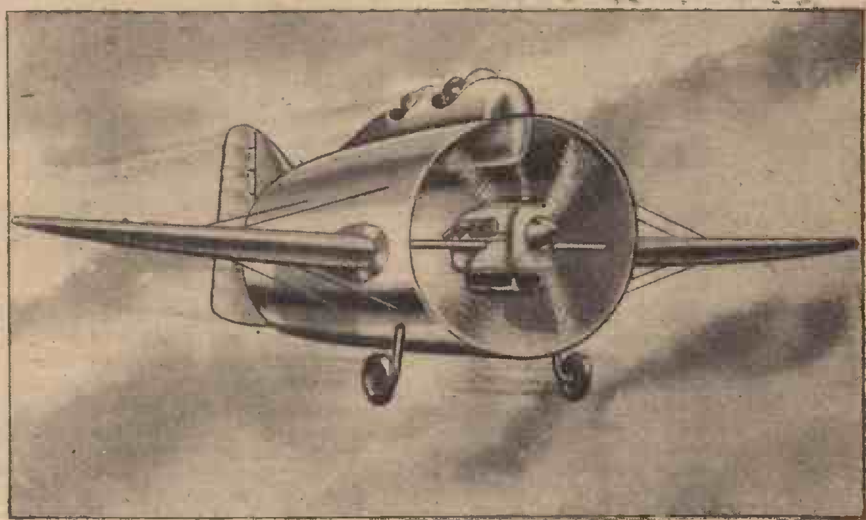


Fig. 3.—The Stipa-Caproni monoplane.

Historic Machines

Let us now leave the story of machines fired by rockets at this inconclusive stage, and examine one more facet. I refer to the type of machine which intrinsically in itself constitutes one huge rocket (or power container). To do this we must cross over to the enemies' camp, as it were, and for the sake of history show by what steps jet-propelled flight has been evolved from its more conventional brother. Fig. 1 shows a historical flying machine constructed about 1911 or 1912 by a Frenchman, M. Jourdan, who pursued a theory of obtaining additional lift by capturing the entire slipstream in a partly enclosed fuselage; and Fig. 2, a later version of the same machine with improvements, consisting of a completely enclosed tube fuselage, with the propeller also encased. In both these machines the engine and pilot shared in the benefits of the whirlwind thus raised, and it is unfortunate that the author has no data to hand as to whether they actually flew, and with what results. The aircraft journal *Flight*, as far back as 1932, was quick to point out the logical sequence that connected this revolutionary idea with the appearance in that year of the Stipa-Caproni (Fig. 3), the result of five years pursuit of the problem. This all-wood, mid-wing monoplane embodied an identical principle, but provision was made for the pilot to straddle jockeywise the tube in an open, compact fuselage section, and the tube extended the complete length of the craft to the rear, where it encased most of the tail unit, obviously with the intention of getting the greatest benefit from the slipstream. The 120 h.p. engine was mounted just inside the leading edge of the tube, with the propeller tips barely clearing, and when the machine was flown it was reported that she possessed exceptional stability, less head resistance, increased rudder and elevator efficiency, plus better visibility for the pilot. The wings were wire braced, and it would be interesting to get details as to their behaviour.

The advent of this machine was closely followed with a report from New York that an Institute in California was examining a design of a General Rocco, of the Italian Air Ministry (though why he had to cross the Atlantic for this concession did not come to light). This was no less than "a superplane" to speed through the strato-

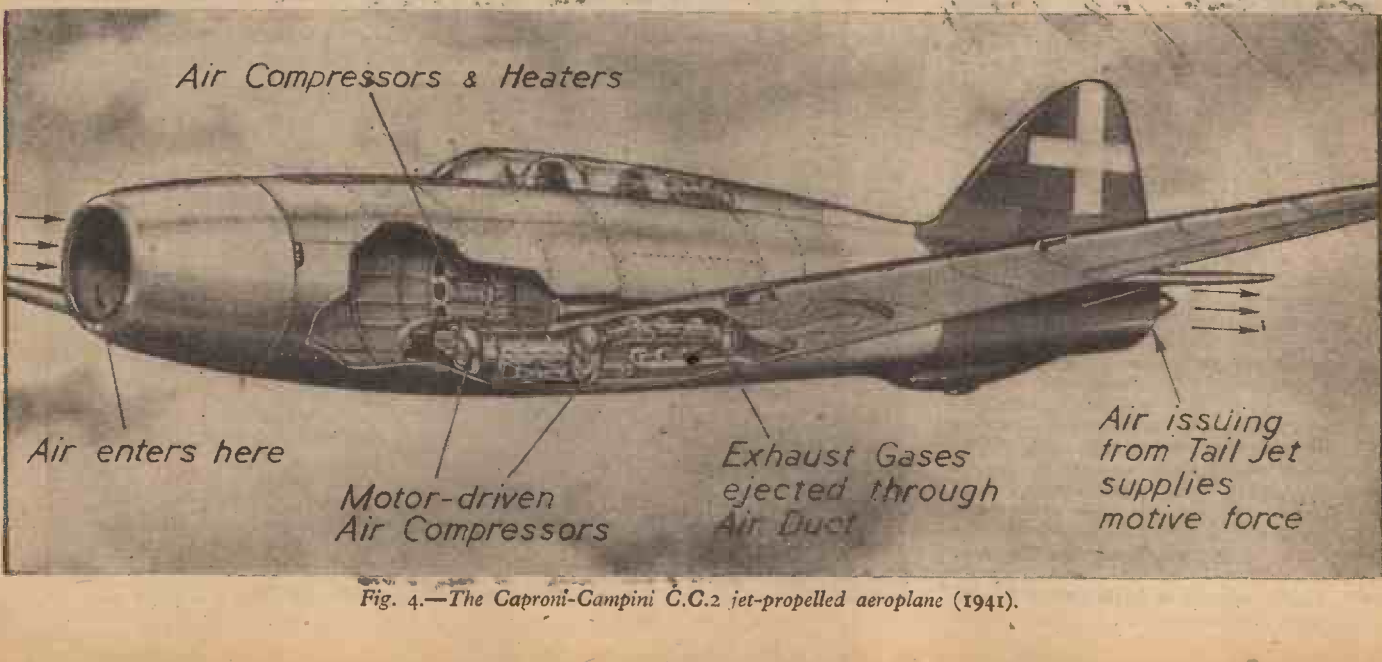


Fig. 4.—The Caproni-Campini C.C.2 jet-propelled aeroplane (1941).

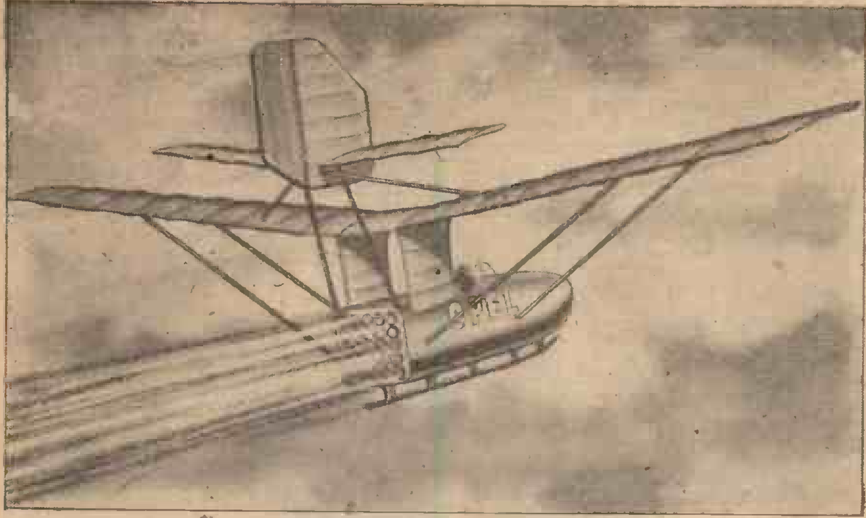


Fig. 5.—The Opel rocket-propelled aircraft (1929).

sphere at more than 1,000 m.p.h. This modest achievement was be accomplished by a rocket-like 'plane, propelled by burning petrol in long, open-ended tubes, the power for this purpose to be supplied by three Rocco-designed tube engines, whilst an ordinary internal-combustion engine would be used for the initial take-off and preliminary climb to some 15 to 25 miles. However eulogistic the claims and expectations may now appear at this distance in time, it is apparent that modesty was given her fair share in the bombast when it was suggested, in such a matter of fact way, that to attain the initial height quoted, before the new Rocco tubes were brought into play, an "ordinary" engine would be used. This announcement was followed by a long gasp, and an equally long gap; although there was also a turbine-engined aeroplane exhibited at the Paris Aero Salon of 1911, designed by Henry Coanda.

The Caproni-Campini

When the war is over we may hear of intermediate machines, but at the time of going to press, the next step in our chain appears to be from the same stable: the Caproni-Campini, the "C.C.1" of 1939/40, believed to be the result of the patient research work of the same L. Stipa of the Italian Air Ministry, who was responsible for the Caproni product of 1932, already referred to. One day we shall probably hear more of the story of this revolutionary craft, but all that can be gleaned from contemporary sources is that she was a single-seat monoplane, and rightly fills the transitional stage between the original Stipa-Caproni, which was purely a tractor air-screwed machine, in a novel frame, and the complete breakaway of the second experimental machine, the C.C.2, which dispensed entirely with the hitherto accepted-as-necessary air propeller. The C.C.1 will stand for all time as the initial step, and should be enshrined in the annals of science along with Stephenson's "Rocket" and Montgolfier's first balloon. Her designers had not at this early stage overcome the difficulties of the take-off, and so relied upon the normal tractor screw to give her an assisted passage in this respect, and once an adequate airflow was established, the jet-propulsive mechanism was brought into play and the propeller dispensed with. The first attested flight was apparently undertaken in August, 1940, and it would seem that already by then the idea of suitable induction machinery had been satisfactorily worked out for her successor, the Caproni-Campini C.C.2.

The C.C.2 must have been on the boards at this time, as she made her maiden flight on December 1st, 1941. As will be seen from Fig 4, she was a low-wing monoplane, with the appearance of a thin, stubby cigar. The wings, of very small area, were finely tapered, and the crew of two occupied a well-designed cabin in the now accepted position astride the tube. The nose, perhaps, would be the first point to attract attention by reason of the absence of propeller, and its curiously flattened silhouette. An unusual excrescence beneath the fuselage aft betrayed the presence of the unorthodox characteristic of a fairing concealing the expansion chamber. The Press of that year reported her flight from Milan to Rome (including a stop at Pisa), a journey of some 170 miles, which was accomplished in about 2½ hours, at an average speed of 130 m.p.h. Other accounts state that the 130 m.p.h. quoted was, however, not the average, but represented the maximum. It is computed that her loaded weight would be of the order of 11,000lb. Her unconventional disappearance of propeller and engine mounting is further enhanced by the absence of the rhythmic beat and drone of the normal engine, its place being taken by a loud humming. It is clear that the humming persisted long after the flight was completed —it echoed through the corridors of every Air Ministry and 'plane factory in the whole world. The industry seethed with excitement. Here was an entirely new type of engine constructed to harness the air and use it far less wastefully than any other type of power unit of a similar weight. There is no engine housed in the nose, instead there is a hollowed air duct, whose function is to scoop the air and force it through a battery of compressors, driven by an especially designed engine, which also undertakes the task of heating it. The hot air is then forced into an ever-narrowing tube, emerging through a splaying nozzle which projects from beneath the tail unit.

The scanty reports reaching this country were closely shadowed by talk of similar experiments on the same lines by the Arado concern in Germany, and hints regarding the trials and setbacks of the internal-combustion turbine sponsored by the Swiss Company of Brown Boveri; and now comes the official curtain-lifting that Britain has entered the lists with a dark horse that has been long and careful in the fashioning. We learn that Group Captain Frank Whittle's experiments started as far back as 1926, and that they entered the final phase in 1933, culminating in patents being taken out in 1936—with the result that the prototype first took the air in May, 1941.

Glider Bomb

It may well be that the Arado concern have developed a rocket-'plane such as is envisaged earlier in this article, and that it is a stable companion to the rocket gun, about which we have heard so much recently. Indeed, some such development is foreshadowed by the scanty Press accounts recently released regarding the German use of a new jet or rocket-propelled high explosive glider bomb sometimes quoted as Henschel Hs.293, controlled by radio from a parent aircraft (identified as Dornier 217). The bomb is fitted with wings of small span and a tail unit. It probably averages about 260 m.p.h., and its weight would be about 1,000 to 2,500lb., and it is carried slung beneath the aircraft, which, flying on a parallel course to its target, and out of reach of its A.A. guns, releases it, and by remote radio control steers it to its objective.

It is always unwise to attempt to prophesy, but if one may hazard a guess as to the track of these parallel lines of development and essay to envisage the place where, in such a future that Einstein postulates, they converge, I would suggest that it is feasible that in both cases the tendency will be for the old established tail unit to disappear (like that of the tadpole), its functions being taken over by a multiplicity of jets spread over the entire span of the "all-wing" (or finally wingless) craft. This stage may be reached by a natural evolution that permits of a retracting wing (Fig. 6) in the intermediate years, pending the fuller development of the rocket discharge type of craft.

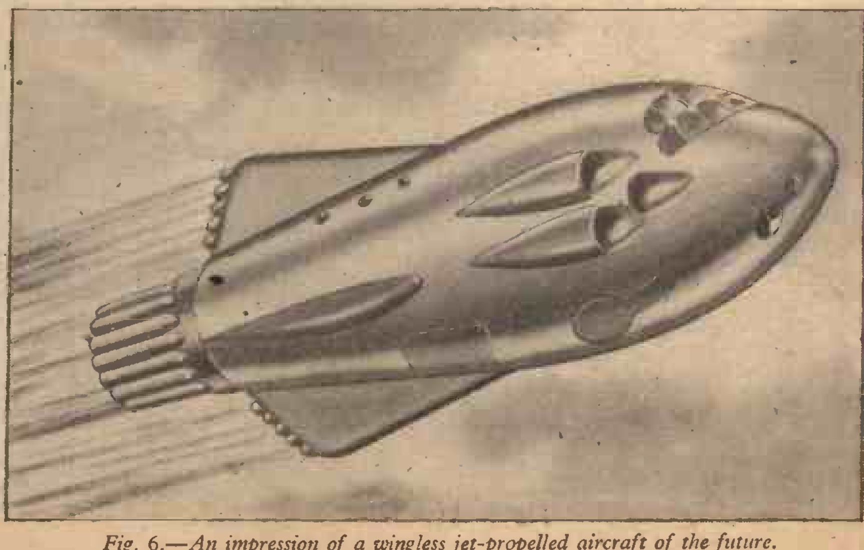


Fig. 6.—An impression of a wingless jet-propelled aircraft of the future.

A Water-driven Charging Plant

Constructional Details of an Inexpensive Unit

By F. G. and H. J. RAYER

IF a suitable location can be used for building a charging-plant driven by water power it will be found that it has many advantages over the more usual wind-driven unit. A windmill runs at varying speeds, depending upon the velocity of the wind, and if an efficient voltage-regulator is not used there is the danger of charging the batteries at a rate in excess of that which should be employed when the weather is gusty, while in calm weather the unit will not work at all. None of these disadvantages are present in a water-driven plant, for the dynamo will run at constant speed, and it will be possible to trickle-charge a small cell at a constant ¼ amp., or charge a large accumulator at 6 amps., as desired.

The charging plant here described (Figs. 1 and 2) is not difficult to build and will provide sufficient current to charge 12 2-volt accumulators of normal capacity simultaneously. The dimensions given could be varied and a smaller or larger unit built, if desired.

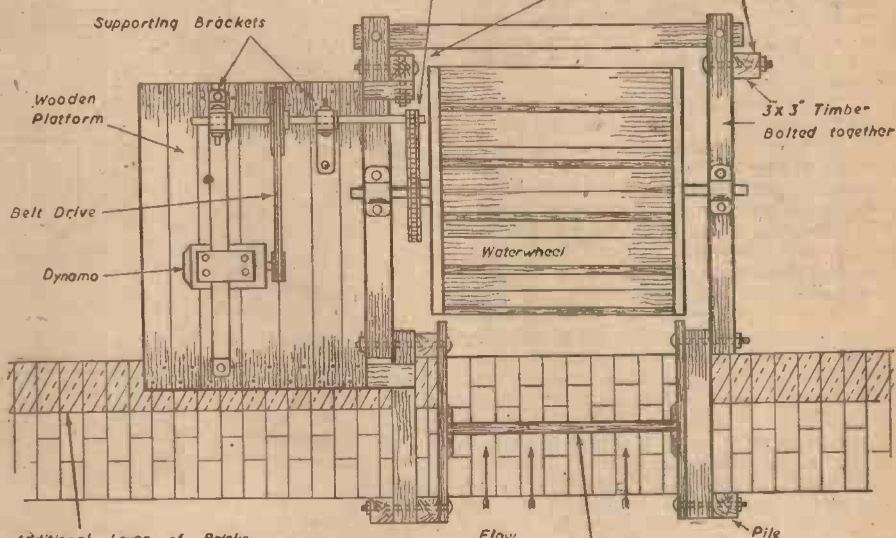


Fig. 1.—Plan of the complete water-driven charging plant.

The Water-wheel

This is not so complicated as might at first sight appear. It is quite small, being only 2ft. in diameter by 2ft. wide. It is made entirely of wood, eight pieces of board 6in. by 2ft. being used for the centre, and 16 pieces 4½in. by 2ft. for the buckets. Fig. 3 shows the shape and method of construction. The wheel is fitted with an iron axle which passes through two iron cross-pieces nailed to the wooden ends of the wheel. When the wheel is completed it should be given a thorough coating with some water-resisting paint. The method of arranging the bearings of the wheel is shown in Figs. 1 and 2; all the necessary metal parts can be obtained from a blacksmith or ironmonger's for a few shillings.

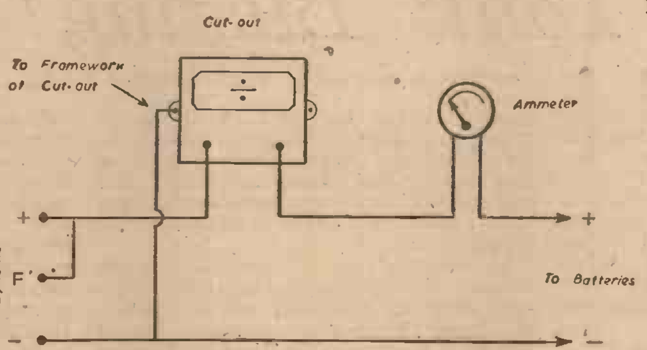


Fig. 4.—Diagram of electrical connections.

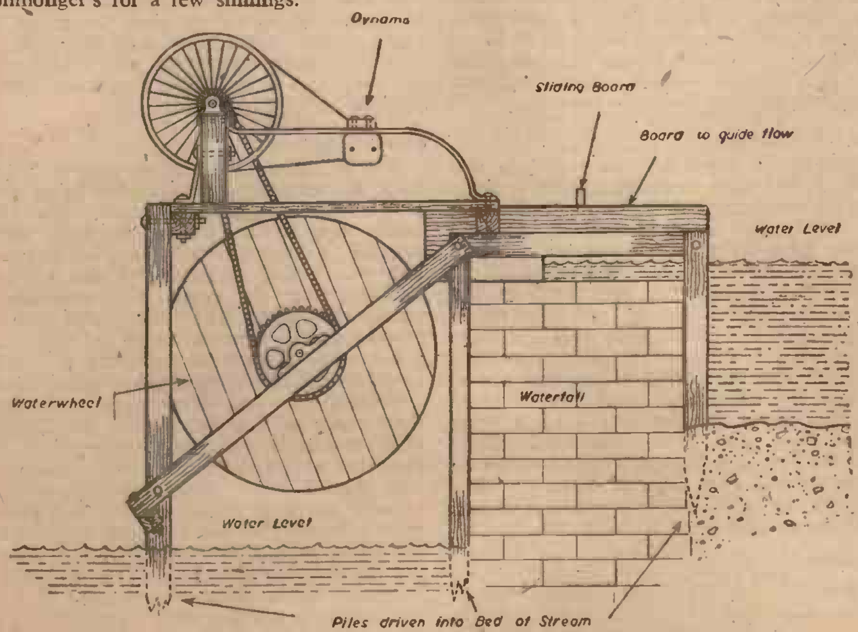


Fig. 2.—Side view of the plant, showing the construction of the framework.

Dynamo and Gearing

As the water-wheel is of small diameter it will turn rapidly, and in the original model built it was found that a step-up ratio of 1 : 20 was ample. The drive from the water-wheel to the countershaft is a bicycle chain, the "crank" gear being fitted to the lower shaft, which is filed to the correct size to make a proper fit. A leather belt is used between countershaft and dynamo, and the illustrations make clear the method of fitting this. The dynamo is clamped to a 2in. wide and ¼in. thick strip of iron which is screwed to the one countershaft bearing support and to the wooden platform; by loosening the clamping screws the dynamo can be moved along the strip to adjust the belt to the correct tension. The whole assembly should run truly and easily, and the bearing should be kept well greased.

Construction of Framework

Timber 3in. by 3in. is used throughout, the separate pieces being bolted together by ½in. diameter bolts of appropriate length. All the woodwork should be painted or creosoted, especial care being taken to thoroughly treat those parts which will be immersed in water. Although not shown in the illustrations for the sake of clarity, a hut-shaped box should be built to fit over the platform to protect the dynamo, belt, etc., from rain. The countershaft passes through a hole in one side, and the cover should be fitted with a hinged lid, so that access may be had to the charging-board and batteries. It can be covered with roofing-felt to make it watertight.

Electrical Details

The dynamo, cut-out and ammeter were obtained from a garage. The dynamo is of the 12-volt 8-amp. type, although a 6-volt unit could be used if desired. If the dynamo used is fitted with a separate field-connection this should be connected to the plus terminal of the dynamo, so that the maximum charging rate is obtained. Some dynamos are fitted with a movable brush to adjust the current output; if this is so, the brush should be moved as far as possible *in the direction of rotation* of the dynamo. The cut-out guards against any possibility of the batteries running down through the dynamo. The ammeter obtained had a maximum reading of 16 amps., which was too great for the purpose. The instrument, which was obtained from a garage, was opened, and the operating coil, which consisted of 2½ turns of wire, was replaced by a coil having 5 turns, so that all the readings were halved.

It is not proposed to give details of the charging of batteries, as a series of articles have lately appeared in *Practical Wireless* dealing with this matter fully (*P.W.* November and December, 1943). The required charging-current for the batteries in hand is obtained by adjusting the flow of water on to the water-wheel, this being done by raising or lowering the sliding board in the chute which carries the water to the wheel. The board is fixed in the required position by means of a small peg. It was found of advantage to fix a piece of small mesh wire netting in the stream immediately above the water-wheel, so that drifting pieces of wood, and leaves, etc., could not block up the water-chute, and partially stop the flow of water.

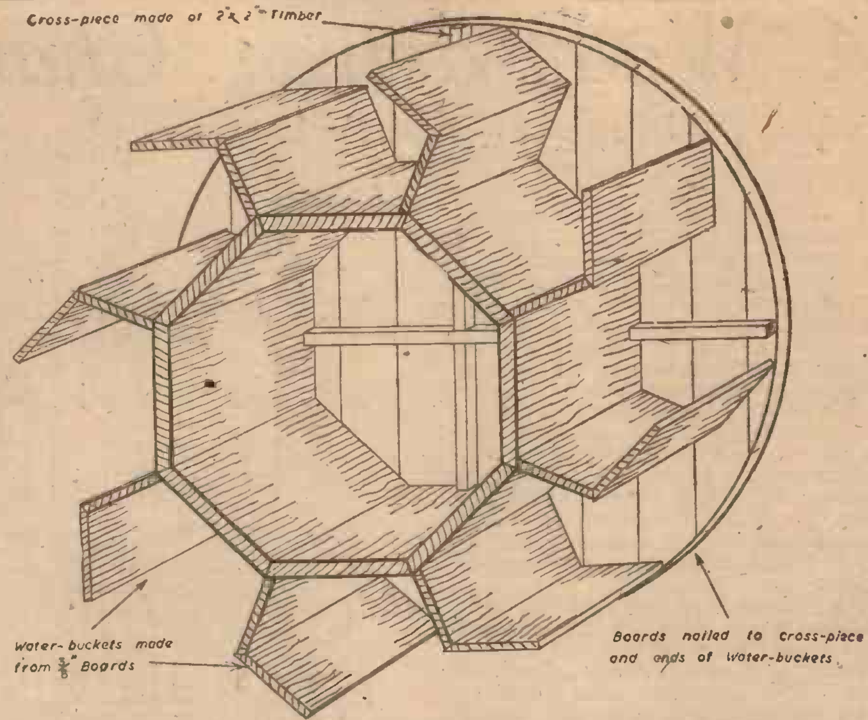


Fig. 3.—The water-wheel, with one side removed to show the shape and construction of the water-buckets.

"Tank Busting!"

Various Weapons for Effectively Dealing With Enemy Tanks. By R. H. WARRING

PARALLEL with the development of any weapon of warfare is the development of methods to nullify or destroy that weapon. In the main "defence" lags behind offence, an entirely new offensive instrument having in the initial stages the advantage of surprise. But tanks are not new; and neither are the methods devised for their destruction. Both, however, have made extremely rapid progress since the beginning of this war, and both rank amongst the major factors of any land battle. Tanks, well directed and supported by the ancillary services, can establish a superiority on any battlefield out of all proportion of their true value unless met by well-planned and determined defences. Their most spectacular results have been achieved against ill-formed, badly equipped and half-hearted troops; their most disastrous against some point at which adequate defences have been concentrated.

Immobility

In spite of their mobility, armour, often heavy armament and terrifying effect, tanks possess many weaknesses. Possibly the greatest of these is immobility resulting from damaged or displaced tracks. A tank is only mobile as long as these tracks hold out. Broken or removed by any means, it may become a metal stationary armoured pill-box, but is subject to any concentration of the defensive fire. A disabled tank is capable of being a great nuisance, but it must remain stationary until repaired, and thus loses the majority of its usefulness.

A disabled tank is further handicapped on account of its relative blindness. Obviously all openings must be reduced to a minimum if the armour is to be effective, and so the only view available is through the inspection slits used by the driver, commander, gunners and periscope, if fitted. On many tanks, and almost all the early types without exception, it was impossible to see any object immediately above the tank or on the ground within a radius of about twenty feet of the tank itself. The only solution to this problem was to open the lid, when the observer is exposed to any defensive fire.

In formation tanks are able to cover one another's blind spots, and therefore are much more dangerous than when isolated. Again, the majority of tanks are unable to depress their guns to fire at anything at ground level within a radius of 20 feet or to fire upwards above an elevation of 25-30 degrees. Turret guns must be revolved, and this takes time, so that a rapid change of direction of heavy fire is not possible. Hence the advantage of simultaneous attack from different directions upon an isolated tank.

Use of Aircraft

Aircraft, in particular, are suited in this manner to tank busting, being quickly capable of changing direction or evading fire put up by the tanks themselves. Ground forces or covering air forces are required to protect the tanks from such an attack.

However, a tank has comparatively few vulnerable points against ordinary small-arms fire. The observation slits are often protected by bullet-proof glass, but this "glass" stars, obscuring vision, and has to be replaced when hit. Such slits are given overhead protection by means of a small metal plate, and thus it is rarely likely that machine-gun bullets from an attacking aeroplane can ever hope to penetrate. For this reason tank-busting aircraft is drawn from those types fitted with cannon.

Cannon

Although we were somewhat backward in adopting cannon as armament for aircraft, the Under-Secretary of State for Air announced in March, 1940, that British fighters were being armed with cannon, and from thence onwards it was regarded as standard. The R.A.F. cannon is a British Hispano, with 20 mm. calibre, each shell weighs one quarter of a pound. Aircraft such as the Beaufighter, Hurricane II B, Mosquito, etc., carry four cannon, with a total rate of fire of 2,400 projectiles per minute or a total weight of fire of 600lb. per minute. These are now followed by the Hurricane II D, with the 40 mm. cannon.

The smaller cannon shells proved themselves capable of penetrating light armour, and also did quite an appreciable amount of damage if mixed up with the tracks of enemy tanks. But they were not always effective; fired at an angle, they ricochetted off the tanks or failed to penetrate thicker armour.

Dive-bombers

The Russians tried another scheme—using what was virtually a dive-bomber fitted with a particularly ingenious bomb. To this bomb were attached rocket jets, and, when released, it did not drop in the usual manner, but was hurled forwards by the rockets, skidding along the ground until reaching a substantial object. The "substantial object" was, of course, intended to be the tank, and when such a hit was registered the tank could be considered as so much scrap metal.

Beaufighters and Hurricanes have had their share of tank-busting in the Middle East, and it is interesting to speculate on the latest of the Hurricane family—colloquially named the "Hurri-buster"—which mounts two large calibre cannon, one under each wing outside the air-screw disc, firing projectiles of sufficient size to penetrate all but the toughest armament. It is interesting to recall that so long ago as 1917 a F.E. 2.B machine was in service with No. 213 Squadron fitted with a 1-pounder gun, whilst in 1933 Blackburn "Perths" of

No. 209 Flying Boat Squadron sported 37 mm. Vickers cannon firing 1.8 shells. Rate of fire was about 100 projectiles per minute. Even bigger amounts were experimentally mounted on isolated machines.

Recoil

The main problem connected with such relatively large cannon fitted to aircraft is recoil. Some of the earliest experiments resulted in the machine in question stalling each time the gun was fired, so great was the recoil. Then some ingenious engineer hit upon the bright idea of simultaneously firing a blank charge in the opposite direction to that of the shell. This was tried out—but the resulting explosion nearly blew the fuselage in halves! No doubt, however, a satisfactory solution has been reached in the case of the "Hurri-buster," or possibly the cannon are not as troublesome as first suspected.

Weak Points

Further points of vulnerability of tanks (the slits being most open to small-arms fire close in) are the belly—generally the spot where the armour is thinnest—the top surfaces, again armour thinner than sides; the louvres and vents, and the turret.

piercing projectile, is effective against light armour at relatively short range, and against tracks of all types of tank. It suffers from the same defect as all small weapons in that projectiles may "glance off" armour from any but a near perpendicular hit.

One anti-tank measure, which has been similarly employed against all types of ground forces, is the land-mine. These are generally arranged in specially prepared positions, having entrance to any specific region (synonymous with sea-mines) or sown indiscriminately as a retarding measure during retreat, to hamper the enemy forces following. Many specialised forms of anti-tank mines are employed, capable of immobilising the majority of tanks in use. They are also effective in blowing off their tracks.

Molotov Cocktails

For individualistic effort the destruction of tanks at close quarters presents a hazardous and courageous job. The well-known Molotov Cocktail of Home Guard fame consists essentially of a glass bottle containing a mixture of petrol and other inflammable substances, such as tar, diesel oil, etc., so that the solution sticks to the surface of the tank when the bomb has been thrown against it and burst. Some simple

is more likely to be seen in local invasion areas.

The art of stopping tanks, although more in the nature of "passive" defence, has also produced its surprises and developments. In the first place a most formidable road is useless if the tank may circumnavigate it, and laying mines around this possible invasion path is not always practicable.

Tank Traps

Defences may also have pits dug as tank-traps, though these have often proved more effective as "reservoirs" of muddy water than their original object. Such a pit must be at best one half the length of the largest tank it is intended to stop, and even then, if approached at speed, the tank may jump such a distance. Raising the other bank so that a jump is impossible may be all right—unless the tank approaches from the other direction, when the bank will help it.

The most effective counter-measure is the anti-tank mine, sown intelligently and well concealed, while decoys and booby traps may be linked with their use. A harmless layer of straw or a sheet of canvas laid on a road may, at least once, cause a tank commander to suspect concealed mines or other obstructions and make a detour.

A tank cannot climb a defile which results

A ground crew servicing a Hurricane "Tank Buster." The 40 mm. cannon can be seen housed under each wing.

To direct against these points the defending forces may have a large assortment of weapons, from rifle fire to flame-throwers. Rifle fire, as explained above, is only effective if directed against openings in the main body of the armour or against an observer stationed in the open lid of a tank. The latter generally adopts this position when running over relatively "free" ground, and so is thus susceptible to surprise attack, but in action the lid is closed.

Anti-tank Guns

One of the main defensive weapons is the anti-tank gun. This has advanced from being an ordinary field-gun firing practically horizontally into a specialised instrument. A detailed description of such types, even if this were permitted, would occupy a whole volume. By themselves and/or artillery, provided they are not "saturated" by the attack, they are the most effective means of defence.

The anti-tank rifle, firing an armour-

form of ignition is fitted, so that when the bottle breaks the mixture is fired.

From this rather "Heath Robinson" contraption the next step is the phosphorus grenade, again a glass case with a mixture of phosphorus and benzine, which will ignite spontaneously when the bomb bursts (i.e., the glass is broken by impact). Besides producing extreme heat in burning, the phosphorus grenade also gives off large quantities of dense white smoke, which makes the interior of the tank particularly unpleasant.

The next step was the "sticky-bomb," so called because it sticks to the side of the tank when thrown against it and then bursts. The high explosive contents (nitro-glycerine or similar) was detonated by a five-second fuse similar to that of a Mills bomb.

But the majority of tank battles at the present time have generally ended in a duel between tank and tank, or tank and anti-tank gun rather than individual effort, which

in its axis being tilted beyond 40 degrees above the horizontal, neither can it climb a vertical face which is higher than the top of its tracks. Thus many natural tank obstacles may be found and, where not quite sufficient, may be supplemented by artificial means.

Trees and tree stumps likewise often prove good "traps," but unless the trunks are greater than 18in. diameter, single trees will be crushed and broken by a medium tank. Small trees become more effective if possessing depth, such as in a copse or wood, particularly if closely placed. Tree stumps of about 3ft. in height and 2 or more feet in diameter are often effective in lifting the belly of the tank and thus raising the tracks off the ground, but a single line of stumps is ineffective, i.e., a "depth" of defences is required.

Once immobilised, the tank may be dealt with in the manner described above or, turned from its course, may be forced on to ground more favourable for the defences.

Small Wind-power Plants—4

Erecting the Pole : Instrument Panel and Wiring

By W. H. SUTHERLAND

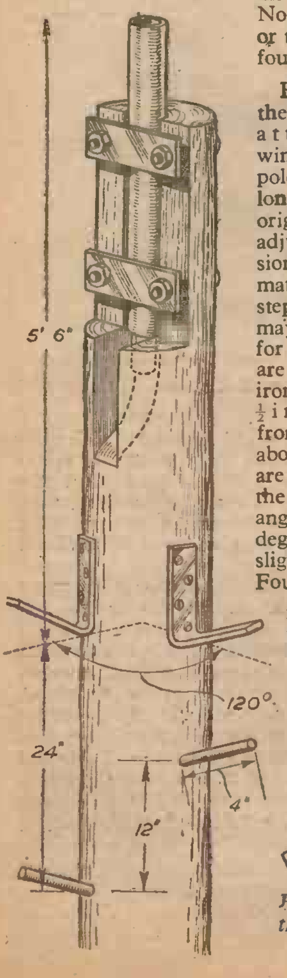
(*Continued from page 187, March issue.*)

THE success of a home-made wind-charger depends to a large extent on the erection, wiring, and associated equipment. Usually a wooden pole is the only type available. One sees very many small units perched on top of light poles only 3in. or 4in. thick, but sooner or later they disappear from view. It is very easy to underestimate the power of a storm, but it is a mistake that is seldom made a second time. A small pole must be well tied with guy-wires, particularly in the direction of the prevailing wind. It is much less trouble in the end to use a large pole containing the greater part of a good straight larch or fir tree, sunk about 4ft. in a hole filled with loose stones and cement. Once erected, such a pole forms a permanent support worthy of the best windcharger.

Erecting the Pole

It is usually convenient to erect the pole beside the wall of a house, to which it is secured by two iron bands, passing around the pole, and through a hole in the wall. The pole in the illustration is held in this way at a point about 13ft. from the ground, the total length above ground being 32ft. The bands used were two leaves from a motor-car spring, bent to "embrace" the pole, where they are held in position by a bolt, and bolted similarly over a long flat iron plate bridging the hole on the inside of the wall. No other supports or tying wires were found necessary.

Fig. 1 shows the best method of attaching the windcharger to the pole. The four long bolts were originally used for adjusting the tension of a wire mattress. The top steps, where one may have to stand for long periods, are made from flat iron bars, 2in. by $\frac{1}{2}$in., projecting from the pole for about 6in. They are spaced, like all the steps, at an angle of about 120 deg. and are tilted slightly upwards. Four 6in. nails, or long screws, hold them in position. The climbing steps are made from lengths of solid $\frac{1}{2}$in. iron bars, driven into $\frac{3}{8}$in. holes in the new timber. Four inches will be found sufficient to leave projecting. Such a system of steps is much easier to climb than a ladder of similar height, and even the most nervous climber becomes accustomed to it after attempting easy stages.



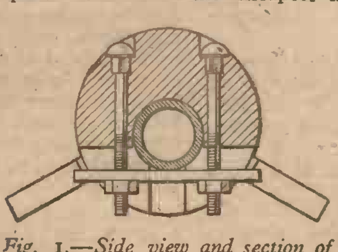
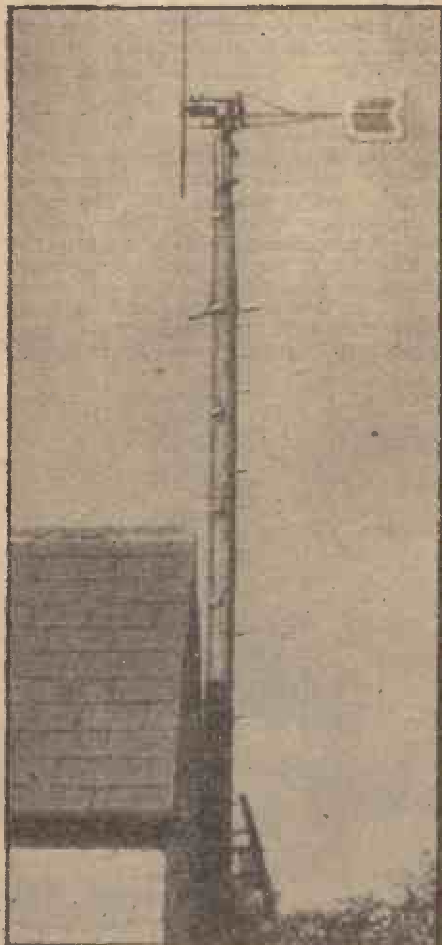


Fig. 1.—Side view and section of the pole, showing method of attaching the wind-charger.



A view of the complete plant. The small blocks seen along the front of the pole carry the copper conductors. One row of climbing steps can be seen on the right of the pole.

Conducting Wires

The wires from dynamo to instrument panel must be as heavy as possible, to avoid excessive losses at the low voltage. In the absence of proper rubber-covered cable, bare 7/22 aerial wire is quite good, and is the cheapest heavy wire available. Those living in a locality where there is a scrap-yard, or large garage at hand, should try to get sufficient copper strip for the job from field-coils of old motor-car self-starters. The small starters only yield lengths about 6ft., but one may be lucky enough to find an old model with large coils. The author found an old "Hupmobile" dynamo which supplied two 30ft. lengths of flat $\frac{1}{2}$in. by 1/10in. copper strip, which, along with that already taken from the coils of the A 900 C, reached to the panel. To join the strips, clean $1\frac{1}{2}$in. of each with emery paper, bind together with bare 18 or 20 gauge wire and melt solder well into the joint. Alternately drill small 6 B.A. holes and rivet the strips together with brass boot nails before soldering. The conductors are held on the pole by wooden blocks every 36ft., some of which can be seen in the photograph. No attempt is made to cover the wire, either here or any other point in the lighting circuit, since no leakage occurs at 6 or 12 volts across timber or plaster. The problem of raising the heavy pole, with the weight of the windcharger already assembled on top, is best solved individually. Ten men were needed to lift into position the pole illustrated. A home-made windcharger should always be "run-in" for several weeks on a small 8ft. temporary pole, where weak points in the construction can be detected and corrected.

Instrument Panel

An ammeter and a cut-out form the essential parts on the instrument panel. However, we shall describe the construction of an elaborate panel, and each reader may include as many of the refinements as he likes. The operation and wiring of a cut-out often puzzle beginners. Two separate coils are wound on the electro-magnet, a coil of many turns on the inside, and a coil of 10 or 20 turns of heavy wire on the outside. The inside coil is connected *across* the dynamo circuit, while the small coil is *in series* with the main charging current. The inside coil alone would not be sufficient for correct working. If adjusted to close the contacts at 6 volts, then, once closed, it would not open again until the 6-volt battery is exhausted. On the other hand, if adjusted to close at 7 volts, it would behave as a vibrator, since the dynamo voltage falls back almost to 6 once the points close and connect it through to the battery. The

Instrument panel.

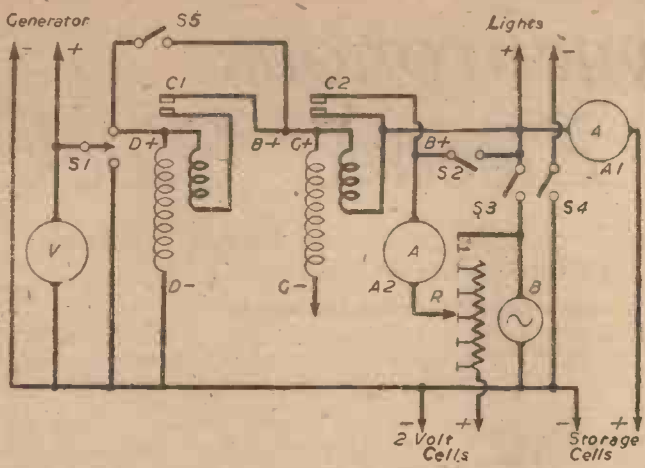


Fig. 2.—Circuit diagram of instrument panel.

second coil is necessary so that the points are held in the closed position in spite of this small drop in voltage by the *added* attraction due to the charging current now flowing through the outside coil. When the charging current again falls to zero, the points open, since the inside coil is no longer able to keep them closed without help from the outside coil. The connections are usually marked clearly by one of the methods illustrated in Fig. 2, but can easily be traced by examination once the above is understood. A 12-volt cut-out with a weakened spring will work on a 6-volt circuit, but a 6-volt cut-out would heat up badly on 12 volts. The voltmeter is connected directly across the incoming wires, so that it registers the actual dynamo voltage under all conditions. The dynamo control switch (S.1) stops the dynamo generating by short-circuiting the field coils when changed into the second position. Under these conditions the propeller "races" when the load is removed, so that the switch should not be used as an alternative to the brake rope! It is useful, however, when one is changing batteries, or working at the instrument panel, or for emergencies to protect the dynamo windings. The push-pull switch (S.5) shorts the main cut-out points, allowing the dynamo to run as a motor from the battery. Its main use is for testing the condition of the battery, indicated by the battery voltage registered on the voltmeter while the battery is supplying 4 or 5 amps. to the dynamo. It is useful also when oiling the dynamo or cleaning the commutator.

Cut-out

The cut-out (C.2) automatically switches on the 2-volt charging circuit whenever the main charge exceeds 6 amps., or any other value for which the spring in C.2 is adjusted. In this way, the 2-volt batteries will receive their current at a time when it can best be spared from the main charging current, and can be left connected for a week or so until their indicators register a full charge. The current delivered to the 2-volt cells is set by means of the rheostat (R.). This was made from the wiper of an old volume control moving over flat contacts cut from the brass vanes of an old variable condenser. Short lengths of resistance wire are attached from contact to contact, the lengths being found by trial. The last pieces should be doubled or trebled to carry up to 6 amps. if necessary. The ammeter A.2 has a full scale deflection of about 6 amps., and can be made by increasing the number of turns in the deflecting coil of an ordinary car ammeter. The needle is also bent to one side to extend the range. The switch (S.2) short-circuits the second cut-out, leaving the 2-volt cells to charge at a steady rate from the car battery. This rate will not be affected when the dynamo begins to charge, but will remain reasonably constant even when the charge rises to 15 amps. Two 2-volt cells in series can be charged simultaneously. The end contact on the "off" side of the rheostat goes to a bulb-holder. If a bulb which consumes 5 or 6 amps. is plugged in, it acts as an artificial load for high winds, so that the current reaching the storage cells does not vary so much. The second last rheostat contact is the "off" position. Normally, a 6-watt bulb in the holder (B.) acts as a panel light, controlled by the switch (S.3). A fuse in the charging circuit is a source of trouble, since it may cause the dynamo to burn out if it blows at the beginning of a windy night. A 10-amp. fuse may be included in the lighting circuit, to protect the battery. A slight alteration is needed in the conections of the cut-out (C.2), but the wiring diagram makes it clear. The main ammeter (A.1) is connected directly to the battery, so that no current may enter or leave the latter without registering on the meter. Remember that the negative wire must be well earthed, preferably at the foot of the pole, as a protection from lightning damage. A 1-mfd. condenser across the brushes on the dynamo will stop any radio interference. See that the 2-volt charging circuit draws its current from the positive line *after* the heavy coil of cut-out (C.2), so that the operation of the cut-out will not reduce the current through its own coil and cause it to vibrate.

House Wiring

For wiring the lights, 7/22 aerial wire is very convenient. For small living-rooms, two 12-watt bulbs suspended over the two main "chair-positions" at each side of the fire, is a good arrangement. When only one person is in the room, the second light can be left off. With a large conical shade made from a circular cake-tin lid, well polished, good reading light is obtained beneath a 12-watt bulb. Two 24-watt bulbs may be kept at hand to be plugged in for special occasions. For passage-ways and halls, 6-watt bulbs are quite sufficient, and can be mounted artistically under thick glass ointment jars with their lids screwed to the wall or ceiling. For very small lights on 6-volt circuits, screw-in cycle bulbs, consuming 1.5 watts, are very suitable. It is advisable to economise on power wherever possible by using efficient tin or other reflectors, even at the expense of appearance.

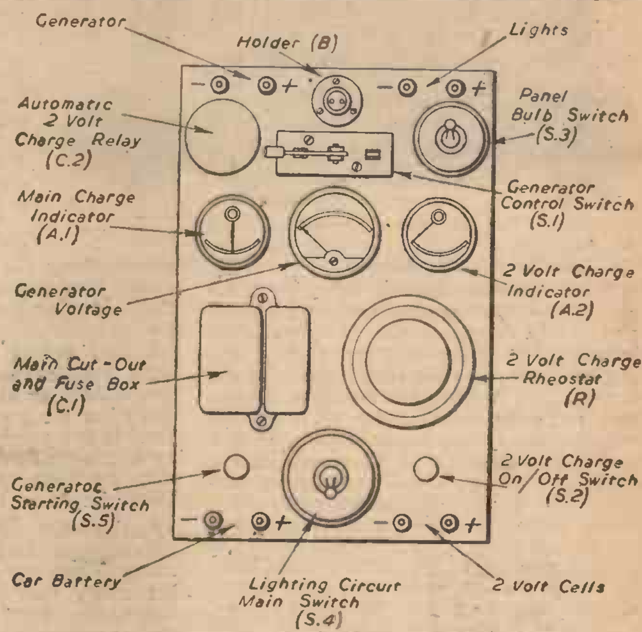
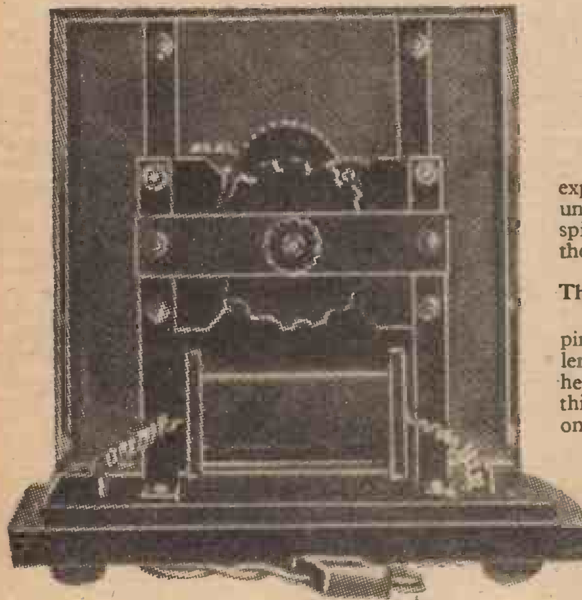


Fig. 3.—Layout of instrument panel.

U.S. naval officers aboard the flying boat Mars *sit at the imposing control board which gives them a visual check on all vital aspects of the massive plane's operations. The* Mars, *which has a wing span of 200 feet, and is the world's largest flying boat, was placed in Pacific service by the U.S. Navy last January.*

Building a Synchronous Electric Clock



A rear view of the finished clock

Further Details of Construction and Bobbin Winding

(Concluded from page 185, March issue.)

The Spindle for the Hands

THIS spindle, which is driven by a 50-tooth wheel secured to it, in a manner to be described later, is journalled in the centre hole of the front gear plate. This hole corresponds to the rotor bearing in the rear plate. The rotor bearing is, of course, occupied by the rotor spindle, so, to provide a rear bearing for the hands spindle, a small bridge is constructed, as illustrated, from a couple of small pieces of angle brass surmounted by a small strip soldered on. Two 5/32in. holes are drilled in the bridge feet, and corresponding tapped holes are made in the rear gear plate. By drilling large holes and using washers under the screw heads, as was done with the horizontal plates, lining up of the bearings is facilitated. This completes the drilling for the 22,500 to 1 reduction between the rotor and the spindle of the minute hand.

The hour hand, which is secured to the boss of a gear wheel mounted on, but free to rotate on, the minute hand spindle, is driven by a reduction gear consisting of a train of 2 to 1, 2 to 1, and 3 to 1, i.e., 12 to 1 in all. An idle pinion is introduced into this train of gears to provide a reversal of rotation. Without this idler the hour hand would revolve anti-clockwise.

A ¾in. pinion is locked on the minute-hand spindle. It drives a 50-tooth wheel on a spindle in hole C. This spindle also carries a ¾in. pinion which meshes with another 50-tooth wheel on a spindle in hole D. The perforated plate is again employed to position holes C and D, which are in both gear plates. A ½-in. pinion on the spindle in hole D drives an idle ½in. pinion, which meshes with a 1½in. gear wheel on which is secured the hour hand. These last mentioned two pinions and gear wheel are accommodated on the front face of the gear plate and it is necessary to saw off the bosses on the pinions and file them smooth. This is done so that the dial of the clock may be brought sufficiently close to the gear plate to allow the boss of the 1½in. gear to project slightly through the dial.

The ½in. pinion on the spindle D is secured to the spindle of soldering. If the hole in the pinion is countersunk fairly deeply, sufficient of the spindle will be exposed to ensure a sound soldered union without projection of the spindle end beyond the face of the pinion.

The Idler Pinion

The pin on which the idler pinion revolves consists of a short length of axle rod on which a head is formed with the aid of a thin, tight-fitting washer soldered on. The position of this short spindle, which only penetrates the front plate, is found by trial, using crimped paper strips to give clearance, as explained earlier. The spindle is secured by means of a collar sweated on to the back of the gear plate.

To allow for adjustment of the hands, to the correct time, the 50-tooth wheel on the minute hand spindle is secured to the spindle with a friction device, consisting of a six-arm star piece. (See Fig. 5.) It is sawn and filed out of a small piece of springy brass, soldered to a collar, and the arms bent to bear on the face of the wheel. The wheel has its grub screw removed. The wheel is prevented from moving away from the star piece by having its boss in contact with the boss of the ¾in. pinion which drives the 12 to 1 reduction train.

At this stage, the polishing and, if desired, lacquering, of the brass parts may be undertaken. Clean up all the brass work with fine emery cloth. When the polishing is satisfactory, apply a lacquer composed of a small quantity of scrap, colourless, celluloid dissolved in amyl acetate. Sixpenceworth of this solvent will be sufficient for the job. The same lacquer is also suitable for applying to the face of the clock after it has been marked out, to prevent it fingermarking.

The various parts may now be assembled. Screwed rods cut into lengths of 3½in. provide the means of securing the stator poles and gear plates in their correct positions. Nuts and washers are used in preference to distance pieces to position the various parts, as they provide means of adjusting the spacing.

At this stage, the front supports, which are similar to the rear legs, except that they are as high as the dial, can be made. To ensure that all the holes are in line, a long piece of axle rod should be inserted through the holes in the back bearing strip, front and rear gear plates, during assembly.

When the clock is completed and running it is, or it should be, quite silent. To show that it is running and therefore indicating the correct time, an indicator is provided. It consists of a 1½in. sprocket wheel to which is attached a disc of white paper, or thin card, on which are painted two black segments. The wheel is attached to the spindle in hole A, the spindle being made long enough to take it. The wheel rotates at approximately 40 revs. per minute, and a semicircular window in the dial allows it to be seen.

Winding Operations

It consists of 8oz. of No. 36 S.W.G. double silk covered instrument wire wound on a bobbin which is a neat fit on the stator yoke. The bobbin is built up by wrapping stiff paper, or very thin card, around the yoke until it is three layers thick. The end cheeks of the bobbin are cut from 3/16in. thick ebonite. They are 2in. square. The central rectangular openings are cut with the aid of a fretsaw, taking care to make them a neat fit over the paper wrapping on the yoke. Secure the end cheeks in position with a little celluloid cement or shellac. When the bobbin is dry slide it off the yoke and fit it on to a piece of wood, previously cut to the same dimensions as the yoke. Commence, and finish off the winding by soldering the 36 gauge wire to a short length of flex pushed through a hole in the end cheek, taking care to insulate the joint with waxed paper or radio sleeving.

Wind on the entire 8oz. of wire as evenly as possible, inserting a layer of thin paper between every few layers of wire. The paper will assist in keeping the layers even. The exact quantity of wire is not critical and there is no need to count the turns. This winding enables the clock to run for approximately nine days for a consumption of one unit of electricity. When the winding is complete it should be covered with a wrapping of dark coloured paper and doped with celluloid lacquer.

The winding is again fitted on to the yoke and placed in position between the stator poles. See that the transformer iron strips bed neatly up to the ends of the pole pieces so that there are no small gaps in the magnetic circuit.

Testing Out

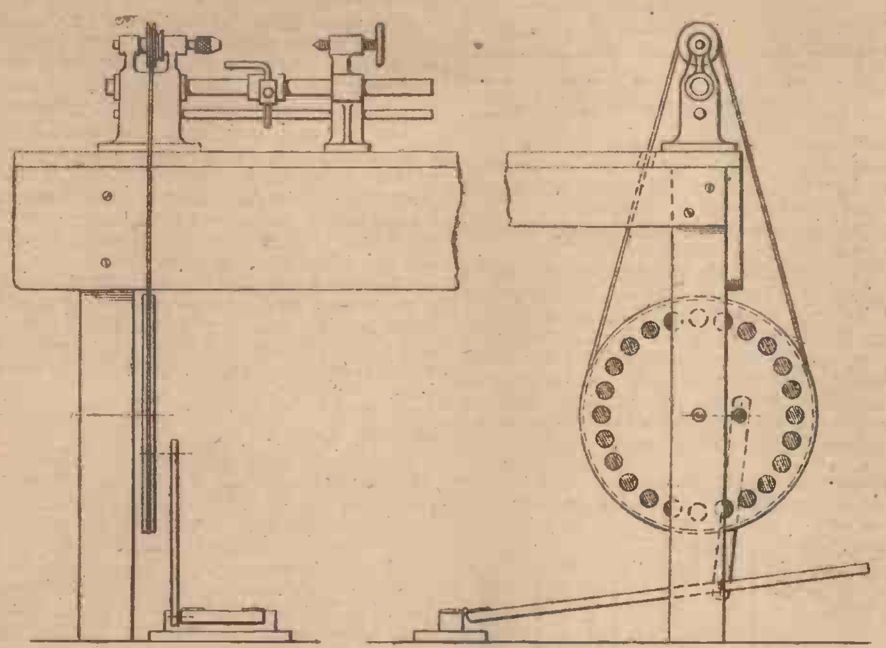
Now connect the winding to the mains, with a temporary piece of flex, and the clock is ready for testing. Spin the rotor, with the aid of the ¾in. sprocket wheel secured to its spindle as a finger grip, gently round. If everything is in order and the right starting speed has been attained the rotor will continue to revolve. A few trials may be required to get the knack of spinning it at just the right speed for starting.

The Hands and the Dial

The hands are sawn and filed from thin sheet brass, and when completed they are given a coat of black lacquer. The minute hand has a collar soldered to it to secure it to its spindle. The hour hand has a piece of tube, whose bore is a push fit on the boss of the front 57-tooth wheel, soldered to it for mounting. This tube should be about ¼in. long and, if a piece of drawn tube is not available, it may be fashioned from a strip of brass bent round the wheel boss.

The case also gives room for personal expression. The one illustrated is built from ordinary window glass, bound at the joints with passe partout. The construction of it was aided, greatly, by making a rough cardboard box, the size of the inside of the glass case, on which to secure the pieces of glass whilst the joints were drying.

A Lathe Treadle-wheel



Figs. 1 and 2.—Front and side views of the completed wheel and treadle fitted to the bench leg and ready for use.

How to Construct a Serviceable Lathe Treadle-wheel in Wood

By A. J. BUDD

HAVING acquired a small bench lathe, and as an iron treadle-wheel for driving it is practically unobtainable at the present time, the writer decided to make one of wood. The accompanying illustrations, Figs. 1 and 2, show the result; the finished wheel and treadle have been in use several months, and have given trouble-free service during that time.

Weighting the Wheel

For the wheel, an old pastry board 1ft. 6in. square was brought into use. This board had been stowed away in a dry place for over ten years, and proved to be a clean and well-seasoned piece of deal 1in. thick. On one side of the board a circle 16½in. diameter was marked, and within this circle another one 13½in. diameter was marked, as indicated in Fig. 3. Radial lines drawn from the common centre divide the inner circle into 24 equal parts, and at the points of intersection recesses 1¼in. diameter and ⅜in. deep were made with a carpenter's centre-bit. The recesses were then filled with molten lead, and for this purpose odd pieces of lead piping and sheeting were melted down in an old aluminium saucepan, which was also used for pouring the molten metal into the recesses.

The next operation was the cutting out of the circular wheel from the square board, and this was done with a coping saw, keeping as near to the marked circular line as possible. The periphery of the wheel was smoothed with a rasp.

Wheel Hub and Crank Pin

The wheel hub consists of three parts; a central brass tube, a flanged brass casting, and a square end-plate, shown respectively at A, B and C, Fig. 4. The piece of tube is 2in. long, ⅜in. bore, and ⅛in. thick, and is a push fit in the central hole in the flanged part B, which was bored to suit. This part was also turned square on both faces. The plate C is a piece of sheet brass ⅛in. thick and 2½in. square, with a central hole bored a push fit for the brass tube, to which it is sweated with soft solder.

Having bored the central hole in the wheel a push fit for the tube A, the latter was pressed in place, and the square plate fixed to the wheel with the four countersunk screws, as indicated in Figs. 4 and 5. The flanged collar, B, was then pushed on to the tube and screwed to the wheel with for countersunk screws.

The crank-pin consists of a ⅜in. coach bolt 3½in. long, and this is driven into a tight-fitting hole bored through the wheel at a distance of 2¼in. from the central hole. This allows of a treadle stroke of 4½in., which will be found ample for the purpose. The bolt is driven in from the flanged-collar side of the wheel, as shown in Fig. 4, the squared part under the bolt head holding the bolt securely and preventing it from turning.

For the wheel axle, another ⅜in. coach bolt, 6½in. long, was used, the threaded part at the end being cut off with a hacksaw, leaving the bolt 5½in. long under the head. At the required height from the floor a hole was next bored squarely through the bench leg to take the axle bolt, which must be a push fit. The bolt was tapped in place with a light hammer, after which a large iron washer was slipped on the axle and then the wheel. A smaller washer was then pushed on, and the position of the hole to take the steel split-pin D (Fig. 4) carefully marked. The wheel was then removed and the hole for the split-pin drilled, after which the wheel was replaced and secured by the small washer and pin, so that the wheel runs freely, but with little end play. It will be noticed that a fairly long bearing is provided for the wheel hub: this is to prevent any tendency of the wheel to wobble,

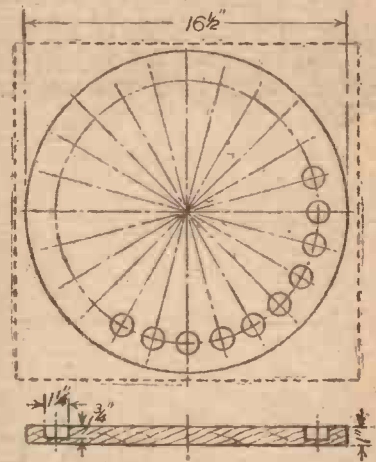


Fig. 3.—Method of marking out the wheel, and the holes for the lead weights.

when running, and also to prolong the life of the bearing surfaces.

Treadle and Connecting Rod

The treadle consists of a planed deal board 22in. long, 4½in. wide and ¾in. thick. The rear end of the board is bevelled slightly and is hinged to a block of wood 6in. long, as shown in Figs. 5 and 6. This wood block

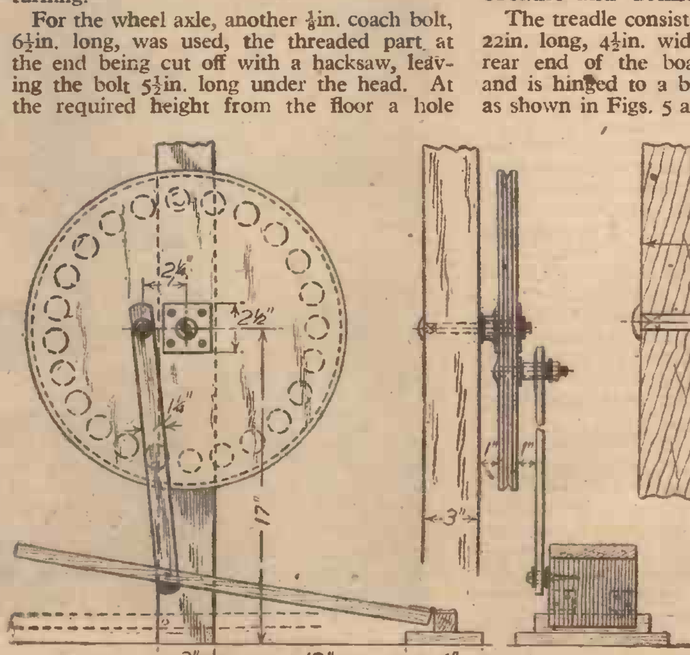


Fig. 5.—Side and front elevations of the complete wheel and treadle.

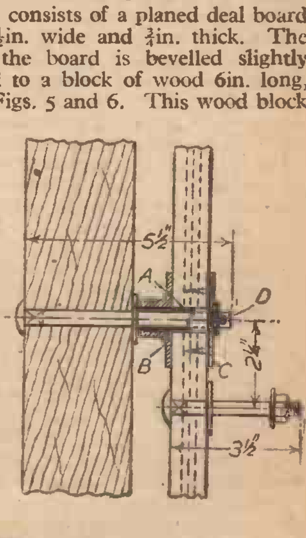


Fig. 4.—Enlarged sectional view of the wheel hub, axle and crank-pin.

is screwed to an 8in. by 4in. board, which in turn is screwed to the floor of the workshop at the required distance from the bench leg which supports the wheel. The two hinges are stout iron ones, with 1½in. by 1½in. leaves.

The connecting rod is a planed oak strip finished to the dimensions given in Fig. 7 and afterwards slightly rounded at the ends. The holes at the top and bottom ends, to take the crank-pin and treadle pin respectively, are brass bushed, as indicated in the illustrations Figs. 5 and 7. The bush (E) for the crank-pin consists of a 1½in. length of stout brass tube, the bore of which is a good fit to the crank-pin. A piece of 3/32in. thick sheet brass, 2in. long and 1in. wide, has a hole drilled through the centre, a tight fit to the piece of tubing, which was pushed through and soldered to the plate, after adjusting for squareness. The hole in the wooden connecting rod is a tight fit for the bush, which is pushed in place and fixed with four round-headed iron screws, the holes for which having been previously drilled near the four corners of the brass plate. The ends of the bush are, of course, filed square.

The bush at the other end of the connecting rod consists of a screwed bearing taken from an old wireless component, the hole through the bush being just the right

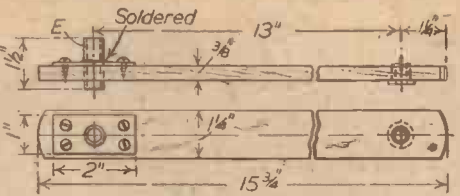


Fig. 7.—Details of the connecting rod.

diameter for the shank of a No. 10 iron wood screw. The hole in the connecting rod is a tight fit for the bush, which was screwed in place till the flanged end is tight against the side of the rod. No other fixing is necessary.

The top end of the connecting rod is held in place on the crank-pin by means of an iron washer and nut, as shown in Fig. 5. The iron screw for attaching the lower end of the connecting rod to the treadle was passed through the brass bush, after slipping on an iron washer. Another washer was then slipped on before the screw was driven into the side of the treadle.

Cutting the Belt Groove

The next part of the work was to true up the periphery of the wheel, and cut the V-groove for the driving belt.

First, a rasp was used, and afterwards a coarse sand-paper block, pressure being applied whilst treadling the wheel fairly fast. A good deal of patience was called for during this part of the work, but the result proved satisfactory, and although the wheel did not run quite as true as a lathe-turned one, it was sufficiently accurate for all practical purposes.

The belt-groove was cut with the aid of a V-pointed tool, filed to shape from a piece of cast steel, which originally formed the tang end of a garden trowel. The wooden handle of the V-tool was held firmly against the apron of the bench, as shown in Fig. 8, and the wheel treadled backwards.

Before commencing the cut with this tool, a shallow guiding groove was formed round the wheel by pressing against it the corner of a square-section rough-cut file, the wheel being treadled at a good speed at the same time.

Driving Belt

For the driving belt, two ¼in. diameter leather belts, as used for domestic sewing machines, were used, joined together to obtain the necessary length. After connecting one end of each belt together with one of the steel links provided, the belt was then placed round the treadle wheel and the larger pulley on the lathe mandrel, and pulled fairly taut. The belt was then cut so that the ends butted, and after a hole was bored through near the cut end the other steel link was inserted and hammered down slightly to pinch both joined ends of the belt. It will be noticed, with reference to Fig. 2, that a hole is bored through the bench, at the back of the headstock, to allow the belt to pass through.

When in use all the bearings of the wheel and treadle are kept well lubricated with machine oil, including the hinges at the rear end of the treadle.

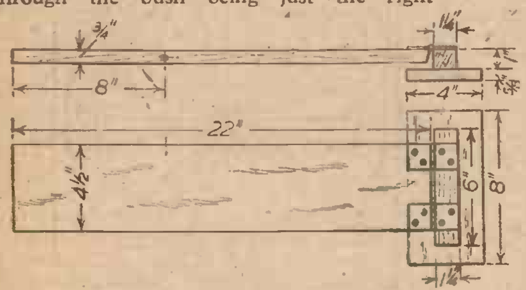


Fig. 6.—Side elevation and plan of treadle.

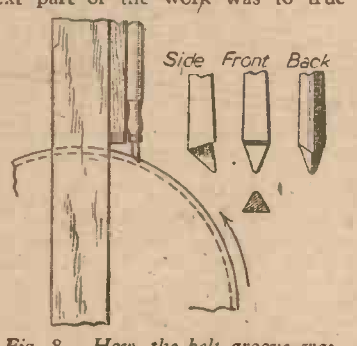


Fig. 8.—How the belt groove was cut in the wheel, and details of the cutting tool.

R.A.F. Make a Runway

WORKING in leather jackets and woollen caps as protection against the stinging winds of north-east Yorkshire, men of an R.A.F. Works Squadron transformed muddy grassland into part of an airfield in a few weeks.

They tackle any airfield construction job in the shortest time, working long hours to break records and increase the Allied air striking power. Here they extended a runway by 300 yards so that it could be used by four-engine as well as two-engine bombers, and to make a new perimeter track around it. The land was first levelled and drained. Then the huge concrete mixer got busy dealing with more than three thousand tons of material each day. In 12 hours 50 men had laid 2,000 square yards of concrete 6in. thick.

The Works Flight with its bulldozer, concrete mixer, tractors, and giant trenching machine is part of an Airfield Construction Wing. There are many such wings working all over Britain speeding up the building and improvement of airfields.

Into the mixer the men shovel sand, stone and cement, which will transform the mud into a flat concrete stretch.

FROM MONTREAL IN 11¼ HOURS

TWO Lancasters operated by Trans-Canada Airlines in the Government transatlantic service, have set a new record for the Montreal to Great Britain flight, arriving respectively in 11 hours 16 minutes and 11 hours 14 minutes after leaving Montreal.

The previous record was 11 hours 35 minutes by a Liberator.

The Proctor IV

Particulars of the New Wireless Trainer for the R.A.F.

The new Proctor IV wireless trainer

THE Proctor IV is a three-seater low-wing monoplane with a 210h.p. De Havilland Gipsy Queen engine, designed to an Air Ministry specification as a wireless trainer for the Royal Air Force, and the Air Branch of the Royal Navy. The machine is a successor to the Percival Gull and Vega Gull.

When the war came the Percival Vega Gull was chosen by the Air Ministry for conversion to Service use. Known as the Proctor I, II or III, according to its duties, it has been used for training or communications by all three Services, in climates varying from those of Scotland to the West Indies.

The new trainer although somewhat similar in appearance to the earlier Proctors, is actually a completely re-designed aeroplane, both from the aerodynamic and structural point of view. In order to emphasise the difference it was officially known, for a time, as the Preceptor; but it was later decreed that it should be called the Proctor IV.

The most noticeable thing about the Proctor IV, compared with the earlier Proctors, is a longer and deeper fuselage with the tail plane set higher in relation to the wing.

From the operational point of view this new Percival trainer is much improved by the wider and deeper cabin, and by the lower engine cowling line. The pilot being seated well forward has a very good view over the nose and leading edge of the wing; this is important for deck landing, and also when taxying on a crowded aerodrome. From his seat on the port side he can comfortably keep in view an aeroplane slightly in front of and below him on the starboard side, as would be the case when flying in formation.

The Proctor IV has been designed to carry the full equipment necessary for training the wireless operators of our big bombers. The possibility of other uses for the Proctor IV has been kept in mind from the outset of the design. The need for an economical four-steater communications aeroplane was foreseen and when, after the first Proctor IV had been delivered, the designers were asked about a communications version, they were able to provide it. The removal of over 200lb. of wireless training equipment allows for the carrying of an extra passenger and some luggage in addition. The unit construction of the seat bearer and control-unit assembly allow for conversion to a side-by-side dual control trainer in a few hours, without any structural alterations.

General Construction

Wood is used for the main structure with metal fittings joining the various components together, and plastics are used for a large number of non-stressed and lightly stressed parts. Synthetic resin glue is used throughout for bonding the wooden parts together, and the interior is coated with seaplane varnish, making the whole structure practically water resisting. With the large inspection panels fitted at different parts of the structure maintenance and repair is easy to carry out.

Wings

The wing is in three sections. The centre portion of parallel chord and thickness carries the undercarriage units and is bolted to the bottom of the fuselage by four bolts. The fuselage is recessed so that its under-surface and that of the centre section coincide. The outer wings taper in chord and thickness and are attached to the centre section by stainless steel fittings. The piece of the wing aft of the rear spar and inboard of the aileron is arranged to hinge upwards allowing the wing to fold back pivoted at the rear spar joint. When the wings are spread a positive and fool-proof device makes sure that the bottom front locking pins are in position before the top pins can be inserted, and the gap fairings cannot be assembled until the top pins are in position.

The outer wings and centre section have two box spars connected at intervals by bulkheads and spruce diagonal bracing members. The contour is formed by wooden ribs and the leading edge is reinforced by plywood extending back to just behind the front spar.

The centre section each side of the fuselage is covered with plywood from the front spar to the trailing edge to provide a wide walkway giving easy access to the cabin. A non-slip tread covers the whole of the walkway. The remaining covering of the wing is fabric.

Wooden split trailing edge flaps are fitted from the aileron to the side of the fuselage, and are operated by a hand lever in the cockpit.

Fuselage

The fuselage is built up with four spruce longerons, plywood sides and a pre-formed ply bottom skin. The top decking is plywood over laminated spruce frames and the complete structure is fabric covered.

Hinged doors are fitted to each side, allowing easy access to the cabin from the wing. These doors can be readily jettisoned, in cases of emergency, by pulling down levers mounted in the roof.

Tail Surfaces

The tail plane is a complete cantilever comprising two wooden box spars, ribs and plywood covering. The complete structure is fabric covered. It is secured to the fuselage by two bolts at the front spar and one bol at the .ear spar on the centre line.

The elevator has a wooden box spar, spruce and ply ribs, and is diagonally braced ensuring a very stiff control surface. A trimming tab is fitted to each side, operated from an irreversible unit on the spar.

The fin is of similar construction to the tail plane. The rudder, of similar construction to the elevator, has a horn balance at the top which houses the mass balanced weight. A trimming tab is fitted at the trailing edge, with a similar control to that of the elevator tabs.

Undercarriage

A robust long travel unit is positioned under each end of the centre section giving a wide track (9ft. 9in.). Each unit consists of a cantilever compression leg, incorporating steel springs and a hydraulic recoil damper. The leg is attached at the top to a simple casting which is secured to the front spar by four bolts. A streamlined fairing from the underside of the centre section merges into the wheel fairing. A mudguard is fitted in the rear of the wheel fairing to prevent large quantities of mud collecting. Medium pressure wheels with Bendix mechanical brakes are used.

Tail Wheel

A pneumatic tail wheel is attached to a cast aluminium rocker arm hinged from the bottom of the sternpost. It is completely rotatable and self centralising. The shock absorbing is by means of a steel spring, the recoil being damped by the use of a Ferode band.

Power Plant

A De Havilland Gipsy Queen II engine of 210h.p., driving a De Havilland constant speed propeller, is mounted in the nose of the fuselage in rubber anti-vibration blocks on tubular steel bearers. The ignition system is fully screened. A vacuum pump is fitted for the operation of the blind flying instruments. A large generator is driven by the engine through the medium of a flexible drive. The cowling is of robust design and comprises four parts, the nose panel, under tray, and two side panels which are hinged on the top, giving complete access to the engine and greatly facilitating maintenance.

A 20-gallon fuel tank is mounted in each outer wing, at the root end between the spars. The feed pipe from each tank is taken to a three-way cock in the cabin. The oil tank of 3.8 gallons capacity is mounted in the leading edge of the centre section on the port side. An oil cooler is fitted at the inboard end of the tank, and faired into the centre section, with an outlet flap adjustable on the ground.

The engine can be started from the cockpit.

Controls

A special feature is the control unit and seat bearer assembly which forms a readily detachable unit bolted to the centre section. This carries the rudder bar, control column, brake lever, fuel cock, fire extinguisher, compass and pilot's seat. A similar unit, but without the fire-extinguisher, etc., is installed when the aeroplane is used for dual control instead of wireless training. The pilots' seats are adjustable for fore and aft position, as also are the rudder pedals. All controls are as frictionless as possible, and although totally enclosed they are readily accessible through the inspection covers provided.

The elevator trim tab control wheel, with its indicator, is mounted in the roof above the pilot. The rudder trim tab control, with its indicator, is on the port side by the instrument panel.

The split flaps are controlled by a spring-assisted lever at the pilot's left hand, giving three positions; flaps up, flaps one-third down (for take off), flaps down. Each of these positions can be clearly felt by the pilot, through the action of the self-locking plunger, so that there is no need to look at an indicator.

The wheel brakes are operated by a hand lever on the right of the pilot, with differential control worked by the rudder pedals.

A bracket mounted from the centre of the dashboard carries the throttle and airscrew pitch control levers, and an additional throttle lever is fitted on the port side.

210 B.H.P. De Havilland Gipsy Queen II Engine.	
Span, 39ft. 6in.	Length, 28ft. 2in.
Aspect ratio	7.72
Wing area	202 sq. ft.
Wing loading	17.3lb. per sq. ft.
Power loading	16.8lb. per B.H.P.
Tare weight with full equipment ..	2,370lb.
Disposable load	1,130lb.
Maximum permissible all up weight ..	3,500lb.
Top speed (sea level)	160 m.p.h.
Maximum permissible cruising speed (sea level)	148 m.p.h.
Economical cruising speed (sea level) ..	140 m.p.h.
Landing speed (flaps down)	55 m.p.h.
Rate of climb at sea level ..	700ft. per min.
Time to reach 5,000ft.	9 min.
Ceiling	14,000ft.
Run to take off (no wind)	320yds.
Run to clear 50ft. screen (no wind) ..	650yds.

All performance figures are based on official trials at the maximum permissible all up weight of 3,500lb.

Equipment

The cabin carries the largest type of wireless sets as installed in operational aircraft. Intercommunication telephone equipment for each member of the crew allows a wireless instructor in the rear seat to talk to the pupil or the pilot.

A fixed aerial and a trailing aerial cover the whole range of wavelengths needed for wireless training. The direction-finding loop aerial on top of the cabin can be used for instruction in flying on a wireless beam or checking position by taking bearings on two or more wireless stations whose positions are known. For training in visual signalling to ships or to troops on the ground, there is an Aldis lamp stowed beside the rear seat.

The Proctor IV is completely equipped for night flying with the standard R.A.F. blind flying instrument panel, cockpit lighting, landing lamps in each wing, navigation lights and downward identification lamps. There are two cockpit lights in the roof of the cabin above the pilot, one over the compass and one in the wall beside the rear seat. Each of these four lamps has its own dimmer switch, so that the operator can adjust the intensity of light to suit the prevailing conditions.

When used as a four-seater communications aeroplane the single rear seat is replaced by two rear seats which are so placed as to give ample leg room and still leave space for light luggage.

Probes and Problems

Here are Some More Mental Nuts for You to Crack

(*Solutions are given on page 246*)

A Matrimonial Medley

Messrs. Smith, Brown, Jones and Robinson each married the sister of one of the other three men. The Christian name of Mr. Smith's wife is Bessie. Kate's maiden name was Jones. Hilda married Bessie's brother. Mr. Brown's sister married Mr. Robinson.

What was Jane's maiden name?

Electing a President

The five members of our football club committee met last week to choose a President; but the election proved a fiasco. The local rule is that each member of the committee has five votes which he can distribute as he likes, with the sole proviso that he must not give any votes to himself. Well, we had to adjourn without a President, because we all got the same amount of support.

Bloggs received all my votes; he was the only candidate thus to receive a maximum. Clark gave the same number of votes to each of two candidates, and received equal votes from each of two members as well. Everett favoured Clark most highly, and Bloggs gave all his votes but one to Adams. Only one candidate received votes from three others.

What is my name?

A Calendar Problem

In each normal year January 1 comes one day later in the week than in the preceding year: for example, January 1, 1943, fell on a Friday, and New Year's Day, 1944, was a Saturday. But when there is a Leap Year the difference is two days—so that January 1, 1945, will be a Monday.

Bearing in mind that century years are Leap Years only if the first two figures are divisible by 4—that is to say, the year 2000 will be a Leap Year, but 2100 will not—how long before the first day of a new century is a Sunday?

Who Stole the Sapphires?

Five suspects were interrogated about the theft of Lady Croesus's sapphire necklace; for the inspector in charge of the case knew for a positive certainty that one, and only one, of them was implicated in the affair.

They made the following statements:

Grabstein: "I was at Brighton when the job was brought off. Bill Basher told me he'd had nothing to do with it."

Lop-Ear: "I've got a perfectly clean record. As a matter of fact, Slogger Joe and I were together when the stones were pinched."

Tommy the Toff: "It was Bill Basher who told me about the robbery. Lop-Ear was hanging around Lady Croesus's house all that day."

Slogger Joe: "I've never been near the place. It's queer that Grabstein seems to have had plenty of dough lately."

Bill Basher: "The Slogger always rats on his pals. I suppose you know that Tommy the Toff has been down for a stretch?"

Rather puzzled by these conflicting statements, the inspector consulted with an Assistant Commissioner at the Yard.

"A man doesn't lie unless he has a guilty conscience," said the Commissioner. "You may rely on it, Inspector, that all these men except the criminal have told the exact truth."

"Oh, all right, sir," replied the inspector. "If that's the case I can lay my hands on the guilty party right away."

Can you?

Engineer-built Houses of the Future—14

(Continued from page 161, February issue.)

Double and Composite Partitions : Flat Roofs

By R. V. BOUGHTON, A.I.Struct.E.

Double and Composite Partitions

THESE are eminently suitable to allow for good principles of pre-building and may be made capable of not only supporting considerable loads of floors and roofs with an inconsiderable amount of material, but, as well, give excellent opportunities for the provision of useful cupboards, cabinets, wardrobes, sideboards, bookcases and shelves. Fig. 86 depicts one example where such partitions may be designed and constructed to ensure many structural and equipmental advantages. In the example it will be noted that the partition is situated between the main front and back rooms of an ordinary two-storey small house—its situation is where the ordinary traditional load-bearing partition is built of brickwork between the dining-room and lounge in the ground storey and the front and back bedrooms in the first storey. A subject for argument may be in connection with the difference in thickness between an ordinary or single partition and the composite type shown by Fig. 86. The argument in favour of the latter is that, in addition to doing heavy structural duty, it gives much useful equipment within its thickness, which equipment, if of the ordinary kind of furniture, projects into and takes up a considerable amount of space in the room. Therefore, it is just to contend that some, if not all, of the space occupied by a double or composite partition may make it practicable to reduce the size of a room by the amount of space used in the partition for cabinets, etc. As an example, the side of the partition which faces the dining-room may be equipped with the equivalent to the traditional sideboard—it may have drawers in it if desired—or there are cabinets and cupboards of a useful character, all of which would save much expenditure on furniture.

The partitions may be factory produced in lengths of, say, up to 4ft. and of a height equal to the height of each storey. If deemed expedient, each section could be made and delivered in a few units which could be quickly assembled at site; in fact, there is a variety of ways in which design and construction can play good parts.

The parts of the composite partition which are subject to structural loads need careful attention, those parts being chiefly the main posts which have to carry floor, roof and other loads. The general design permits the posts being made capable of carrying quite heavy loads because of the number of horizontal, longitudinal and transverse members which may be employed in the general structure. No post need have a high slenderness-ratio, and consequently the permissible stress which may be imposed on the posts can be reasonably high. Let us investigate this important structural matter in regard to the partition in the ground storey, which has to carry greater loads than that in the first storey. Take one row of posts only—those which have to carry part of the first floor, part of the roof and some of the superimposed partition, as Fig. 86. There is no need to be pedantic in the investigation, so let it be assumed that the room is 12ft. from wall to the partition and 16ft. in the other direction, which means that the partition is 16ft. long, consisting of four 4ft. wide units with posts at about 2ft. centres. Each post will have to carry a floor area of 6ft. x 2ft., equals 12 F.S. at, say, ½ cwt. foot super to cover dead weight of the floor, and a superimposed load of 40lb. F.S. This gives a load of 6 cwt. The area of roof, which is supported by the upper partition, which transmits the roof loads to the lower partition, is also about 12 F.S., and, although the superload may be 30lb. or 50 lb. (as described in the last article), depending on whether the house is built outside or inside the London area, it is reasonable to again allow 6 cwt. This makes a total of 12 cwt., and as the dead weight of the partitions must be covered, let us assume that 15 cwt. must be supported by each post. If the posts are 3in. x 2in. and the slenderness-ratio is based on the 2in. dimension, and the timber is ordinary ungraded redwood, each of such posts will support safely about 36 and 19 cwt. with slenderness-ratios of 20 and 30 respectively. This means that the 2in. dimension of the posts must be laterally supported at vertical intervals of 3ft. 4in. and 5ft. for such ratios, and a study of the details will show that this is quite practicable. Even allowing for non-axial loading on the posts due to the floor, it is obvious that quite small scantlings may be used for the posts, such as sizes varying from 3in. x 2in. up to 4in. x 2in.

The composite partitions, despite their overall thickness, which makes them very stable and resistant to buckling and overturning, must be anchored securely at the bases to the floors and fixed firmly at their tops.

Figs. 87 and 88 show typical plans of the partitions. Instead of the doors to the various fittings being hung on butt-hinges, they may be horizontally sliding doors; the whole of the fittings are capable of being designed and constructed in many ways to suit any reasonable needs and æsthetic requirements.

Roofs

Roofs of engineer pre-built houses are of

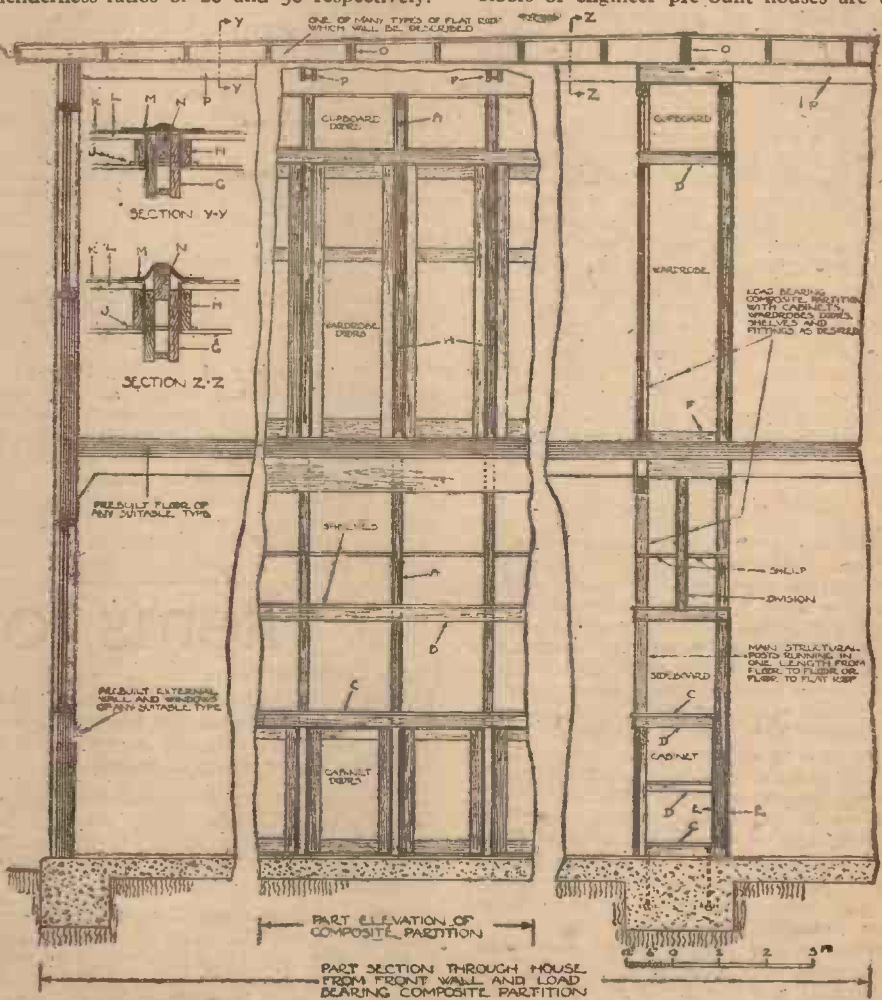


Fig. 86.—COMPOSITE PARTITIONS AND FLAT ROOF. A—Structural posts. B—Rails. C—Shelf. D—Bearer. E—Linings. F—Sill. G—Composite beam. H—Side of panelled unit. J—Metal corbet extending through beam to form bearer for panelled units. K—Roofing material. L—Boarding. M—Joint cover. N—Packing laid to falls. O—Joists at junction between units. P—Part section and elevation of composite beam.

considerable importance and interest as they give full scope to the designer and constructor to provide a general design which will appeal to varying æsthetic tastes and allow for the use of many kinds of structural and roofing materials. The traditional types of pitched house roof consist of the timber framework with its rafters, purlins, struts, ceiling joists, ridges, hips, valleys, binders and hangers; the rafters support battens or boarding on which are laid thousands of little tiles or slates; the ceiling joists support the ceiling covering, which may consist of thousands of feet of laths nailed with thousands of nails and the lot covered with plaster, or the covering may be of building boards. Gutters, flashings and other items, complete the roof. These traditional pitched roofs are exceedingly heavy, and they are costly, and if not constructed properly they exert forces which tend to overturn walls. The traditional type of flat roof is structurally better than the pitched roof described above.

Engineer-built roofs designed in accordance with the best codes of practice will ensure strong, light-weight, weather-resisting, long-life, and economical pitched and flat types of roofs. The roofs should conform with essentials in connection with the following: (1) stability, (2) durability, (3) transportability, (4) resistance to rain, etc., (5) thermal insulation, (6) sound insulation (rain beating on roof), (7) economic initial cost, (8) economic maintenance costs, (9) speed and ease of erection, (10) light weight, (11) good appearance, (12) fire resistant, (13) avoidance of condensation, and (14) space for, and protection of, water cisterns, pipes, etc.

Flat Roofs

This general type of roof, used either entirely to groups of houses or alternated with pitched roofs or a combination of pitched and flat roofs, is a matter of æsthetical design. But it is conceded by many designers that the flat roof with good overhanging eaves and with proper proportioning of walls and windows, etc., can provide houses of very good appearance. Apart from this, all persons connected with the design of engineer-built houses should appreciate the fact that the public do like traditional buildings, and this liking should be met to a reasonable extent. The ordinary pre-war type of flat roof to houses consisted of timber flat roof joists laid level with taper or other fairing pieces to form falls, and on this structural foundation was laid roof boarding and flat roofing of asphalt or built-up felt roofing and the underside ceiled with lath and plastering or building boards. This construction provided an excellent roof, as did other types of flat-roof construction, such as of reinforced concrete, patent roofs, etc. Of course all these methods of construction caused much more site work than is necessary for pre-built systems. There are many good systems of flat-roof design and construction which will be explained in this series, and in this article it is advisable to discuss general principles based on two of the systems shown by Figs. 86 and 89.

I am not yet convinced that dimensional co-ordination of the various units of floors, walls, partitions and roofs will be satisfactory. I believe it will be found that variation in dimensions of the units for the different main structural parts, and no definite relationship of the dimensions of such units, as in walls, with those of other units, such as in roofs and floors, will provide a much greater freedom in designing sizes of rooms and their disposition in the general planning system, than by trying to make the widths of all units to certain defined standards. This belief is intensified by the facts that there are so many window and door openings, corners, projections, stairs, fittings and other items, that dimensional co-ordination will do one of those things which those antagonistic to pre-building predict, viz., cause too much monotony in planning and in æsthetical design. I am equally convinced that the vast post-war programme of house building—400,000 houses at least yearly—will tempt those interested in pre-building to provide a reasonably large range of units to suit most practical requirements of architects and builders. On this assumption, flat roofs can be designed as almost completely independent of some of the dimensions of the wall and partition members which support them.

As flat roofs have to span rather considerable distances which depend on the sizes of rooms, some of which are of widths and lengths varying from, say, 12ft. to 16ft., it is manifest that roof panels of such lengths would be rather unwieldy, but that beams of such lengths are much more easily handled. Therefore, for flat roofs it is considered that pre-built beams of long lengths and comparatively small panel units should be employed to achieve the best results.

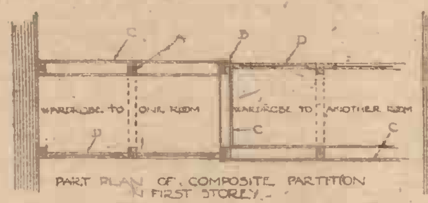


Fig. 87

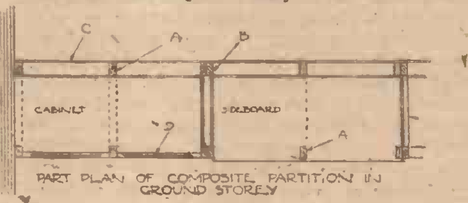


Fig. 88

Fig. 87.—A—Structural posts. B—Posts at vertical junction of partition units. C—Linings. D—Doors.

Fig. 88.—A—Structural posts. B—Posts at junction of units. C—Linings. D—Doors.

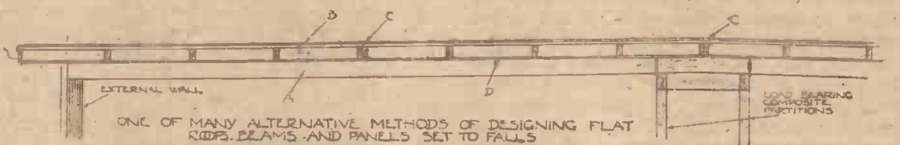


Fig. 89.—FLAT ROOF WITH BEAMS AND PANELLED UNITS SET OUT OF LEVEL TO PROVIDE FALLS TO ROOF. A—Beam. B—Roofing, etc. C—Small section roof joists. D—Ceiling lining.

Fig. 86 shows one of the simple types of flat roofs. The loads of and on the roof are carried primarily by built-up beams which support panelled units. The beams are of particular importance not only as to their duty of carrying the loads, but to the fact that their width can be varied by a few inches to allow for the use of standardised widths of the panelled units; they are the means by which standard width panels can be used to suit dimensional variations of several inches in the width of a house. The main structural twin members may be placed at from about 2in. to about 6in. apart, thereby giving up to 4in. variation to every, say, 4ft. centre of the beams, which will necessitate only varying the width of the framed-in soffit member and the upper packing member and cover strip.

Flat roofs must be formed so as to provide falls to the upper surface to drain off rainwater, most roofings requiring a fall of not less than 2in. in 10ft. or 1 in 60, and this is not too much if it is borne in mind that such practical matters as a little deflection in the roof, seams over joints, can easily nullify such fall and cause pools of water which all good designers endeavour to avoid.

Fig. 86 shows roofing panels of reasonable width and length, but of varying thickness to provide falls. This system of design ensures a level ceiling. The general framework of the panels consists of narrow-width timber members covered on the upper side with boarding, and, if desired, sound and thermal insulating material, and with any of the many kinds of impervious roofings which will be described in the future article. The underside of the panels may be covered with any of the many varieties of building boards.

Fig. 89 shows a principle of construction which is well worth attention. The whole of the roof structure is set out of level, which is a principle that may shock those designers who like level lines and do not realise that such lines are often undetectable and of little interest to those who live in the rooms. Such a method of construction allows for an equal thickness of the roof units.

Items of Interest

Bread Cutter

IN institutions and other places where large quantities of bread are consumed, for many years it has been the custom to slice the staff of life by means of a machine.

To perform this work without at the same time slicing the fingers of the operator is the principal object of a bread-cutting machine, for which a patent in this country has recently been applied.

This machine includes a conveyor arranged to carry the bread or other articles in succession past a driven rotary slicing cutter. And there is means designed to impale the articles in order to retain them in place upon the conveyor while they are being sliced.

War-time bread, however, does not lend itself to slicing by machine.

Fighting 8 Miles Up

IT is reported from Washington that a new version of the P 38 Lightning, now being produced, capable of fighting in thin air eight miles above the earth while manœuving at high speeds in escorting long-range bombers, as well as making its own bombing missions.

It has a service ceiling "well in excess of 40,000ft." and the new Lightning is "a dog-fighter which can out-manœuvre many single-engine planes."

Artificial Gems

ARTIFICIAL sapphires and rubies are being manufactured in the United States for the war industries.

With the cutting off of the natural gems from Burma and Siam, it became necessary to manufacture synthetic gems used in precision instruments.

A Watch De-magnetiser

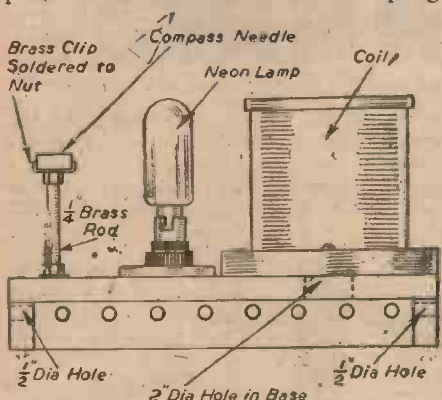
Its Construction and Operation

By J. L. WATTS

THE steel parts of watches are liable to become magnetised if the watch is brought within a magnetic field such as exists between and around the poles of a permanent magnet as used on a magneto and certain types of dynamos; and in the vicinity of an electromagnet such as the field magnets of a dynamo, electric brake, or other electro-magnetic apparatus which is fed with direct current. A magnetic field surrounds any conductor carrying direct current, the strength of field being proportional to the current flowing, when the magnetic field does not pass through an iron or steel path, so that a watch may even become magnetised by coming too near to a cable carrying a heavy direct current, although the strongest magnetic fields are usually found near coils having an iron core.

It is wise to keep all watches away from such magnetic fields, as a watch may fail to go at all if the steel parts become strongly magnetised so that the balance is attracted by nearby screws, etc., or the hair spring is attracted to the balance. A weaker state of magnetism in a watch may lead to erratic running, and bad time-keeping. Watches having cases of iron or steel tend to deflect any extraneous magnetic field through the case itself, and thus screen the internal parts to a large extent.

Once a watch has become magnetised it is practically impossible to remove all traces of the magnetism, as this would necessitate heating the steel parts to redness, re-hardening and polishing them, and renewing small parts such as the balance and hair spring.



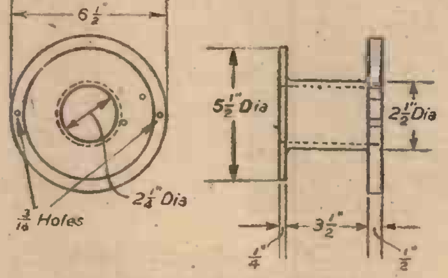
General arrangement of the de-magnetiser.

Fortunately, however, a watch can usually be made to work quite satisfactorily by removing nearly all the magnetism.

Testing for Magnetism

A small compass needle can be used to test the watch for magnetism. For this purpose it is best to use as small a needle as possible, as such a needle will have a low moment of inertia and be more likely to respond to a moving magnetic field. The type of compass needle which used to be fitted to such novelties as small mirrors, pencils, and pencil sharpeners, obtainable for a few coppers before the war, will do very well. Various points on the watch should be brought to one end of the compass needle in turn and any movement of the needle carefully noted. It should be remembered that the magnetic needle itself has a weak magnetic field, and this field will be diverted towards and through any path of high permeability such as the main spring of the watch when brought within the vicinity. Such a weak field, of course, would have no permanent effect on the watch, but the diversion of the field would cause the needle to be deflected by the watch, as would any other unmagnetised piece of soft iron.

It should not, therefore, be assumed that a watch is magnetised merely because it deflects the compass needle. Should such a deflection occur, move the watch into such a position that a maximum deflection occurs, then move the watch straight away from the needle. Keeping the watch well away from the needle, move it round and approach the opposite end of the needle with the same point of the watch. If the opposite end of the needle is equally attracted, it may be assumed that the attraction is due to neutral steel parts of the watch. On the other hand, if the second end of the needle is repelled away from the watch and the needle tends to turn through 180 degrees, so that the first end of the needle is again attracted to the watch, it is evident that some steel part of the watch has a definite magnetic polarity, and the watch should be treated to remove the magnetism. If the compass needle is placed with its centre over the centre of the balance shaft of a magnetised watch, the needle may vibrate through an arc as does the balance, or may swing round and round.



Details of the hardwood bobbin.

Constructional Details

The following notes describe the construction of a watch de-magnetiser suitable for operation from a 200 to 250-volt 50 cycle A.C. supply. The base is first built up, using a piece of hardwood about 9in. by 6½in. by ½in. thick, this being walled round underneath with wood strips ½in. thick by 1in. deep, to provide a recess for the connections. The next step is to construct the bobbin, which can best be turned up from hardwood to the dimensions given. If it is not possible to get this turned up, it could be made in parts which were afterwards well glued together. The obvious method is to use plywood or other thin wood for the coil cheeks; whilst the tube could be of wood or cardboard, or might be built up with several thicknesses of good quality paper impregnated with shellac varnish. It is not advisable to attempt to make a metal bobbin, as the varying magnetic flux set up in the coil would then induce a voltage in the conducting bobbin so that eddy currents would flow and heat up the bobbin. Two 3/16in. diameter holes are drilled in one of the coil cheeks for the wood screws which secure the coil to the base, together with two smaller holes for the coil leads.

The Coil

The coil should be wound with 6½lb. of 30 s.w.g. enamelled copper wire. A single insulated wire from a twin lighting flexible lead about 2ft. long should be passed through one lead in hole of the bobbin and wrapped round the bobbin, leaving about 9in. of lead outside. The coil end of the lead should be firmly secured with tape and soldered to one end of the 30 s.w.g. wire. If a lathe is available, the bobbin can be mounted on a mandrel for winding, or possibly a wheel brace secured in a vice could be used. The coil should be wound as evenly as possible, the finishing end being soldered to another flexible lead brought through the coil cheek; the coil then being finished by taping and, if desired, a cord binder.

It is useful, but not essential, to fit a small neon bulb and small bayonet type of insulated batten lamp-holder on the baseboard to indicate when the supply is switched on. The two coil leads can then be connected across the lamp-holder, to which can also be connected a twin flexible lead of the required length for connecting to a lamp-holder through which the apparatus is supplied. Alternatively, the flexible lead could be connected to a two-pin plug if the suitable plug socket is wired up. A switch is not fitted on this apparatus, which must therefore be isolated from the supply by removing the plug or lamp-holder adaptor, or by switching off at the fixed switches, when not required for use. The reason a switch is omitted is that a lamp-holder adaptor and two-pin plug are not polarised, that is, they can be fitted in two ways. There is, therefore, a risk that a single-pole switch on the apparatus might be connected in the neutral pole instead of

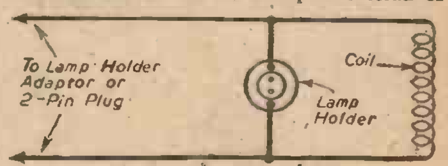


Diagram of connections.

the live pole, in which case the coil might be at 230 volts above earth when the switch was off.

A brass rod ¼in. diameter and 3in. long forms a rigid support for the compass needle when testing the watches. The rod is screwed for 1¼in. from one end and clamped to the baseboard with a brass nut and washer on either side; the top of the rod is screwed ¼in. for a brass nut, to which is soldered a brass clip for the compass needle. This arrangement allows the maximum freedom of movement to manipulate the watch round the needle. After testing the watch the compass needle should be taken out of its clip and removed to a safe distance before switching on, otherwise it may become de-magnetised as well as the watch. The current is then switched on and the watch held in or near the coil, being turned round and over for a few times. After a few seconds the current is switched off, by which time any serious degree of magnetism should have been removed, and the compass needle can then be replaced on its stand for any further tests required.

A Miniature Hand Loom

An Easily-made Machine for Weaving Cloth

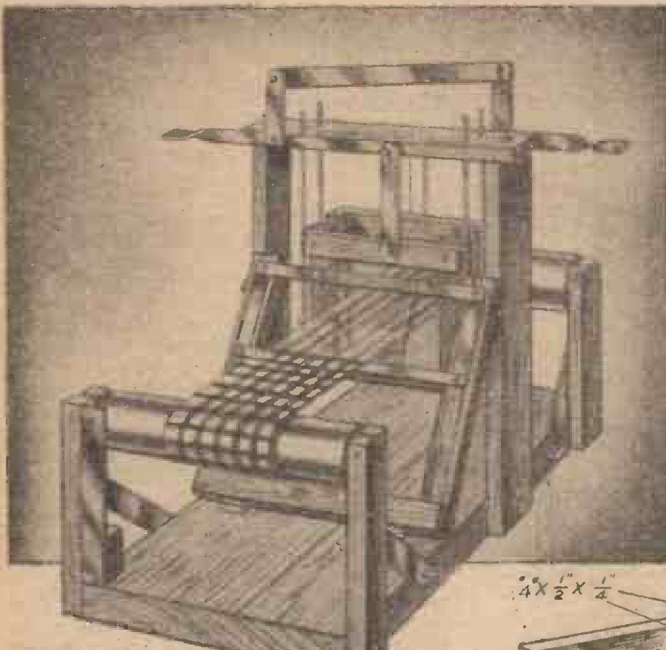


Fig. 1.—The finished model hand loom.

A LOOM is often regarded as a complicated piece of machinery, but the model described below is really quite simple to make from everyday materials, and requires the use of only a modest set of tools. A certain amount of patience is needed in making a few parts, but one is rewarded by the fascination of working the model and seeing the cloth grow as the weaving progresses.

The illustration, Fig. 1, gives a good idea of the complete model; the finished cloth with a check pattern can be seen on the roller at the front. The longitudinal or "warp" threads are wound on to the roller at the back and pass through the "healds" to the front roller. These rollers are called "beams," that at the back being the "warp beam" because it holds the warp threads, while the front roller is the "cloth beam." As the weaving progresses the finished cloth is rolled on to the cloth beam and the warp is unrolled from the other.

Forming the Cloth

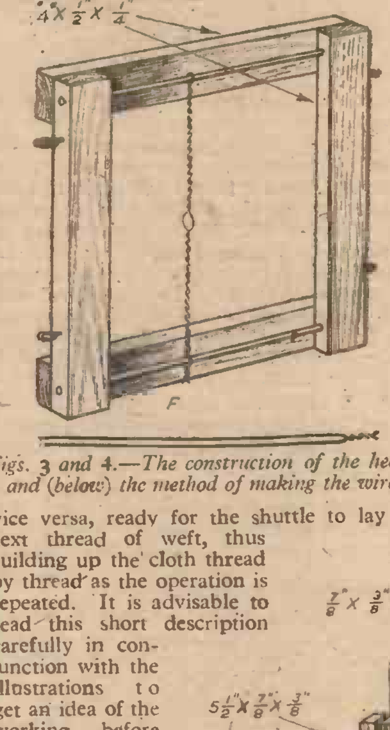
To form the cloth alternate threads of the warp are lifted or depressed to form a "shed" or wedge-shaped opening through which the shuttle is passed, leaving behind it the transverse thread or "weft."

The Wooden Frame

Fig. 3 shows the construction of the healds, two of which are required. The wooden frame is of the simplest possible description, all the four pieces of wood are alike and are just screwed together, as shown, with tiny screws. A touch of Seccotine on the corners before screwing together is an advantage. The horizontal wires are 1/16in. diameter and a tight fit in their respective holes. A knitting needle does very well for these wires. They should be exactly $3\frac{1}{2}$in. apart and quite parallel. Care should be taken when making the frame that the screws are not put in a position where they are likely to get in the way of the 1/16in. wire. The screw eyes in the side members should be small ones; they have to slide up and down the vertical rods inside the central frame. Screw them in just far enough to bring them the right distance apart to allow them to fit nicely on the guide rods.

The wires to carry the warp threads should now be made; only one of these is shown in Fig. 4 to avoid confusion, but 60 are required, 30 for each heald.

The weft is pressed tightly into place by means of a comb-like affair termed a "reed," after which the warps change over, the lower ones coming to the top and vice versa, ready for the shuttle to lay the next thread of weft, thus building up the cloth thread by thread as the operation is repeated. It is advisable to read this short description carefully in conjunction with the illustrations to get an idea of the working before beginning construction.



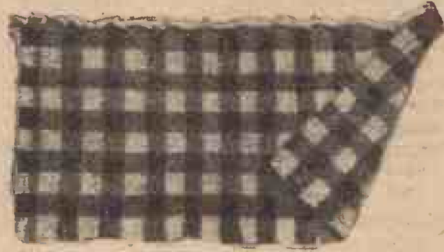
Figs. 3 and 4.—The construction of the healds, and (below) the method of making the wires.

Start by making the main frame, as shown in Fig. 2. This is just a simple piece of woodwork all screwed together; skilful joinery is not required for this so long as all the parts are planed exactly square. The brass diagonal struts are necessary on the four corner posts to prevent them from being pulled over by the tension on the warp, but there is no tendency to pull the central frame over, so it will suffice just to screw this up as tightly as possible. The four vertical rods inside the central frame are made of straight lengths of round brass or steel $\frac{1}{8}$in. diameter; they are not fixed otherwise than by being a tight fit in the holes drilled for them at top and bottom. Each rod should be $\frac{1}{2}$in. from its immediate neighbour and $\frac{1}{2}$in. from the wooden frame when fitted so that they may be withdrawn by means of a pair of pincers when necessary. These rods form guides for the "healds" or frames which lift or depress the warp threads.

This will give us 20 warp threads per inch on a piece of cloth 3in. wide, like that seen in Figs. 1 and 2. The method of making the wires is shown in Figs. 5 and 6. Drive two nails about 3/32in. diameter into a piece of wood, so that they are 3 13/16in. apart, centre to centre, and cut off the heads; then take a piece of wire about 9in. long, lay it round the two nails and twist up the end for several turns to form a long loop, as shown in Fig. 4. Now make another jig with two nails and a piece of wood exactly as before, except that the nails should be only $3\frac{1}{2}$in. apart this time.

Adjusting the Wires

Lay the loop on the new jig and put a short piece of 1/16in. wire through the loop



A specimen of cloth woven on the hand loom.

and twist the loop up by means of the 1/16in. wire till all the slack is taken up, as shown in Fig. 5. Give one or two extra turns to make the wire taut, but not enough to break it. It is better, perhaps, to twist

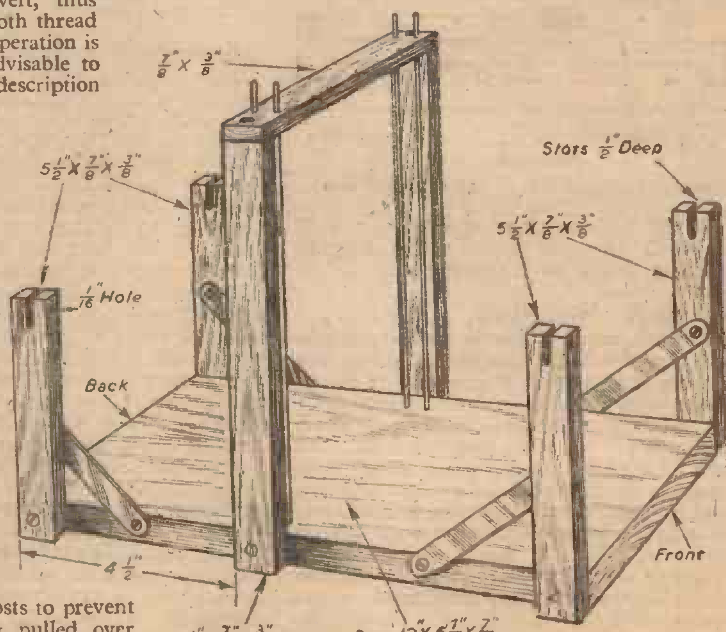


Fig. 2.—The main frame.

one or two up until they break so as to get a good idea of how much twisting is required, then you can stop just short of breaking point afterwards. When finished, the central eyelet should be in a plane at right angles to the eyelets at each end (see Fig. 6). Twist the wire in the same direction on both jigs, otherwise you may find yourself in difficulties.

The wire should be 28 gauge soft brass or copper, or 28 gauge enamelled copper electrical wire will do very well; leave about $\frac{1}{8}$in. of the twisted end on, as shown in Fig. 6, the rest may be snipped off.

Draw back the 1/16in. wires on the healds and thread on 30 of the twisted wires, then push the 1/16in. wires back into place; they should fit tightly in the wood. The twisted wires should be able to move about freely when fitted, so as to be able to take up their own position when the threads are in place. The healds may now be fitted to their guides in the main frame with the horizontal wooden members outside as shown in the photos.

Next make the operating levers for the healds, as shown in Fig. 7. Two of these are required; they are just strips of 1/16in. brass soldered together, the end being twisted to make a convenient handle.

The Pivots

These are ordinary brass wood screws soldered on and the threaded part cut off, after which a 1/16in. hole is drilled for a split pin. Screw the levers on to the top horizontal member of the main frame by means of a single screw which forms a pivot. One lever should be on the front at the left and the other on the back at the right, the inner end of each lever reaching to the centre line of the machine. Connect each inner end to its respective heald by means of a simple link like Fig. 8. The top end of this link goes on to the pivot soldered on to the lever and the bottom end is screwed to the top of the heald by means of a single screw, which must not be screwed right home.

Now make another link like Fig. 8, but long enough to connect the vertical members of the levers together; this link will have to be about 5in. long, but it will be better to measure off the exact distance on the job and make the link to suit. When this link is fitted and held in place by split pins, either lever will move both healds, so that when one heald goes up the other goes down. Fix a screw into the side members of the main frame to limit the movement of the levers, allowing the healds to move $\frac{3}{4}$in. above and below the centre line, i.e., each heald has a total movement of $1\frac{1}{2}$in.

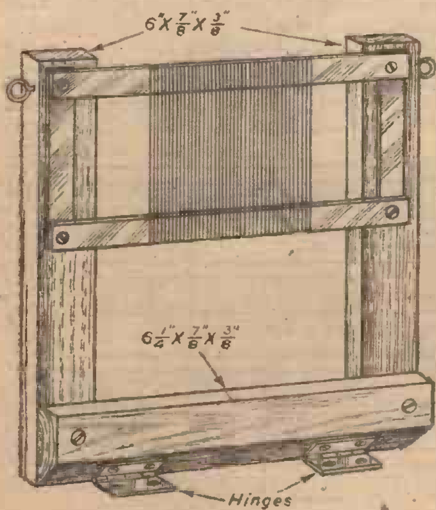


Fig. 9.—The reed and its frame.

The Reed and Frame

Next make the reed and its frame, as shown in Fig. 9. The wooden part is simplicity itself, the bottom is cut off on a slant at each side to allow it to rock freely on its hinges. The metal frame is made from $\frac{3}{8}$in. by 1/16in. strip brass, the horizontal members being 6in. long and the vertical ones 3in. long.

Take the two horizontal members and clamp them together in a vice, then make a cut about 1/32in. deep in the centre of the length with a fretsaw (don't use a hacksaw, it will be too wide). On each side of the first cut, $1\frac{1}{2}$in. away, make another; this makes three. Halfway between each make another cut (giving five nicks in all), then go on halving the distance between each until you have 65 nicks altogether in a space of 3in. Separate the two pieces, solder up the frame at the corners and drill a hole at each corner for the fixing screws. Now get some 28 gauge hard brass wire (don't use soft copper or enamelled wire for this),

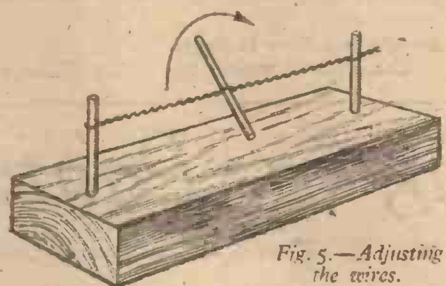


Fig. 5.—Adjusting the wires.

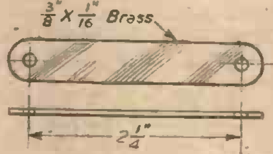


Fig. 8.—Details of the link.

Fig. 6.—The central eyelet should be in a plane at right angles to the eyelet at each end.

if the wire is not hard when bought you can harden it by stretching it; fix one end of the wire by twisting it to the frame, then wind it over and over the frame, one wire in each nick until all the nicks have a wire in them and secure the end of the wire temporarily. Wind the wire with moderate tension only; if wound too tightly the frame will bend inwards and the wires first put on will be found very slack. Now solder all the wires firmly to the frame.

Brief instructions for weaving plain cloth were given in the article describing the construction of the Hobbies loom, but cloth having check and stripe patterns can also be woven on this loom.

To produce this kind of cloth, first obtain four twopenny cards of darning wool, two black and two white. Of course, you can choose other colours if you prefer, say, brown and white, or light and dark brown.

Setting the Warp Threads

Set the first six warp threads as described in the previous article by temporarily fixing the warp beam about a yard from the loom (or farther if a longer length of cloth is required). Then thread a length of about 2 yds. of white wool into a darning needle, knot one end of the wool and stitch it

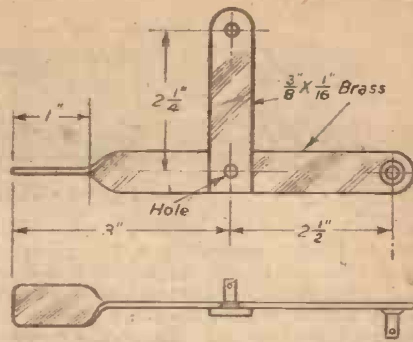


Fig. 7.—The operating levers for the healds.

through the tape on the cloth beam; thread a single strand of the wool through the reed, then through the first eye of the front heald, after which pass the needle through the tape of the warp beam. This makes the first warp thread. With the wool still in the needle lead it back through the first eye of the back heald, then through the reed, in the opening next to the first thread (i.e., leave one wire between the threads) and secure the end to the tape of the cloth beam, taking care that the tension is as near as practicable equal in both threads.

This makes the second warp thread. Thread the needle again and repeat the above sequence of operation, of course using the next eye in each heald, and the proper openings in the reed, thus completing four warps. Fix two more white warps, making six altogether, then change the white wool for the black and set up six black threads. Continue setting six white and six black, alternately, until the width of the loom is filled. Take care to keep the tension as even as possible, otherwise the warps may break later on; also keep the threads as nearly parallel as you can.

Now take up the warp beam and, by turning it in the hand, wind all the warps on to it in such direction that they run off the top side of the beam towards the loom, and fix the beam into its bearing. Do not let the side threads spread outwards on the beam while winding them up, or they will be too slack when wound; guide them in towards the middle slightly as you turn the beam. Fit one or more rubber bands round the beam and catch the other end of the bands on the hook provided on the base, to give the required tension. This should be carefully adjusted by choosing suitable rubber bands, for if the tension is not sufficient the warps are likely to cling together, so preventing the formation of a clear "shed" to pass the shuttle through; but, on the other hand, if the tension is too great, some of the warps may break, causing considerable trouble to the amateur weaver.

The Transverse Threads

Turning our attention now to the "weft" or transverse threads, two shuttles are required, one wound with black wool and the other with white. Take up a position at the front end of the loom so that the shuttle can be entered into the shed with one hand and withdrawn conveniently with the other. Move the healds (one up and one down) by means of the operating lever, and see if a good, clear shed is formed by the warp threads; if the warps show a tendency to cling to one another owing to projecting fibres of wool catching the neighbouring warp, move the reed to and fro once or twice. This will probably effect an improvement, but if the shed is still not well defined, add more tension by altering the rubber bands.

Moving the Shuttles

Now, with the reed pushed back to its

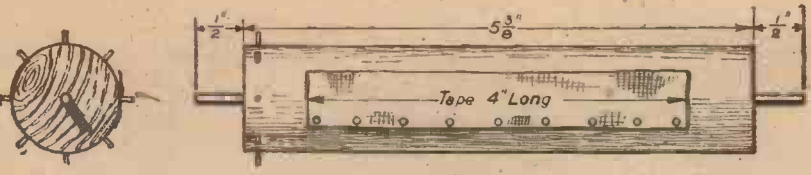


Fig. 10.—Details of the "beams."

limit, take one of the shuttles, say the white one, and after unwinding a few turns of wool, pass the shuttle through the shed so as to push the weft right up into the angle of the shed. Next, return the reed to its backward position and change the position of the healds. If necessary, move the reed to and fro to clear the shed, then pass the shuttle back again from left to right, but do not pull the weft tightly. Pull the reed forward to drive the weft home, and while the reed is still in its forward position, draw the weft through until it folds neatly over the extreme warp thread. If you do not do this, the selvedge (i.e., the edge of the cloth) will probably be uneven and untidy. After a little practice you will find that you can carry out the whole procedure quite quickly.

After weaving six white threads, leave the shuttle laying on the base and weave six threads of black, and continue changing shuttles after every six threads. There is no need to cut off the threads when changing shuttles.

After you have woven an inch or two of cloth you will find the shed getting too small to allow the shuttle to pass freely. When this occurs, wind the newly-made cloth on to its beam by turning the beam towards you, of course lifting the flat spring on the left while you do so, afterwards making sure that the spring catches one of the pins again before you let go of the cloth beam.

Producing New Designs

The amateur weaver has plenty of scope for the exercise of his ingenuity in producing other patterns. For instance, with the warp set as above, and one shuttle only in use, a cloth with longitudinal stripes would result. Transverse stripes can be obtained by using two shuttles, with warps all of one colour. Smaller or larger checks and stripes are, of course, made by changing the colour of the threads (either warp or weft, as the case may be) more or less often than every six.

It is not possible to obtain herringbone or twill patterns on a loom with two heald frames, and the provision of three or more would complicate the model considerably.

If desired, other material than wool may be woven into cloth, say silk or cotton.

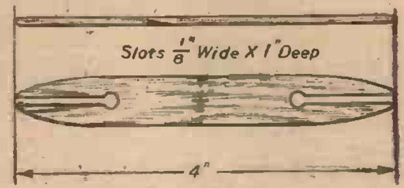


Fig. 11.—The shuttle.

Making a Pantagraph

A Useful Instrument for Copying Drawings

A PANTAGRAPH is a simple tool by means of which you may copy, enlarge or reduce drawings and illustrations. The device shown in Fig. 1 consists of the various parts shown in Figs. 2 to 5. Use strips of oak ⅝in. wide and ⅛in. thick for the four arms, and carefully mark off the distances shown in Fig. 2. Drill the holes shown to accommodate the screw-eye illustrated in Fig. 5.

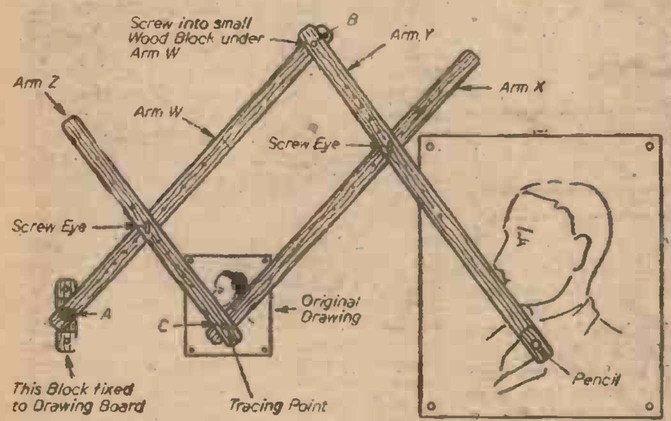


Fig. 1.—The pantagraph completed. The assembling of the parts is clearly shown in this illustration.

At the point A a little bar of wood is attached, as shown in Fig. 3, so that the end of the pantagraph can be screwed down to the drawing-board. The tracing point C consists of a nail with a washer soldered beneath the arm X to keep it in place; the nail should be filed up to a sharp point and serves as the tracing point.

To accommodate the pencil a piece of wood is glued over the end of the arm Y, as indicated in Fig. 2, and a hole is drilled in it of a size to suit the diameter of the pencil. The other joints are made clear from the drawings.

Enlarging and Reducing

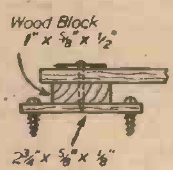
To enlarge a drawing to, say, three times its size, insert the screw-eyes into the holes marked 3, and upon tracing over the drawing with the tracing point, the pencil will trace out the drawing three times the original size.

When it is required to reduce the size of a drawing, the positions of the pencil and tracing point must be reversed, and for this purpose a short, stumpy piece of pencil should be pushed over the tracing point, and a piece of round iron pointed at one end, and of the same size as the pencil, should be pushed in the pencil hole. The various letters in Fig. 1 correspond to those shown in Fig. 2.

It is absolutely important, if accurate scale copying is to be done, that the distances of the holes from the points A, C and B (Fig. 2) should be carefully marked out. To ensure this, place the arms W, Y and Z together and scribe the three off at once with square. Then place the point 8 on arm X level with the point 8 on arm W, and by means of the square scribe off the position on arm W on to arm X. You will then be quite certain that the positions are correct.

Operation

In using the instrument let the left hand press on the tracing point and the right hand grasp the pencil. Now guide the tracing point over the drawing to be copied, and at the same time exert a slight pressure on the pencil. As the tracing point is moved over the drawing the pencil will draw out an enlarged copy of the original.



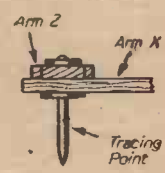


Fig. 3.—The block for clamping the pantagraph to the drawing board. *Fig. 5.—An ordinary screw-eye is used where show in Fig. 1.* *Fig. 4.—How the tracing point is made.*

You will probably find at first that the pencil lines are wavy, and this is because the pencil magnifies any false movement of the tracer.

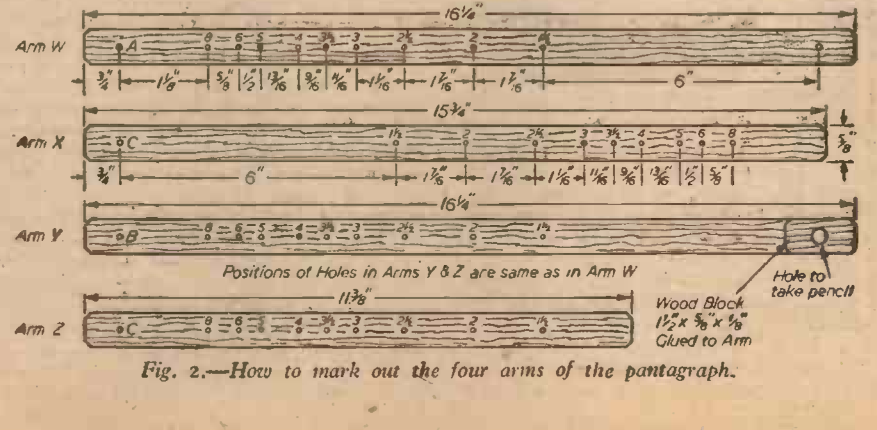


Fig. 2.—How to mark out the four arms of the pantagraph.

Inventions of Interest

By "Dynamo"

Safety Pocket

TO guard against loss is the aim of a self-closing safety pocket for which an application for a patent in this country has been made.

It is affirmed that even when this impeccable receptacle is inverted its contents are perfectly secure. A U-shaped spring engages the pocket at the edge and resiliently holds closure members in taut condition.

This safety pocket can easily be incorporated in or as part of a garment. For example it may be used as a breast pocket in a sports shirt or as a trousers pocket.

As a separate article of manufacture it can answer the purpose of a purse.

Dish Washer

THE washing of dishes is a necessary but not always a welcome practice. An inventor has been devoting his attention to this subject and has devised an improved method of cleansing quickly and effectively a large quantity of crockery and domestic utensils.

His plan concerns the kind in which a casing has in its lower part separate reservoirs for cleansing and rinsing, while in the upper part there is a receptacle for the articles to be washed first with the cleansing and then with the rinsing liquid.

The device is characterised by the fact that a casing containing in its lower part two reservoirs, a motor, a pump and time-control means, has its upper portion divided into a series of superposed compartments, each with its own door. A common delivery pipe leads from the pump to all compartments. There is a valve in the pipe for each compartment and the arrangement is such that on starting up of the motor, cleansing liquid is first pumped from and returned to one reservoir. Then an automatic change-over supplies rinsing water from and returns it to the other reservoir.

Easy Unloading

TO facilitate the discharge of loads by gravitation—in plain English to provide an improved tip cart, waggon or lorry—is the object of a new device which has been submitted to the British Patent Office.

This invention relates to vehicle bodies of the type which tip automatically when they have been moved backwards to a point at which the load overbalances.

Included in the design, pivotally secured to the chassis of the vehicle towards its rear, is a short underframe upon which a body can slide. Normally this body is carried only partly by the underframe. The remaining or forward portion is on fixed supports on the chassis, on which it slides to and from the position of overbalance.

To Strengthen Plywood

THE reinforcement of plywood is the chief object of a recent invention. The plywood is formed of two or more layers of thin, narrow strips of wood of low value placed with the grain at a right angle in the separate layers. Between two of the layers there is at least one sheet of thin metal or waterproofed fibrous or other waterproof material. The layers and the sheet are fastened together by stapling, nailing or similar means.

The sheet extends beyond the sides and ends of the layers, in order to form a flexible connecting link at these points between the sides and bottom and lid and ends of a packing case or crate.

A further object of the invention is to render the plywood impermeable to the penetration of moisture, insects, etc.

> 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."

Cheap Chessmen

SINCE mediæval days the pieces occupying the chequered board have been made of a variety of materials. The aristocratic sets have been formed of ivory. But the pieces have often consisted of wood and sometimes even of paper. And full sized human beings have been known to act the part of chessmen on a Brobdingnagian board.

An inventor has recently conceived the idea of chessmen which can be furnished cheaply in large quantities from inexpensive and readily available materials.

The method of manufacture comprises cutting a strip of wood, or other appropriate substance, by a milling operation to conform to the contour of the respective pieces and slicing the profiled strip transversely. The individual slices are then mounted on stout discs of wood, to which they may be permanently secured by glue.

An interesting alternative is to shape each slice in such a manner that it will dovetail with the disc and be detachable. The discs can then be available for playing draughts.

In the making of these chessmen, notches, such as for example, the gap between the ears of the horse's head of a knight and the division in the mitre of a bishop, can be formed by a bandsaw or any other suitable tool.

Pneumatic Gun Firer

THERE has been accepted by the British Patent Office an amended specification relating to improvements in pneumatic means for controlling the firing, reloading and safety blocking of automatic guns.

Previously it has been proposed to effect these three functions by pneumatic cylinders on a gun. In that case the circuits were controlled from a distance or from a signal central station for a whole series of guns.

The aim of the improved device is to place at the disposal of the occupants of an aeroplane simple means for reliably ensuring the firing, reloading, or simultaneous safety blocking of the various firearms on board.

According to the invention, a pneumatic control of aeroplane armament consisting of several arms, such as machine guns, has, interposed between the source of compressed air and the cylinders, allotted to the gun triggers, and preferably located near the latter, a gun-selector device. This device connects up in the pneumatic circuit the selected gun or guns to the exclusion of the others in such a way that one operator, without altering his position, can bring about numerous varied firing combinations. And this he does by acting on one—and always the same—control number. Thereby effective communication is established between the source of compressed air and the selector.

The first mobile camera, "The Dinosaur's Eye," for taking mass X-ray pictures of lungs, in the Ministry of Health's drive against T.B., is now in use touring factories in Britain. It is an outsize camera, and consists of a network of flexible metal tubing, a high tension transformer, and adjustable stand for persons being photographed. The illustration shows the film being placed in the special camera which takes the pictures of the lungs.

A CORRECTION

IN the article on "A Printer Enlarger" which is published in the February issue, page 148, the formula for the distance "lens to negative" was given as x = f. This should read $x = f + \frac{1}{m}f$.

The Story of Chemical Discovery

Tracing the Missing Elements

Sidelights on an Intriguing Field of Chemical Research

THE Periodic Table constitutes one of the fundamentals of chemical science. It was originated some seventy years ago (in 1869, to be exact) by the famous Russian chemist of the former city of St. Petersburg, Dmitrii Ivanovitch Mendeléeff by name.

Readers who have followed this present series of articles on chemical discovery will have gained an insight into the nature of this remarkable "natural" classification of the chemical elements, whereby every known element is accurately codified, ticketed and pigeon-holed in a comprehensive "table" or scheme according to its individual properties and those of its compounds.

When Mendeléeff first propounded his great Classification Scheme of the elements there were only 63 known elements. For this reason he was obliged to leave many blank spaces in his table, which spaces, all of which represented then unknown elements, would, he hoped, be filled up as time went on and as further chemical discoveries were made.

Among the heavier elements in Mendeléeff's original table of 1869 there were numerous unoccupied spaces, but among the lighter elements, such as boron, aluminium, silicon and others of relatively low atomic weight the number of vacant spaces representing "missing elements" was much fewer. To three of these hypothetical or missing elements, Mendeleeff gave the names of *eka*-boron, *eka*-aluminium and *eka*-silicon respectively, the prefix "eka" being the Sanscrit numeral "one."

From a careful study of the known elements whose names were adjacent to the spaces representing the three missing elements, Mendeléeff proceeded to predict the characteristics and properties not only of the unknown elements themselves, but also of some of their compounds. This was a bold step for any man to take, and Mendeléeff was, in some scientific quarters, derided for his chemical prophecies.

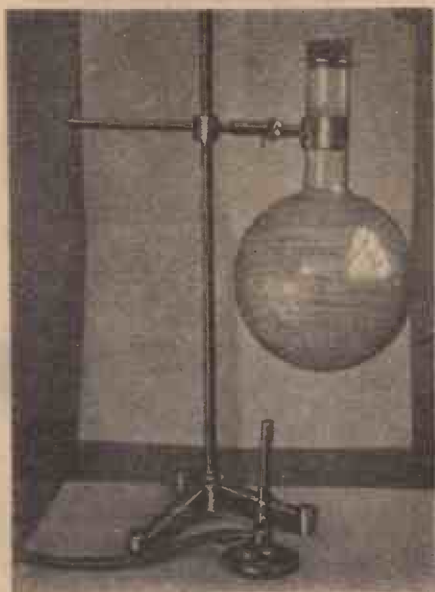
Gallium and Scandium

Mendeléeff's triple prediction was announced by him in 1871. Three years later (in 1874), Lecoq de Boisbaudran, a French chemist, happened to examine a specimen of natural zinc blende (zinc sulphide) in the spectroscope. He found in the spectrum of the mineral a then totally unknown brilliant blue line. Suspecting at once the presence of a new element, he forthwith proceeded on an analytical trail, the eventual result of his investigations being the discovery of a new element—a metal—to which, in honour of his country, he gave the name of *gallium*.

Gallium's properties were ascertained. They were found to coincide with Mendeléeff's *eka*-aluminium. Gallium was actually, in fact, the prophesied *eka*-aluminium.

In 1879, a Swedish investigator named Nilson was engaged in chemically extracting the constituents of a rare mineral called *euxenite*. He found in it an unknown ingredient which gave rise to a hitherto unknown spectrum. Further investigations were carried out and another new element was given to the world. Again this was a metal, to which Nilson gave the name of *scandium*, in allusion to his native country. The properties of scandium were investigated and were found to approximate with extreme closeness to those of Mendeléeff's predicted *eka*-boron. Again the famous Russian chemist had triumphed.

At the end of the year 1885, another of Mendeléeff's predicted elements was brought to light. Dr. Welsbach, of Berlin, investigating a sulphide ore from a mine near Freiberg, Saxony, discovered that it contained an unknown constituent, which constituent ultimately turned out to be a new element, to which, in honour of his fatherland, the worthy Welsbach applied the name of *Germanium*. It was not long before germanium was found to coincide in properties with Mendeléeff's "*eka*-silicon," for it is very much like silicon in characteristics, and is, indeed, only half a metal.



An experiment on the vaporisation of iodine, the fourth of the known "Halogen" elements. Element No. 85 should turn out to be the "fifth halogen" when it is discovered, but it has not yet been conclusively found.

For a long time germanium was one of the rarest of metals, but, about the middle of the last Great War, a new mineral, named *germanite*, was discovered. This contains among other things, about 8 per cent. of germanium together with about 1 per cent. of gallium, a fact which resulted in germanium becoming a commercially obtainable product.

Atomic Numbers

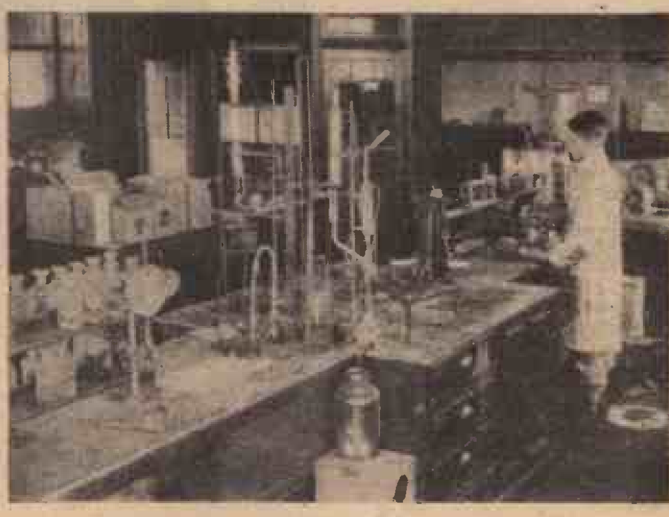
Just previous to the last war the young physicist Moseley, of Manchester, made a discovery of profound importance. It is impossible to go into the details of this discovery at the present juncture, but one of the important consequences of it was that it became possible to give to every element a number beginning with No. 1 for hydrogen up to No. 92 for uranium. This number was termed the "atomic number." It was found to be an even more fundamental factor than the atomic weight of an element, for this number was shown to represent the number of revolving electrons possessed by the atom. Thus Element No. 6 (carbon) has six "planetary" electrons surrounding its central nucleus, Element No. 47 (silver) possesses 47 planetary electrons, whilst, say, Element No. 26 (iron) is equipped with 26 of these "outside-the-nucleus" electrons.

The most interesting thing about Moseley's discovery of atomic numbers was that this system of numbering the elements served to confirm the amazing accuracy of Mendeléeff's "Periodic Table." Moreover, it showed at a glance the number of "possible" elements between hydrogen (Element No. 1) and uranium (Element No. 92), the lightest and the heaviest of the elements respectively. By comparing the number of "possible" elements with that of "actual" elements, the number of "missing" elements became clear to all concerned.

Since the days of Moseley (he was killed during the Gallipoli campaign of the last war) the number of "missing" elements has set up a sort of provocative challenge to many a chemical investigator, with the result that a very considerable amount of work has been carried out with a view to discovering all the missing elements and thus to "complete" the now classical Periodic Table of Elements.

The trailing of the modern missing elements forms one of the most interesting chapters of present-day chemical discovery. It is a chapter, too, which is not yet complete, for, although, at the present date, *traces* of all the unknown elements have been reported by different academic investigators, satisfactory confirmatory evidence in a few instances has not been forthcoming.

One of the first modern discoveries of missing elements was made about 1925, when indications of the material existence



A glimpse of a modern chemical research laboratory.

of two manganese-like metals were first clearly shown. Mendeléeff, before his death in 1907, had predicted, among other elements, the existence of two metals which he named *eka*-manganese and *dvi*-manganese. The later introduction of the atomic numbering of the elements showed that *eka*-manganese coincided with the unknown Element No. 43, whilst *dvi*-manganese was apparently the same as unknown Element No. 75.

Rhenium

Two Germans, Noddack and Tacke, in 1925, announced that they had discovered traces of the hitherto unknown elements Nos. 43 and 75 in certain platinum ores. To Element No. 75 they gave the name of "Rhenium," in allusion to the western district of Germany (the Rhineland), and to Element 43 they imparted the name of "Masurium," a name which was intended (with characteristic German stupidness and inanity) to commemorate the German defeat of the Russians in the Masurian district of East Germany during the period of the last Great War. No discoverer other than a German would have endeavoured to fasten on to an element a title so reminiscent of bitter memories. Nevertheless, the name "Masurium" still stands.

Rhenium, during the last decade or so, has become an almost common element. Some of its compounds are even listed in chemical catalogues. This is because rhenium is associated in Nature with molybdenum compounds.

Metallic masurium has never been isolated. Nor have any clear-cut compounds of this element ever been prepared. Noddack and Tacke, the co-discoverers of masurium, state that one part of this element is contained in 10,000 parts of native platinum, but, according to a number of Russian chemical investigators, neither masurium nor rhenium are to be found in native platinum ores or in the chemical concentrates of these materials.

Element No 43

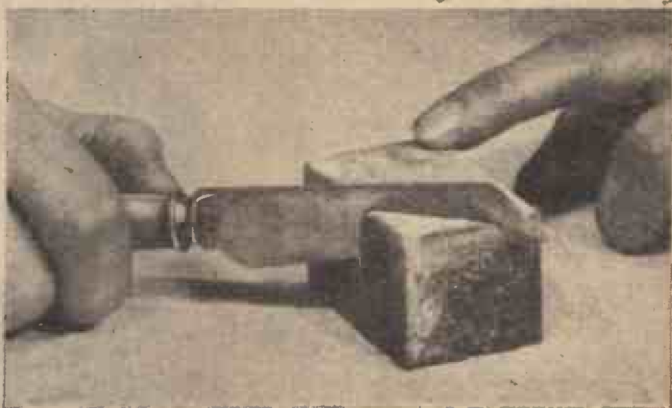
In view of the facts that between the years 1877 and 1920 at least four supposed "elements" were successively put forward as corresponding to the missing *eka*-manganese (Element No. 43), and that all these claims were proved to be unfounded, one is still justified in coming to the conclusion that Element No. 43, the supposed "Masurium," is still, in strict reality, a very much missing element. Let us hope, therefore, that if such is the case, the final discoverer of this elusive element will impart to it a happier name than the one which it bears at the present time.

An American Discovery

In 1926 Professor Smith Hopkins, of the University of Illinois, together with his co-workers, Drs. Harris and Yntema, announced to the world the discovery of a new element which they claimed to have detected in monazite sand. Hopkins named the element *Illinium*, in honour of the American State of Illinois. According to results obtained from X-ray spectrum working, the new element, illinium, corresponds with the missing Element No. 61.

At approximately the same time, Professor Rolla, of the Royal University of Florence, Italy, published a statement to the effect that he had, two years previously, obtained indications of the existence of the missing Element No. 61, to which element he proposed to apply the name *Florentium*, after his native city. The record of Rolla's supposed discovery was deposited in a sealed package, which was received into the custody of an Italian scientific society in June, 1924, and the seal of the package was broken in November, 1926, *after* the American announcement of the discovery of illinium.

Rolla's claims were apparently discredited. And even Professor Hopkins's illinium is, as yet, no clear-cut element. For one thing, neither metallic illinium nor any of its compounds have ever been obtained in weighable amounts. All that we know about the existence of illinium is through the evidence (and rather uncertain evidence at that) of X-ray spectra. It is quite possible that illinium is a fantasy, and that Element No. 61 is still at the present day a missing one. At all events, if illinium does happen to exist, it must be one of the scarcest of elements, far exceeding the rarity of radium.



Sodium, the commonest alkali metal, is so soft that it can be cut with a blunt knife. Whether element No. 87, the missing alkali metal, will be found to possess such a characteristic remains to be seen.

The Missing Alkali Metal

One of the present-day missing elements is an unknown alkali metal. It comprises Element No. 87. The term *eka*-caesium was formerly given to it, since, in Mendeléeff's Table of Elements, it was given a place near the metal caesium in the alkali group of metals.

In 1930 a couple of American investigators, Messrs. Allison and Murphy, stated that they had found clear evidences of the existence of *eka*-caesium (Element No. 87) by spectroscopic methods. They called the new element *Virginium*, after the American State of Virginia. But, somehow or other, more satisfactory proof of virginium's true existence was not forthcoming. No one had made, seen or handled a lump or even a mere grain of metallic virginium. And, to make things more confused, another investigator, H. Hulubei, came along some seven years later (in 1937) with an entirely fresh claim to the discovery of the missing alkali metal (Element No. 87), which element he proposed to name *Moldavium*.

An analyst's work bench in an up-to-date laboratory.

Hence, virginium and moldavium are still disputed entities, although virginium has certainly found its way into the American chemical dictionaries and other works of reference. Whether, however, it will be replaced at a future date by another "Element No. 87" is, at the present stage, quite impossible to say.

The "Fifth Halogen"

A perhaps still more interesting "missing" element is the famous "missing halogen." The "halogens" (Greek: *hals*, "salt"; *genes*, "producing") comprise a group of four well-known, closely related and highly reactive chemical elements, to wit, the elements fluorine, chlorine, bromine and iodine.

Now, in the table of "possible" elements there is a place for a fifth halogen, to which the name *eka*-iodine has been applied. *Eka*-iodine, the missing halogen, corresponds with the unknown Element No. 85.

About 1932 a group of American scientists, headed by Dr. Allison, claimed to have discovered the missing halogen element. They christened it *Alabamine*, from the State of Alabama. It was extracted from monazite sand residues, and it was examined by spectroscopic and magneto-optical apparatus. But, once again, alabamine in the mass, that is to say, material which could be weighed, was woefully lacking.

The chemical world is apparently divided into two camps over the question of alabamine, Element No. 85. One section of opinion asserts that the original claims for the existence of this element have been made good. The other section holds that when you peer into a spectroscope or into a magneto-optical apparatus, and are not quite sure that the lines which you see are real or imaginary (owing to their faintness) then, under these circumstances (which seem to have prevailed at the supposed discovery of alabamine) you are not justified in stating that you have found something new.

Thus, to all practical intents and purposes, the verdict in the case of alabamine, Element No. 85—the "fifth halogen"—is the good old Scottish one of "not proven."

Anglo-Helvetium

It was only last year that Element No. 85 was again in the news. This time, it was presented under the absurdly cumbersome

(*Continued on page 246*)

Making a Success of Your Photography

More Uses for Your Camera. By JOHN J. CURTIS, A.R.P.S.

THE above title will appear to be rather facetious to many of my readers in these days when it is so difficult to obtain supplies of films and papers for using in the ordinary ways of amateur photography, but, fortunately, these restrictions are not permanent fixtures, and we hope that they will become much more elastic in the latter part of this year. Further, these articles on photography are not intended for the present day only; they are written in the belief that those who read them will acquire information, hints and advice that will enable them to become more progressive and familiar with the various processes and applications of the art of photography.

With these thoughts in mind let us for a few moments consider the many uses to which photography is being put in these times; we all know something of what the Air Force, Army and Navy are doing with the camera. Thousands of films are being exposed daily for use in the training and instruction of men and units, in reconnaissance work over territory occupied by the enemy, in research work in the medical sections, and statistical records are being made and checked in large quantities by the clerical departments, but probably only a very few of us know or realise how very important it has become in most of our leading industries.

Photography in Industry

It is now recognised as a leading factor in the daily routine of most of our large engineering works, and thousands of pounds and hours of labour are being saved by the use of still photography and cinematography, and it can be honestly be assumed that hundreds of lives are saved by the use of radiography—a very close relative to photography—for examining raw metals before being fabricated; also for parts, sections and joints before assembling an aeroplane engine, machine or other valuable plant.

Shipbuilding, locomotive construction, architecture, farming and agriculture, canning of foodstuffs, banking and insurance, and many other departments concerned with our existence and daily life, are now finding photography is almost a necessity, because it helps so much in speeding up production, in the elimination of mistakes, in the making of true records for future planning and estimating, and in many other ways facilitates the work and solves the problems which inevitably occur in large organisations.

But how does this interest or affect ordinary individuals who are using photography merely as a hobby or as a spare time occupation?

Lantern Lectures

Well, the best answer that can be given to such a question is to relate a personal experience which occurred only a few days ago. It happened whilst with a party of friends on a short ramble; seeing a camera slung on my shoulder, a stranger approached me who also had a camera, and soon we were relating our experiences. He proved to be very keen on giving lantern lectures with his own slides, whenever time and opportunity served, at the local literary, debating and other meetings, his chief subjects being English landscapes. On occasions he showed one slide of a totally different subject, one of which he was very proud because of its high technical quality, and which always created great interest among his audiences. "What do you think the subject is?" he inquired. I replied: "I was not good at guessing," and he then informed me that it was the works of a watch taken with the back open. Apparently he was very interested in watches and clocks, and in order to make himself familiar with the works, and so to be able to do repair work, he would photograph each layer of wheels and other parts during the dismantling.

To me this application was quite a new departure, but I can readily understand how, by means of a series of prints made from one's own negatives of a clock's works or the wheels and gadgets of any intricate piece of machinery, it would be possible to gain sufficient knowledge to be able to successfully repair the same when anything went wrong. For purposes of identification the prints might be marked with figures or letters indicating each unit so as to ensure it being replaced correctly, especially useful where two or more items were similar. This is a method that is quite commonly used in actual practice in many engineering shops, and at two recent exhibitions in London, one of a well-known make of motor and aeroplane engines, the other of a complicated piece of machinery for cutting screws of varying degrees of length, thickness and thread, photographic enlargements were displayed for the benefit of the public in order that visitors could get a better understanding of the workings.

A good photograph of the works of an alarm clock.

Some may know and have had experience of the difficulty of getting a typewriter satisfactorily repaired; it takes several years to make a reliable and skilled repairer, because there are in the average machine about 3,040 parts, together with 380 screws. Before attempting to dismantle your typewriter, I suggest therefore you take a series of photographs and continue to do so during each period of the dismantling. It may be the means of making you a skilled operator, and it should help to overcome the trouble which crowns the efforts of so many of us would-be amateur mechanics of finding at the end of the job that we have more parts than when we started the work.

Another very interesting work for the camera which to my knowledge has proved its value already in many directions is the photographing of fireplaces, both ancient and modern, including those with marble or wood surrounds, plain and carved, small and large. For some years there has been a craze for something original or out of the ordinary, and builders of houses welcome any designs with a touch of originality and artistry. For small houses, the built-up brick type is still very popular, and it is possible for anyone with a flare for this work to make a fair income. One method is to procure several photographs and to colour the bromide prints with Johnson's photo tints to suit your own ideas, then to make composite drawings, using parts of the designs of three or perhaps only two of the original photographs; in this way it is possible to design a brick or tile fireplace with a wood or store surround. The finished design should then be photographed and coloured and submitted to the builder, who would pay a fee if he made use of it, or a series of such might be accepted by the actual makers of fireplaces.

Aids to Decorating

When the war is over there are many who will want to try their hands and skill at redecorating their homes, and amongst other items the question of graining of panels and doors may claim attention; an expert grainer is not easy to find, but it is possible to make a collection of photographs of the various types of grainings, such as walnut—burr and straight—oak, maple, mahogany, etc., and if these prints are coloured to give the right effect they would give the amateur the right basis on which to work, and the paint supplier would advise what paints are necessary to use for the door, panel or cupboard to obtain the best rendering.

When plain papers for wall coverings took the place of the horrible uniform floral decorated papers, the makers of papers had the idea of supplying cut-outs like big "scraps" of birds, trees and other devices for pasting on the wall to relieve the plainness or bareness, but the scheme did not catch on for a long time, and so supplies were stopped. Now, however, there is a demand, and it is practically impossible to obtain any of the designs, but the amateur photographer can make his own. I have seen a nursery made beautiful by photographic enlargements, tinted with photo tints, of teddy bears, golliwogs, penguins, pigeons and other items which always appeal to young children. The bathroom walls of another house were distempered a pale blue, and the owner, being a keen amateur, made two or three enlargements of some cloud negatives, the prints were suitably cut and trimmed, then pasted on the walls near the ceiling, then he made other enlarged prints of seagulls on the wing, and these were arranged in suitable positions below the clouds. It is curious to note that this decoration had the effect of making that bathroom appear much larger than it actually is.

Radiography

One short note for those who have photographic knowledge, yet through circumstances are not able to pursue their hobby. A friend, well on in years, offered his services to his local hospital, he had very little knowledge of radiography, but was prepared to learn if he could be of service. To-day, after about two to three years' casual work, he has become almost an expert, and is giving valuable aid to those who are very much overworked.

THE WORLD OF MODELS

By "MOTILUS"

The Lizard Lifeboat and Its Model . . . A Large-gauge Model Railway Enthusiast, and the Work His Models are Doing for War Charities

Fig. 1.—*The lifeboat of the Lizard outside her station. As will be seen, she is launched down a slipway.*

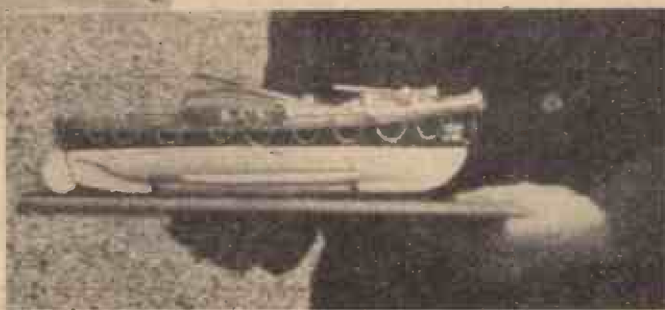


Fig. 2.—The $\frac{3}{8}$in. to the foot model of the "Duke of York" lifeboat, made by Mr. W. J. Stephens, motor mechanic of the vessel.

A Cornish Seaman and Model-maker

MR. W. J. STEPHENS, of Cadgwith, is something of a character in Cornwall. He is one of eight brothers who, in peacetime, were all connected with the little village of Cadgwith and the lifeboats of the Lizard.

His first service in a lifeboat was in 1911, when these gallant little vessels were of the pulling and sailing type. In 1913 he joined the Navy, and was there until 1920, and, when discharged, was appointed motor mechanic of the first motor lifeboat of the Lizard, the *Frederick J. Pilley*, in which he served for fourteen years.

The latest boat, the *Duke of York*, has been at the station ten years in February, and Mr. Stephens has therefore spent twenty-four years as motor mechanic of the Lizard lifeboats.

The *Duke of York*, whose picture you see on this page (Fig. 1), was built out of a gift of £5,000 from King George's Fund for Sailors, received between 1929 and 1933. She is a motor lifeboat of the Watson type, 41ft. by 11ft. 8in. On service, with crew and gear aboard, she weighs just over 15 tons.

She is divided into eight watertight compartments and fitted with 145 air cases, and her engine room is a watertight compartment. Her two 35 h.p. engines also are watertight, and would continue running even should the engine room be flooded. Her speed is just over eight knots, and she carries enough petrol to be able to travel 120 miles at full speed without refuelling. Also she has a line-throwing gun and an electric searchlight, and is lighted by electricity.

Since her arrival at the Lizard in 1934 she has been launched on service 19 times, and has rescued 70 lives. Eleven of those launches have been in service since the outbreak of war, and they have resulted in the rescue of nine lives. She carries a crew of eight, and in rough weather can take up to fifty people aboard.

Her motor mechanic, Mr. Stephens, whose personal hobbies are knitting jerseys, and the famous sport of bass-fishing with the rod, has made an excellent model of the *Duke of York*.

The Model

The model is $\frac{3}{8}$in. to the foot, and is noteworthy as the first model he has made. Judging from the photograph (Fig. 2) it appears a really expert attempt, and we trust it will not be his last effort! Mr. Stephens tells me it took him three months to build, and he did it completely with a pocket penknife.

In these days of war, when most of our thoughts are with the Forces and the Merchant Navy, don't let us forget that all along the coast of the British Isles there are hundreds of lifeboats and thousands of men of the Royal National Lifeboat Institution quietly carrying on their gallant work of rescuing lives from the sea. Long may they continue to do so.

Powerful Model Locomotive

Having to make a call at Nottingham recently on business, I had the opportunity of visiting the exhibition in aid of the Merchant Navy Comforts Service, held at the Ritz Cinema there during Merchant Navy Week.

I found there not only some quite good specimens of model ships of every type and description, but also an excellent display of larger gauge model locomotives, the work of Mr. Ernest Dove, of Sherwood, Nottingham.

Not only does this gentleman build the models, but also operates them as a feature of exhibitions, giving rides to all and sundry for the cause of the deserving charity.

The model $7\frac{1}{4}$in. gauge $1\frac{1}{2}$in. scale 4-6-2 L.N.E.R. Pacific, to be seen in the two accompanying illustrations (Figs. 3 and 4), has been on exhibition in various parts of the country, and Mr. Dove calls it his exhibition "ace," for in two years it has collected £8,000 for various war charities.

He commenced to build this model in 1931, and completed it in 1940. The frame is made from 3/16in. Bessemer steel, and it is fitted with Wallschaerts valve gear. It is coal fired, with a working pressure of 90lb. The seamless drawn-tube boiler is tested to 250lb. to the square inch. The cylinders are $2\frac{1}{2}$in. bore, $3\frac{1}{2}$in. stroke, and the total

Fig. 3.—The $7\frac{1}{4}$in. gauge Flying Scotsman locomotive built by Mr. Ernest Dove (extreme left). His son is in the driver's seat.

weight of the model in working order is 11cwt. 80lb. It is fitted with mechanical lubrication, and has gun-metal axle boxes and Ross pop safety valves. The total number of bolts and rivets used in construction amount to 1,850.

Mr. Dove tells me that on a severe test last summer this locomotive was in steam for 20 hours, carried 4,600 passengers, travelled a distance of 85 miles, and consumed 285 gallons of water to a fuel consumption of 2¼cwt. of anthracite coal—safety valves blowing off practically all the time. As soon as the regulator is open the engine will start away under the heaviest load without a sign of slip.

Mr. Dove is to be seen on the extreme left of illustration (Fig. 3), and the young engine driver is his son.

The illustration Fig. 4 was taken at the Nottingham Merchant Navy Exhibition, where the proceeds totalled £450 for 10 weeks, and among those to be seen are Nottingham's Lord Mayor — Alderman Braddock—and the Lady Mayoress, Sheriff Mitchell and his wife, the Merchant Navy Queen, and Commander Macness, chairman of the Nottingham Branch of the Merchant Navy Comforts Service.

Fig. 4.—At Nottingham's Merchant Navy Week exhibition. Mr. Dove's models raised £250 during the first six days. The Merchant Navy Queen and her attendants are present, also the Lord Mayor of Nottingham (Alderman Braddock) and the Mayoress, and Sheriff Mitchell and his wife. Mr. Dove and his son demonstrated the models.

Other Locomotive Models

Another of Mr. Dove's models is to be seen here, the Southern Railway Schools class, which has taken him six years to build and complete, and follows closely the design of the Pacific engine as regards boiler, water feed supply, etc. (The Scotsman's water feed supply from tender to boiler is by injectors working at the rate of two pints a minute.)

Mr. Dove has not yet made a thorough test of the S. R. locomotive, but says she is a very "sharp mover." He is now engaged in completing a 7¼in.-gauge tank locomotive, and also an L.M.S. Duchess of Buccleuch class, which he hopes will turn out as successfully as his previous efforts. Although he has had no engineering experience, he says he has been plodding along patiently at model engineering for the past 25 years, and considers the hobby most interesting, and an outstanding attraction. He also stated that if any model engineering enthusiast would care to come and see his models at any time—and come to drive them—he will be happy to oblige, if possible!

Solutions to Probes and Problems

(*See page* 234)

A Matrimonial Medley

Jane's maiden name was Smith.

Electing a President

One of the candidates is unnamed; we may call him "X." The voting is then distributed as follows:

	A	B	C	E	X
A	X	5	0	0	0
B	4	X	1	0	0
C	1	0	X	1	3
E	0	0	3	X	2
X	0	0	1	4	X

"I" who gave Bloggs all my votes cannot be Clark or Everett, so that "I" must be either Adams or "X." Since Clark gave the same number of votes to two candidates, he must have given one to Adams.

Experiment shows the above arrangement to be the only possible one; so that "I" who gave all my votes to Bloggs must be Adams.

A Calendar Problem

The first day of a new century can never be a Sunday. The only possible days of the week for that date are Monday, Wednesday, Friday and Saturday.

Who Stole the Sapphires ?

Lop-Ear declares that he was with Slogger Joe at the time of the robbery, Joe that he has never been near the place, and Tommy the Toff that he saw Lop-Ear in the vicinity. One of these statements must be untrue, and hence one of these three is the criminal.

Also, the Toff says that he heard of the robbery from Bill Basher, while Grabstein declares that Bill said he knew nothing about it. Hence of one these three has lied.

Tommy the Toff, who appears in both lists, must therefore be the culprit.

TRACING THE MISSING ELEMENTS

(*Continued from page* 243)

and chemically impracticable name of "Anglo-Helvetium."

This, the latest claim to the discovery of the missing halogen element, was made by two physicists working in the Radium Institute at Berne, Switzerland, Mrs. Alice Leigh-Smith, a pupil of Mme. Curie and the wife of a British diplomat, and Dr. Walter Minder, a Swiss professor, who is Director of the Radium Institute at Berne.

The Leigh-Smith/Minder discovery announcement first appeared in a tentative form in July, 1940, the 1943 announcement only having been made after "eighteen months of laborious research." Whether Mrs. Leigh-Smith and Dr. Minder have really hit upon the missing halogen element or whether, like the previous American "Alabamine," the proposed "Anglo-Helvetium" is merely a chemical wish-fulfilment it is, of course, quite impossible to say, since few, if any, of the essential details of its discovery are yet available.

To all intents and purposes, at least three elements are still to be included in the "missing" list. Masurium (Element No. 43) is doubtful. The "Fifth Halogen" and the "Unknown Alkali Metal" still fail to give satisfactory evidences of their mass existence.

Even, however, supposing that all the elements from No. 1 (hydrogen) to No. 92 (uranium) had been duly discovered, catalogued and correctly indexed in the great Table of Elements which was originated in practical form by the genius of Dmitrii Mendeléeff, would it be possible for us to discover elements *beyond* uranium, which is the heaviest of all the known elements, and which forms the end of the known series of such bodies ? Is there, in short, an Element No. 93, an Element No. 95, and even an Element No. 100 to be discovered ?

To such a question we cannot give any definite answer. The probabilities are all against there being any stable element of higher atomic number than uranium (No. 92), for, on theoretical grounds, it can be shown, very decidedly, that any such element, under our own earthly conditions, would be quite unstable, and that it would at once split up—or even violently explode—into far simpler and lighter elements.

It is, perhaps, possible that an element one degree higher than uranium may be found. This would be Element No. 93, to which mysterious and entirely hypothetical material, the name *eka*-rhenium has been applied. This element has been claimed to have resulted in traces from the bombardment of uranium atoms with neutrons, but the claim has never been substantiated. If, therefore, *eka*-rhenium is, perchance, on theoretical grounds, a "possible" element, it is still very much a "missing" one.

About Dead-Centres

Details of an Experimental Gear for Cycles and Other Machines

By G. W. HART

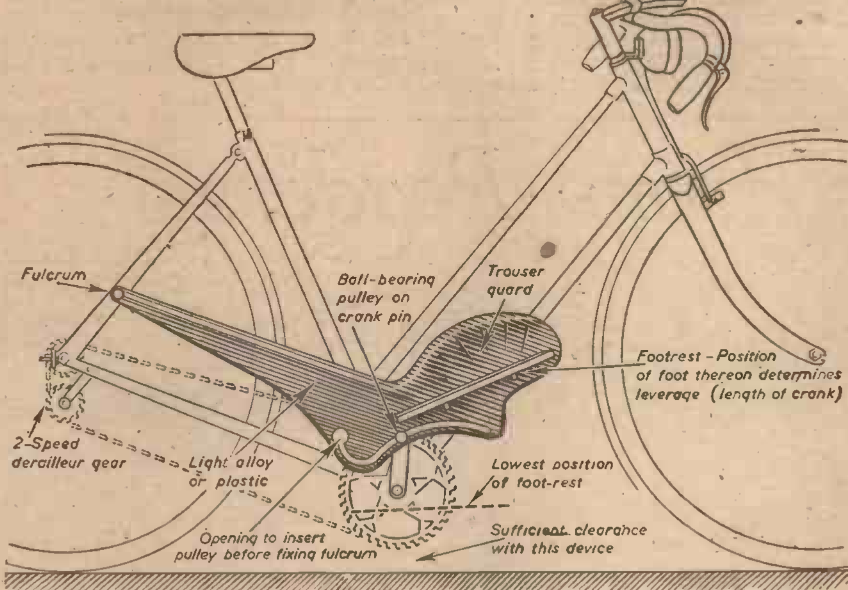


Fig. 1.—An improved driving gear for a cycle.

WHEN the device known as the crank is used for the purpose of converting a reciprocal motion into a rotary motion the question of "dead-centres" frequently arises, especially with regard to engines which include a piston in the design, and also where a lever motion is used to turn a crank. The reference to "dead-centres" in this connection is a loose one and is not strictly correct: it is true, of course, that where there is an oscillating motion there must be a point where the motion ceases to move in one direction and commences to move in another, and at this moment there is no motion imparted to the crank, but this point of "dead-centre" is quite negligible for practical purposes since it must consist of a period of time of quite immeasurable brevity, and it must occupy a space on the crank-throw circle of quite immeasurable width. In other words, the line of the "dead-centres" is a knife edge and consequently, as already stated, is of no importance whatever in practical machine design. What is commonly called a "dead-centre" is an entirely different matter. There is a dead space of about 20 deg. on each of the two positions of the crank-throw circle which are normally regarded as arising from "dead-centre," but these cannot arise from this fact of physics, and it is a matter of leverage only. From 0 deg. to 10 deg. the motion of the piston (as representing any reciprocating force) moves very little, but it does in fact move. It *must* move, because point 10 deg. is in a different position relative to the piston to point 0 deg. Pressure required upon the piston to rotate the crank is very great from 0 deg. to 10 deg., but if great enough it will always move the crank, unless it should so happen that the points piston, crank-pin, crank-shaft are dead in line, which is nearly an impossibility on account of the lack of width in this line (speaking in popular terms).

Crank Leverage

The leverage upon the crank at different positions of the crank-pin varies from 0 deg. to 90 deg., getting progressively larger and after this getting smaller to the same degree. This would be in order if the pressure of the piston varied in the same proportions, but this is very unlikely. What is wanted, therefore, to overcome this so-called "dead-centre" effect is some means whereby every progressive degree of motion on the piston is converted to an equally progressive degree of motion on the crank. If this is done, it follows that the leverage will be constant throughout the whole of the rotation of the crank, instead of being in an increasing and diminishing degree as at present.

At the present time large fly-wheels are used in single-cylinder engines, and the trend of I.C. and steam engines is to increase the number of cylinders with the sole object of getting an even torque; but if the problem as stated can be solved as indicated the need for multi-cylinders ceases, and the greater efficiency of a twin-cylinder engine can be utilised, together with its reduced weight and cost.

In practice a connecting rod is always used between the thrust force and the crank-pin, and this to some extent gives a forward thrust on the crank, but it is purely incidental and the object of using a connecting rod is not for the purpose of overcoming the defect in the leverage which has been mentioned. A simple improvement on the present arrangement would be a connecting rod that moves directly parallel with the piston, and having on its lower surface a cam so designed that the first motion of the piston would be to drive the crank-pin forwards and then downwards, but this can only be effective over the first quarter of the revolution. When the crank-pin reaches 90 deg. this design would become inoperative, and, in fact, during the second quarter of the revolution the difficulty would be greater than before. There are, in fact, two motions required—one to push the crank-pin forward to a horizontal position, and another to move it backwards from 90 deg. to 180 deg., and this is the problem the solution of which has been attempted in the invention, a description of which follows.

An Experimental Cycle Gear

Interposed between the thrust force and the crank-pin is a lever which is pivoted on a line approximately 45 deg. to the line of thrust. This lever bears a cam so plotted that, on the first movement, the crank-pin is thrust forwards and downwards to the 90 deg. position, and then thrust downwards and backwards to the 180 deg. position. Both the face of the cam and the length of the lever, with the position of its pivot, is so plotted that for every degree of movement by the thrusting force there is a correspondingly equal degree of movement of the crank-pin, so that the conversion of the reciprocal force is exactly converted into rotary motion throughout 180 deg.

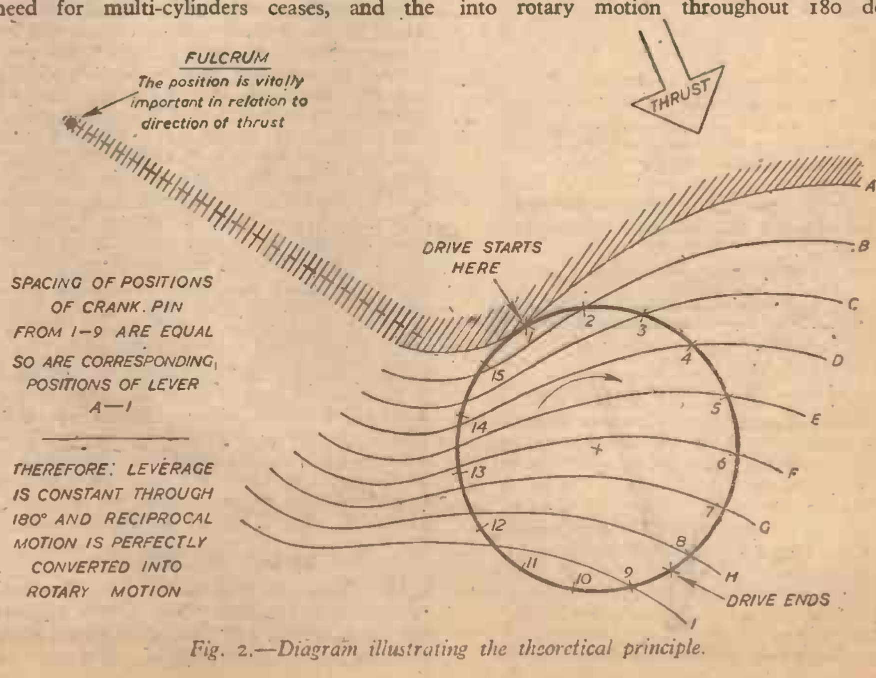


Fig. 2.—Diagram illustrating the theoretical principle.

motion of the crank-pin. If two such levers are used in conjunction with two thrusting forces, it will be seen that a perfectly equal torque of 360 deg. can be obtained with the use of two pistons only. These facts are shown diagrammatically in Fig. 2, which shows one lever only. Although the term piston has been used freely in the foregoing remarks, the present invention has in mind the employment of any rectilinear motion such as in machines where lever or treadle operation is used. It would be particularly acceptable to the user of an invalid carriage, where propulsion is obtained by the use of two levers, as the improved transmission would enable him to use a much higher gear, and, by a simple arrangement, the fulcrum of the levers could be adjusted so that the "gear" could be raised or lowered at will. There are also about 500,000 cyclists who reach some degree of success in rotating pedals through 180 deg. by what they call "ankling," but there are about 8,000,000 cyclists in this country alone who have no conception of this, nor have they the inclination to learn; this invention should also be of use to them since the dancing motion of the butcher's boy, which is so popular, would become fully effective instead of a pure waste of energy as at present. Further applications in this connection, such as the treadle sewing machine and the foot lathe, could be quoted, and its application to the single-cylinder gas engine is fairly obvious.

Letters from Readers

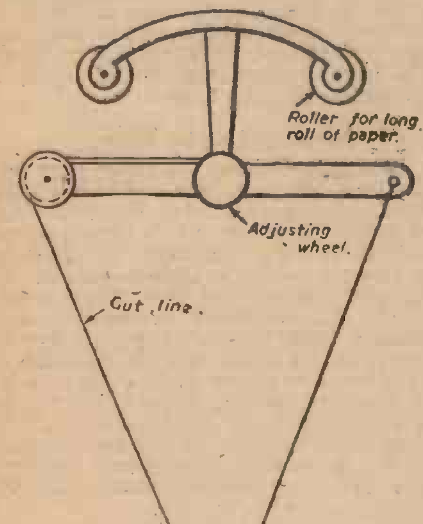
A PENDULUM HARMONOGRAPH

SIR,—I was interested in the "Harmonograph" described in the November, 1943, issue of PRACTICAL MECHANICS.

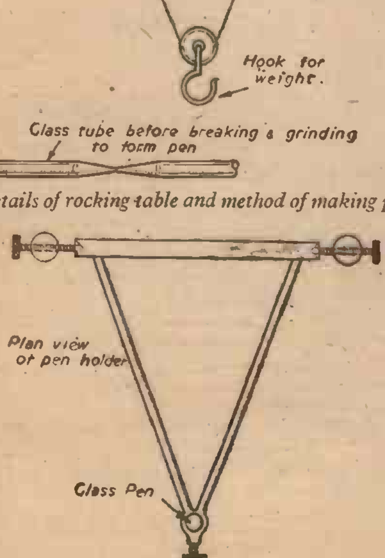
I made a similar instrument about sixty years ago, and enclose a few specimen designs which were produced with it.

The pen I made from a piece of ¼in. glass tube (see sketch), drawn out to a point, and this was ground down on an oilstone till the opening was large enough for the ink to flow. My ink was methylated spirit stained with analine dye, and a little glycerine added to make it a little more stable.

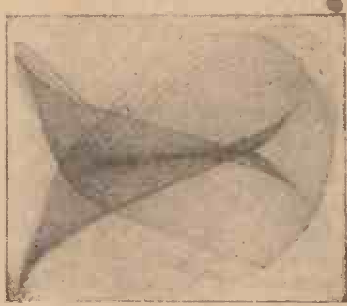
A. R. HALLETT (Sturminster Newton).

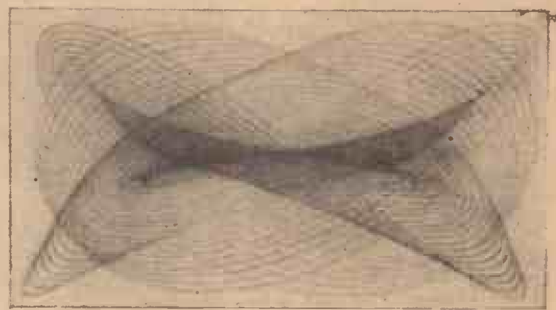


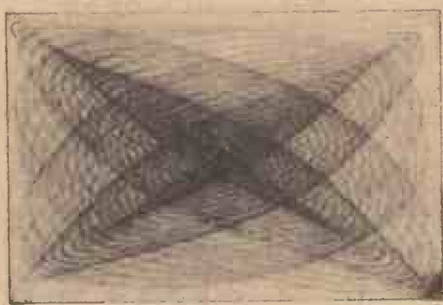
Details of rocking table and method of making pen

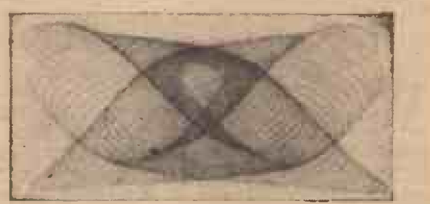


Method of pivoting the pen-holder









Specimen designs produced on A. R. Hallett's harmonograph.

CUTTING SCREW THREADS

SIR,—The following tip may be of interest to owners of small screw-cutting lathes.

I needed to cut a screw thread of 26 to the inch—a common figure in bicycle engineering—but had no gearwheel over 55 teeth nor any multiple of 13 below that. Being unable to obtain a 65 wheel I determined to use sprocket-wheels connected by a roller chain. "Magneto cogs" are procurable having eight teeth upwards; bicycle hub-cogs from 12 to 28 teeth, screwed internally to fit a standard boss; and chain-wheels from 28 to 52 teeth, all to fit the standard ½in. by ⅛in. bicycle roller chain. My lead-screw has eight threads per inch, so I procured an eight-tooth magneto cog and turned it out to fit to the headstock main spindle, or alternatively, to a gear-wheel engaging with another fixed to that spindle, to give left-hand thread. I fitted an old bicycle freewheel-boss to the lead-screw shaft, so that any hub-cog can be fitted at will; and some calculation is saved, since with this arrangement, the number of threads per inch will be the same as the number of teeth on the driven sprocket wheel—in this case 26. The chain is tensioned by an idle sprocket whose size is immaterial, turning on an intermediate gearwheel-shaft whose position is, of course, adjustable. W. H. SPOOR (Saltash).

SPACE ROCKETS

SIR,—Your correspondent, Mr. Scanlon, gave some interesting details regarding space rockets but two grave errors were included in his information. The first of these was his statement that the escape velocity from the earth's attraction is 609 miles per second, when the correct figure is 6.95 miles per second. Quite an appreciable difference when space travel is contemplated. This value is obtained as follows:

The value of the gravitational attraction varies as the square of the distance and for any height S it is given by $g_s = G.\frac{R^2}{R + S^2}$ and when (R + S) is made equal to r, then the equation of motion of a projectile projected vertically upwards will become, $\frac{dv}{dt} = -G\frac{R^2}{r^2}$ and if both sides are multiplied by dr, $v.dv = -G.R^2.r^2.dr$ and if this is integrated between the limits when r = R (the radius of the earth) and r = r (the height of the projectile), then, $\frac{V_R^2 = V_r^2}{2} = G.R^2\left(\frac{1}{R} + \frac{1}{r}\right)$ In the limit when V_r becomes zero, then the distance r is infinite and the initial velocity will be given by: velocity of liberation = $\sqrt{2.G.R.}$ when G is the value of the gravitational attraction at the surface of the earth and R is the radius of the earth.

The second point is that Prof. Hermann Oberth was not killed by rocket experiments, and as far as is known, he is still alive to-day. Max Valier was killed by the explosion of a liquid fuel rocket car, but Herr Tilling was actually killed by the explosion of about 30lb. of powder in his workshop.

E. BURGESS, President.
Combined British Astronautical Societies.

QUERIES and ENQUIRIES

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

Gesso Powder

CAN you oblige by giving me the receipe for making gesso powder? This used to be obtainable before the war, and was used for the fancy relief moulding on the edges of lamp shades, etc., when mixed to the desired consistency with water. I believe some people call it "barbola," which is obtainable in paste form, but is not suitable for my purpose.—J. Osbourn (Leicester).

THE reason why gesso powder is so hard to obtain nowadays is on account of the fact that the gold powder which is incorporated into it is only being supplied for essential purposes.

Essentially, this material consists of about equal parts of pigment, whiting and a binding material such as dextrin. This mixture is made into a paste with water. The product can be much improved by incorporating a little casein glue powder into it in order to stiffen and harden it.

A still better gesso can be made up on an oil basis, as below:

(a)	Fish glue (liquid)	4 parts
	Water	1 part
(b)	Raw linseed oil	1 part
	Clear oil varnish	1 part
	Whiting	6 parts

Work into "b" sufficient gold or other pigment to shade. Then work "a" into "b."

This material is slower drying than the water gesso, but it is stronger and much less liable to flake or chip. Its drying speed may be increased by adding a little paint "drier" to it.

Battery Plates and Electrolyte

I HAVE five negative and four positive "Nife" battery plates (new), and I want to use them for lighting a 6-volt, 24-watt lamp. Can this be done, and, also, what sort of case should I use for the plates, and what kind of electrolyte should I use? Could you tell me the capacity of the plates? Their size is 4½in. × 4in. and their width is 3/10in. for the positives and 2/10in. for the negatives.—J. W. Smith (Sandown, I. of W.).

THE capacity of one positive and one negative plate will probably be about 18 ampere hour, with a normal discharge rate of about 3.6 amps. Each cell would give an average discharge voltage of about 1.2 volts.

You would, therefore, require five cells for the 6-volt bulb, and a discharge rate of 4 amps. It will be seen that you could not build up a battery to light a 6-volt lamp, even by using only one positive and one negative plate per cell. The electrolyte used in such cells is an aqueous solution of caustic potash having a specific gravity of 1.200.

Electric Soldering Iron

I WISH to make a 12-volt soldering iron for use outdoors, as my blowlamp does not appear to be very satisfactory. I can obtain the supply from two 6-volt 125 amp. hr. batteries. Can you inform me what length and gauge wire I should need for the element, or if I can buy the element already wound? Also, how can I fit it inside the copper bit?—F. S. Horsman (Swindon).

FOR a 1lb. soldering iron you require a heating element of about 90 watts rating, that is to take 7.5 amps at 12 volts. We suggest that you use 1¾ yards of 18 s.w.g. nickel-chrome resistance wire. You could wind the element on a mica tube or strip wrapped round the supporting tube to which the handle is attached, covering the element with another thin tube or strip of mica; the whole being arranged to fit snugly inside a hole bored in the copper bit.

Extracting Silver and Gold from Alloys

WOULD you kindly advise me of a method for extracting almost pure silver and gold from alloys of these metals.

A method I could suggest for silver would be:

(a) Convert the silver alloy to nitrates of the metals contained in the alloy by the action of dilute nitric acid.

(b) Deposit silver chloride from the solution with a chloride of, say, sodium.

(c) Wash the deposit and filter.

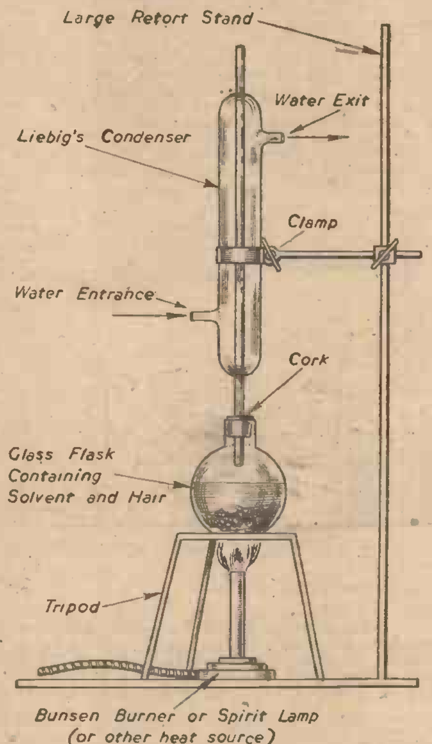
(d) Dissolve the contents of the filter paper in ammonia solution.

(e) Electrolyse this solution using carbon electrodes.

This method fails when dealing with gold alloys and, in any case, appears rather lengthy, giving black deposits instead of white crystals of the metal.—S. G. Bubb (Porthcawl).

UNLESS we are informed of the precise, or, at least, the approximate nature and composition of the alloy from which you wish to extract silver and/or gold it is absolutely impossible for us to advise you as to the exact mode of procedure for extraction of the required metals.

For one thing, not all metals are soluble in dilute nitric acid, and silver itself, when alloyed with some of these metals becomes very difficultly soluble in this acid. Provided that the silver in the alloy is in such a form that it can be dissolved out with nitric acid, your proposed scheme of extraction is quite feasible, but it would be better if you collected your silver chloride, suspended it in water and passed hydrogen gas into the aqueous suspension. This would result in the silver chloride being converted into metallic silver, which would fall to the bottom of the vessel as a black deposit. This could then be filtered off, washed, dried and fused under a layer of carbon and soda.



Simple apparatus for extracting oil from hair by means of a boiling solvent.

Alternatively, the precipitated silver could be dissolved in dilute nitric acid, and thus converted into silver nitrate.

With regard to gold, there is no single acid (except selenic acid) which is capable of dissolving gold. Your plan, therefore, would be to dissolve out the various other ingredients of the alloy with dilute or concentrated mineral acids, and then to boil up the residue with *aqua regia*, which latter is a mixture of 2 parts concentrated hydrochloric acid and 1 part concentrated nitric acid. A yellow solution of gold chloride would thus result. This should then be filtered and evaporated down to dryness, the resulting crystals being then strongly heated in a porcelain crucible in order to convert them into metallic gold, which latter, if desired, could then be redissolved in *aqua regia* to form a pure solution of gold chloride.

You must always bear in mind the fact that the extraction of any one metal from its alloys is a process which must necessarily be governed in its details by a consideration of the other ingredients of the alloy. For this reason alone, it is quite impossible to lay down hard and fast rules or procedures for the extraction of silver and gold from all their different alloys, mixtures and compounds.

Extracting Oil from Hair

I AM interested in an experiment in regard to extracting oil from hair. I am anxious to retain all the qualities of the oil. Can you tell me the best way to achieve this?

Since horsehair is the kind most easily obtained, I would most probably make an attempt with that variety first, using the tail or mane as likely to give the greatest yield of oil.—J. A. V. Connell (Southport).

WE believe that various attempts have been made to extract a usable oil from waste hair, but they have not been successful in practice on account of the very small amount of oil which the average hair contains.

However, if you wish to make experiments, your best plan is to fit up the apparatus shown in the accompanying rough sketch. The hair is placed in a flask together with the solvent, the quantity of the latter being immaterial. The solvent is then boiled for an hour or two under the Liebig's condenser. After this, the solvent is filtered and then carefully distilled off, leaving the extracted oil behind.

Solvents to use are many and various. You can try benzene, ether, light petrol (petroleum ether), alcohol (rectified spirit), trichlorethylene, carbon tetrachloride, chloroform, naphtha, carbon disulphide, ethylene dichloride, and many more. Although ether is an excellent solvent for oils and fats, its use is not unattended with some danger, for ether has been known to detonate violently when boiled and distilled, causing damage and injury to the operator. Our advice to you is to keep clear of this particular solvent, unless, of course, you happen to be skilled in its use.

The chemical apparatus described can be obtained from any firm of chemical wholesale suppliers and laboratory furnishers, as, for example, Messrs. J. W. Towers, Victoria House, Widnes.

Converting a Universal Motor

I RECENTLY purchased a ¼ h.p. electric motor of the universal type. I would like, if possible, to convert this to a repulsion type motor for 230 volt 50 cycle to run at 1,450 r.p.m. The bore of stator is 3in. and the 2-pole rotor is 2 15/16in. diameter and 2in. long. There are 18 slots and 36 segments to the commutator. Would it be necessary to rewind the two field coils, also would it develop enough power to drive a 3½in. bench lathe?—Charles Harris (Tunbridge Wells).

IT does not appear that there would be any gain in converting the machine into a repulsion motor, as it is hardly likely it could be converted without loss of efficiency, and the converted motor would have similar characteristics to the former machine—that is, the speed would vary with the load. The repulsion-starting-induction motor starts up as a repulsion motor but at a certain critical speed a centrifugal device short circuits the commutator, and usually then raises the brushes from the commutator to reduce wear on these parts. Such a machine runs at a fairly constant speed on varying load but it would be a difficult matter to fit such a short-circuiting device to a series motor. It is probable that the ¼ h.p. motor would drive the lathe in question.

Making Dolls: Papier-mâché

WOULD you please oblige me by answering the following questions?

1. I wish to make fabricated dolls of pre-war style, and would be glad to know the names of the necessary materials.

2. I have made papier-mâché articles, but owing to the waste of time in etching and drying of same, I would be thankful if you could tell me the compositions of something similar to

papier-mâché work. I don't want to use Delph or china.—M. McKennan (Southfields).

I. The making of serviceable dolls is not an easy task. It demands much skill and experience, to say nothing of equipment. The bodies of most dolls are composed of a hempen fabric which is frequently painted a flesh colour. This material is sewed up and is usually stuffed with sawdust and/or other fibrous materials. The limbs, if they are not of pot or of composition, are usually made separately and then sewn on to the main trunk. The head (and limbs) are usually moulded in porcelain, celluloid or other material and afterwards painted. The eyes may be painted in or, as in the better-class dolls, they may be attached separately. The hair is usually a bleached and dyed animal hair.

It is possible to mould a doll's head in ordinary plaster, but the result is never satisfactory owing to the essential fragility of the plaster. Most of the dolls' heads and limbs of pre-war years came from Germany and Japan, but it is likely that in post-war times a similar industry will be set up in this country based on the use of one or other of the new synthetic moulding products.

If you inquire at Messrs. W. and G. Foyle, Ltd., Charing Cross Road, W.C.2, you may be able to obtain a book on doll-making, although our lists do not reveal any such publication.

Sources of supply for various doll-making materials are as under:

HAIR.—Messrs. Morris Charkham, Ltd., York Road, Battersea, S.W.11; Nagele's (London), Ltd., Edward Street, W.1.

DOLLS' CLOTHING.—Dolgar Manufacturing Co., Ltd., 156-7, Lower High Street, Stourbridge, Worcs.; Messrs. F. J. Prudoe, 301, City Road, Islington, N.

DOLL MANUFACTURERS, COMPONENTS, ETC.—Messrs. Bradfield, Ibberson and Co., Ltd., 78, Norfolk Street, King's Lynn, Norfolk; Messrs. J. K. Farnell and Co., Ltd., Alpha Works, Acton Hill, W.3; Messrs. Merrythought, Ltd., Merrythought Works, Iron Bridge, Salop.

2. A good substitute for papier-mâché is:
Finely shredded paper, 100 parts.
Zinc oxide, 75 parts.

The above is mixed to a thick paste with a fairly strong solution of celluloid in a mixture of equal parts of acetone and amyl acetate, or, alternatively, the above may be made into a paste with shellac varnish ("button polish").

Electrical Heater Elements

IN connection with some experiments which are being carried out to ignite "producer gas" on starting up lorries driven by gas generators, it has been found that a small coil of (80 per cent. Ni, 20 per cent. Cr.) wire heated from 6-volt supply is quite satisfactory except for one thing. Using a spring push-button to close the circuit for about three seconds only, is quite effective for about 20 starts, after which the Ni-Ch. wire becomes burnt through at about the middle turns of the coil.

Is there a wire which will not oxydise so soon, such as tungsten-carbide drawn wire? If so, where can it be obtained?—G. H. Child (Hove).

THE cost of a tungsten-carbide drawn wire would be prohibitive, and it is doubtful if you would procure it without great difficulty under present conditions.

There is a high-temperature resistance material known as Kanthal which might meet your needs, and we suggest you place your problem before Messrs. Henry Wiggin and Co., Ltd., Birmingham.

Converter Details

I HAVE a 110-volt series wound D.C. motor of approximately 1/10th h.p. and I want to make a converter from D.C. to A.C. and rectify this for the power supply of a receiver, as I find that 110 volts are not quite sufficient to run a large superhet. I wondered if it would be possible to wind on other coils under the field coils to obtain a higher voltage. I have tried to make vibratory converters but cannot find a suitable rectifying valve.—A. J. F. Trott (Kintbury).

PRESUMABLY it is your intention to use the series motor as a dynamo and drive this with an A.C. motor. A series wound dynamo gives a voltage which varies considerably with the load current and would hardly be suitable for your purpose. The simplest method would be to rewind the field coils with a shunt winding which can be connected in series with a regulating resistance and fed from the brushes. When running on full load the present field current will be about 1 amp., so that the present number of amp. turns will be practically the same as the number of turns. To obtain the same amp. turns with a shunt field winding carrying 1/16th amp. you would need to use a winding having 16 times as many turns as at present and wire having 1/16th the cross sectional area of the present wire. The voltage of the machine can best be increased by driving it at a speed somewhat higher than the present full load speed. Some increase of voltage could also be obtained by using a shunt field winding in which the size of wire is reduced in a less proportion than the number of turns is increased, compared with the present series winding.

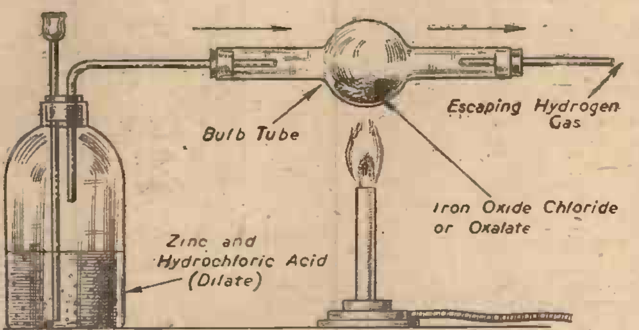
Carbon-arc Sun-ray Lamp

I HAVE been interested for some time in the making of a carbon arc sun-ray lamp and having only very elementary knowledge of the subject, I shall be glad if you can give me some hints or recommend some books on the subject. I understand the supply reaches the carbons through a resistance (this resistance varying with the diameter of the carbons), the carbons being mounted to adjust the air gap. Is above right? The supply is 220-230 v. A.C. Where could carbons be obtained, and are sun-ray lamps still purchasable under a medical certificate, or otherwise?—J. Lowry (Belfast).

AN ordinary arc between carbon electrodes will give off ultra-violet rays suitable for your purpose, and could be used with a first exposure of about five minutes. You may be able to obtain carbon rods for this purpose from the Morgan Crucible Co., Ltd., of Battersea Works, London, S.W.11.

More powerful radiation, however, is given from an arc drawn between tungsten electrodes, with which about two minutes' exposure should be sufficient for the first time. British Thomson-Houston Co., Ltd., of Rugby, manufacture such tungsten electrodes. In the Finsen lamp the light is transmitted through a system of water-cooled quartz lenses which concentrate the light and permit contact treatment of a patient without danger of heat burns. With a straight arc between an upper carbon electrode 13 m.m. diameter and a lower carbon 12 m.m. diameter, you require an arc voltage of 30 to 35 with a current of 20 to 25 amps. The best and most economical method of operating such an arc from A.C. mains is by the use of a step down transformer with a secondary voltage of about 60, but you could use a resistance in circuit with the arc direct from the mains. In this case you would need a resistance of about 8 ohms, for which you could use 64 yds. of 10 s.w.g. nickel chrome resistance wire.

It is rather doubtful if you could obtain a new sun-ray arc lamp at the moment, but you may be able to buy a second-hand one. Perhaps your local doctor or clinic could assist you.



Method of making pyrophoric powder.

Pyrophoric Iron Powder

WILL you help me with the following query? I desire to know how I can make iron with pyrophoric properties (becoming red hot on being shaken). After cooling down has a change taken place; if so, what change, and can it become hot again if shaken?—A. Richmond (London, E.).

IN order to make pyrophoric iron powder, take iron oxide, iron chloride or iron oxalate and heat any of these in a stream of hydrogen gas at a temperature of about 400 deg. C., i.e., *below* dull red heat. The iron compound will gradually turn black. This black substance is metallic iron in a condition of very fine powder. When scattered into the air, it becomes incandescent and falls to the ground in a shower of sparks. The apparatus necessary for this experiment is shown in the accompanying sketch.

It is essential to observe that the iron salt in the bulb tube is not heated to visible redness, otherwise the iron powder obtained will not be pyrophoric.

It is still easier to make pyrophoric lead. Add to a solution of either lead nitrate or lead acetate an equal quantity of a solution of tartaric acid. White lead tartrate is precipitated. This should be filtered off and dried. When this is gently heated in a test tube it turns black owing to the production of pyrophoric lead. This latter gives rise to a shower of sparks when scattered into the air.

In the case of these pyrophoric powders, the effect is due to the rapid oxidation of the metal, i.e., the combination of the finely divided metal with the oxygen of the air to form the oxide of the metal. The change is not reversible, and the metal will only become incandescent once. Moreover, the metal must be freshly prepared for this effect to take place.

"P.M." Battery Clock

WITH reference to the cells for the P.M. battery clock, I am having trouble with crystallising on the porous pots, and the + zinc rods are nearly eaten away, after only three months' use.

Have I got the salammoniac solution too strong? Then again, I have various sorts of cell sizes, as follows:

One 3 pint jar with a 3 pint porous pot.
Two 2 pint jars with a 3 pint porous pot in each.
One 2 pint jar with an old porous pot (2 pint size).
Four cells—6 volts.

The 3 pint size may be all right, but I'm afraid the 2 pint jars with 3 pint porous pots are not; there isn't, of course, the amount of solution or clearance. Am I at fault here?

Also the last cell with the old pot: do porous pots deteriorate? I have Brunswick blacked and Vaselined them.

I am in earnest to get my clock correct, although 72 years old. Electrically I'm not very well up, only by thinking things out. Do you think I do well—or not? I now get 10 lifts of crutch arm per contact, 20 left and right swings of pendulum, 10——10=20. It's all home made, but well made; bob weighs 12lb. approximately. I have fitted my trailer finger inside pendulum rod, thus getting a directly central movement, also my back stop I have carried to top, with a reversal of the arm pin, doing away with that pushing movement, giving the gravity arm less to do. Please say if 20 swings of pendulum is good or not good enough. I am anxious to know—C. Ward (Spondon).

WE are very interested in your letter, and you have certainly made a good job of the clock, and although it is possible to get much more than 10 lifts per impulse, this is only obtained by patience and critical adjustments of all parts. If you are interested in obtaining longer swings (which do not affect timekeeping but merely saves battery current) you should pack the lower magnets up gradually, so reducing the clearance between pole-pieces and armature, and adjust the trigger height and contact strip. This is admittedly a tedious process, and in the end little is actually saved, as the batteries deteriorate even when not actually delivering current. It is interesting, however, and gives a feeling of satisfaction when improvements are made.

The large porous pots in the small jars will not affect things at all. They will still not deliver any more current, as the cell will only deliver 1.5 volts no matter how big the individual parts. A certain amount of "corrosion" is always obtained with these cells, and is merely slight chemical action, plus a deposit of the salammoniac due to evaporation. Always "top up" with plain water, not salammoniac solution. A drop or two of oil on top of the solution will help to prevent creeping, and externally the jars should be kept quite clean to avoid leakage of current and loss of power. Porous pots do deteriorate, and after a period of use need replacing. The zincs also need replacing but if the solution is too strong, they will naturally be eaten away quicker. It would appear from your details that your solution is rather too strong.

Restoring Daguerreotypes

I HAVE in my possession an old daguerreotype (the old photographic process in which the print is on metal). Owing to its extreme age, it is rather faint, and I wish to preserve it.

Will you please tell me the best way to store it, i.e., should it be kept in darkness or daylight? Also, can you inform me of any safe way of improving it?—L. G. Chamberlain (Woodford).

THE restoration of daguerreotypes is a task for the expert only, and if you have not had any experience in photographic manipulation we would not advise you to undertake such a task. Essentially, the restoration process is a simple one. It consists of immersing the daguerreotype in a 1 or 2 per cent. solution of potassium cyanide in distilled water. The dish containing the solution is gently rocked, the result being that the weak cyanide solution gradually dissolves away the film of tarnish, leaving the daguerreotype image clear and bright. The greatest care must be taken not to overdo the cyanide treatment, for after the tarnish has been removed, the cyanide solution will attack the image on the daguerreotype plate and will gradually dissolve it away. Hence, immediately the tarnish has been removed, the daguerreotype plate is immersed in clean, distilled water and rinsed in several changes of distilled water in order to remove all traces of the cyanide. Distilled water must be used, and the daguerreotype plate must be dried quickly in a current of cool, dust-free air, otherwise streaks and markings may appear on the plate.

There is no way of renovating a daguerreotype other than the above, and if you think anything of the daguerreotype in question, we should very strongly advise you against tackling its restoration yourself. Unfortunately, there are very few people who have had any experience in the restoration of daguerreotypes. The only firm we know which has had experience of such jobs is that of Messrs. James A. Sinclair & Co., Ltd., 3, Whitehall, London, S.W.1.

Apart from having the daguerreotype restored in the correct manner, the only thing you can do is to re-bind it to its cover-glass in order to keep impure air and fumes out of contact with the metal plate. It would be advisable for you to keep your daguerreotype in darkness, and away from damp and impure atmospheres.

THE Cyclist

Editor: F. J. CAMM

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Phone: Temple Bar 4363

Telegrams: Newnes, Rand, London

Comments of the Month.

Electoral Blackmail

By F. J. C.

ONE of our contemporaries in an article entitled "Organised Power" quotes the following words from one of its readers: "If they (cyclists) could all be organised to speak with one voice they would represent a very powerful body."

Their editorial comment is: they do not care to mix politics with cycling! "Like oil and water, the two do not seem to mingle." "*We may be wrong but it is our considered opinion that no prospective Parliamentary candidate would lightly ignore the views of an organised body representing more than 20 per cent. of the electoral voting strength.*"

The article goes on to suggest that we must get as many as we can into our present organisations. The fact is that there is not any cycling body at present so constituted that it can claim to represent cycling opinion. No one has yet discovered what cycling opinion is, for neither the C.T.C. nor the N.C.U. has taken a referendum to ascertain the views of its members. The members are expected to support the views of the Council of the C.T.C., and as far as the N.C.U. is concerned it is a body whose main concern is track racing. The C.T.C., indeed, is so fantastically constituted, that whilst keeping up the pretence of being a democratic body, it need take no notice of resolutions passed by its members at its annual general meetings. The position in the cycling world as far as representation of cyclists views is concerned, is grotesque. It is doubtful whether, considering the overlapping membership, the C.T.C. and the N.C.U. combined represent more than 50,000 cyclists, probably far less, out of a total number of cyclists variously estimated as between 10 millions and 12 millions. The C.T.C. publicity notices bear the inscription "What do the cyclists say? Ask the C.T.C." Yet the C.T.C. itself does not investigate the views of its members.

Now, the contemporary from which we have quoted above merely reflects the views which have been so often expressed by some members of the C.T.C. and the N.C.U., namely, that the Government is *afraid* to introduce any legislation to which the C.T.C. and the N.C.U. object because the Government is afraid of the 10 million votes. This argument has been used so many times by these two unrepresentative bodies during the past 50 years that it is time it was debunked.

These two bodies do *not* represent the views of 10 million cyclists, nor do they even represent the view of their own members on such question as cycle paths, rear lights, registration, insurance, or any of the other topics which these bodies have consistently opposed.

If the argument against these things reposes on nothing more solid than the threat that cyclists will vote against Government candidates, then indeed the arguments must fall to the ground. It is a form of electoral blackmail, to which no Government should subject itself. One might as well argue that if every payer of income tax were organised the Government dare not impose income tax; or if every motorist were organised the Government dare not impose a tax on motor-cars.

It is implied by those who claim to represent the views of all cyclists we should only elect Members of Parliament who are prepared to obey the wishes of cyclists. Presumably if cyclists organised, as our contemporary would like to see them organised, and opposed the use of the roads by motorcars or pedestrians, the roads should be barred to motorists and pedestrians.

The whole country should be run, apparently, to suit the whims of the Councils of the C.T.C. and the N.C.U.

Herewith a further quotation from our contemporary: "*If such organised power in the cycling ranks could be brought about the prospects of our being relegated to certain roads or cycle paths, made to register our machines, or submit to other petty annoyances, would be far less than they appear to-day. Looked at in this way, cycling and politics have an obvious link, even though at first consideration they may not seem to mix.*"

What is sauce for the goose is sauce for the gander, and as organised motorists certainly outnumber "organised" cyclists by about 10 to 1, and pedestrians outnumber them by at least 3 to 1, the two latter sections of the community only have to become organised in a way similar to that suggested for cyclists for them to impose their will, too, on the Government. Could any argument be more fatuous or specious?

Legitimate Claims

WE have supported the legitimate claims of cyclists for many years, and the arguments we have used have been based on something more solid than the threat of the vote. There are many sound arguments against cycle paths as at present constructed. The arguments against other aspects of cycling politics are not based on such solid grounds. Whether the C.T.C. and the N.C.U. like it or not, and whether cyclists like it or not, we know that the Ministry of Transport has made up its mind on certain aspects of road policy, and will ignore the threat of the cyclists' vote. The unrelenting, narrow, and parochial views of certain of those alleged legislators whose minds are still back in the "'eighties," and who have never taken the trouble to align their views with modern trends, are not the considered views of 10 million cyclists.

We know that this is also the view of certain members of the Ministry of Transport. We think that the cycling organisations have made grave mistakes in policy during the past thirty years. They have earned the reputation of being anti-everything. They would make no concession graciously (it is often far better to concede a point here and there, and thereby indicate a reasonable attitude), and so they will be compelled to accept them ungraciously. We venture to suggest that the balance of electoral power will not be disturbed by the attitude of the C.T.C. and the N.C.U.

A few unreasonable people have decided that they will impose their will upon the Government and upon all cyclists. The latter must in no way question their views, but must worship at the shrine with obeisance and supplication, and lay their tribute of adulation at the foot of Parnassus.

Care of Pumps

EVERY endeavour is being made to provide more bicycle pumps, but meanwhile make sure—before turning over any discarded pump to salvage—that it really has reached the end of its usefulness. If the pump has been discarded, due to lack of compression, it is almost certain that it can be put back into commission by very little effort on the part of the owner. This lack of compression is usually due to the screw which holds the compression washer in place having come undone due to vibration. Sometimes the screw thread in the plunger is stripped. A fresh lease of life can be given to it by winding a piece of 30 gauge copper wire round the threads of the screw, which will provide sufficient bite to give the pump a further lengthy period of useful life.

Unscrew the end cap of the pump barrel and withdraw the handle. The parts forming the piston of the pump, including the leather washer, are probably trapped in the barrel, but can usually be retrieved by gently tapping the pump with the open end down. If not, use a length of stout wire to remove them. If the end cap threads have stripped, they can be made to bite by means of 30 gauge wire, as described above.

You should find a screw, a metal cup and a leather washer, and possibly a coil spring, although the latter will usually be found still on the plunger rod. If the leather cup washer has been mislaid, another can be made from the tongue of an old boot or shoe. Cut a circle of leather, $1\frac{1}{2}$ times the diameter of the barrel. Soak this in boiling water, to render it fairly pliable, and then shape it over the end of a piece of wooden or iron rod, which just fits comfortably inside the pump barrel. Then soak it in oil and fix it in the usual way.

To re-assemble, push the screw first through the leather washer (the head of the screw to be inside the cup formed in the washer) then through the metal cup, and then screw it tight home into the end of the plunger. The plunger rod must fit *into* the metal cup; all you need is a screwdriver.

If you experience any trouble ask a friend or local dealer to help. If the thread which carries the connector is stripped, use copper wire round the end of the connector to give it a bite. In the case of a kinked barrel, this can usually be remedied by passing a piece of mild steel rod smaller than the bore of the barrel into the latter and then raising the dent with a hammer from the outside.

Another very important point is to see that the tiny washer at the end of the connection where it screws into the pump is in place.

Paragrams

Stratford St. Mary, Suffolk.

No "12" in Scotland
CONTRARY to previous expectations, there will be no Open 12-hour time trial in Scotland this year.

Best Tricyclist
C. MULLNER, Western Roads C.C., won the Major Liles Memorial Trophy as the best all-round tricyclist in 1943.

Y.H.A. Pioneer Dies
EDWARD ALBERT, M.A., vice-president of the Scottish Y.H.A., has died. He was a pioneer of the Hostels Movement in Scotland.

Essex Roads Resuscitation
THE new hon. secretary of the Essex Roads C.C. is A. Willshire, 3, Greenway, Woodford Green, who would like to contact old members.

National Clarion Jubilee
THE National Clarion C.C. attains its Jubilee this year and the Glasgow Section plans to celebrate accordingly.

Notts Castle Loss
PILOT OFFICER E. H. McCORMACK, former path champion of the Notts Castle B.C. has been killed in action while on fighter patrol over France.

Scottish Cyclist Decorated
MEMBER of the Lanarkshire Road Club, Pilot Officer R. B. Berwick has been awarded the D.F.C.

Notts Castle Activities
ALTHOUGH only re-formed a short while ago the Notts Castle B.C. has over 30 members. Contact with pre-war members has shown that P. Wears and A. Wynch are prisoners of war and that J. Else has been killed in action.

Brentwood Road Club's Loss
TWO members of the Brentwood Road Club, Flight Engineers A. Gurny and A. G. Wright, have been killed in action.

Welcome News
C. HUTTON, Southend Wheelers, previously reported "missing," is now known to be in Japanese hands.

D.F.C. for Norwood Paragon Man
AFTER 27 operational flights, R. Ash, Norwood Paragon C.C., has been awarded the D.F.C.

In Enemy Hands
W. M. MATTHAMS, Southgate C.C., previously reported "missing," is known to be in enemy hands. He was captured in the Middle East.

John Walker Missing
HERO of over 20 operational flights, many of them as a Pathfinder, Sergeant Air Gunner J. Walker, Early Birds C.C., has been posted "missing."

Barras Road Club Loss
PRE-WAR member of the Barras Road Club, Flying Officer J. K. Meyler, who was only 25, has been presumed killed.

Old Timer Bereaved
TWENTY-FIVE year old Sergeant John Denny, son of the old-time track rider, lost his life as the result of a flying accident.

Timekeeper's New Role
NORTH MIDLAND timekeeper, J. C. Tate, Rockingham C.C., is now in the Fleet Air Arm.

Southgate Club's Record
SEVEN members of the Southgate C.C. hold commissions in H.M. Forces; 44 members are serving with the Colours; twelve are abroad and two in enemy hands.

Tees-side Celebrity
HAROLD HEATLEY, former member of the Stockton Wheelers and champion of the Tees-side Cycling Association in 1934, has been awarded the Military Medal for gallantry in Italy.

Scotland's Contribution
OVER 70 events on the road will be promoted in Scotland this year.

Cycling Instructors?
SPECIAL instructors of cycling, as of cricket, football and boxing, have been suggested by the National Committee on Cycling to the Board of Education.

Rickmansworth Promotions
ALAN ORBELL has been promoted from Flying Officer to Flight Lieut.; Tom Hart from L.A.C. to corporal. Both are members of the Rickmansworth C.C., whose latest member to report to the Forces is E. Crothall.

Frank Tillman Killed
FRANK TILLMAN, Finsbury Park C.C., recently decorated with the Polish Cross for conspicuous bravery, has been killed in a flying accident.

For the Forces
LATEST member of the Broad Oak C.C. to join the Forces is James Cockayne. Performing equally well on road and track, he had many wins to his credit and showed outstanding promise for the future. He is now in the Navy.

Wings in Canada
POPULAR touring member of the Portsmouth North End C.C., C. A. Smith, has received his wings in Canada. He was also promoted to Pilot Officer.

Mid-Devon R.C.
WITH a creditable accumulation of 33 points, Ron Billing has won the special trophy of the Mid-Devon Road Club, for consistency of rides in map-reading contests, speed judging, paper chases and treasure hunts.

Albert Leggett Married
ALBERT E. LEGGETT, King's Lynn C.C. club record holder, has married Miss Doris Holmes of Boston. The bridegroom holds a commission in the Army and his bride is in the N.F.S.

Alternative A6!
IT has been advocated that the steep section of A6 which crosses Shap Fell should be obviated by a new road up the Lune Valley on a line close to the main L.M.S. route to Scotland. Such a road would save 500ft. of climbing.

Preserving Mountains
AN anonymous donor has given £7,000 to the National Trust for Scotland to preserve mountains.

Death of Kenneth Spence
KENNETH SPENCE, a leading worker for the preservation of the Lake District, died recently in Monmouthshire.

Clarion for Edinburgh
AN attempt is being made to reorganise the National Clarion C.C. in the Edinburgh district.

Club Notes

Cumbrae Race
WEST of Scotland Clarion will again be running the Cumbrae massed start race. The date chosen is early in June and it is hoped to provide a substantial prize list.

Out of Commission
THE track at Dinnington, in South Yorkshire, has been put out of commission, and will not be available for competitive sport this season.

Servicemen and Cycling
CYCLISTS in the R.A.F. at a certain station in the north are being permitted to cycle in club dress, if their applications are endorsed by the local club secretary.

Now in Y.R.C.
ALF. MARTIN, the speedy South Yorkshire rider, has joined the Yorkshire Road Club.

D.F.C. for Cyclist
PILOT OFFICER R. B. BERWICK, brother of James Berwick, the former Scottish champion, and also a cyclist, has been awarded the D.F.C.

Handicapping Investigation
THE Scottish Amateur C.A. has set up a committee to investigate the possibilities of a national handicapping system.

Kitching in Hospital
RON KITCHING, the fast Yorkshire massed-start man, has been in hospital for an operation and unable to follow his usual activities.

Cumnock Reunion
THE "Cumnock Reunion" of the West of Scotland Cyclists' Defence Committee attracted 150 and was the best social event of the winter season in Scotland. Speakers included Lord Provost Welsh, of Glasgow, and Tom Fraser, M.P. for the Hamilton Division.

More Opens
THERE will be 70 open cycling events in Scotland this season, the best figure of the war years.

Robert Marshall, secretary of the West of Scotland Cyclists' Defence Committee, and Lord Provost Welsh of Glasgow, at the Cumnock Reunion.

Around the Wheelworld

By ICARUS

At the recent Roadfarers' Club Luncheon: Sydney Camm, H. G. Wells, E. Goles Webb, and Sir William Rootes, K.B.E.

The "Really" Cyclist!

I DEALT last month with the definition of a "real" cyclist given by a contributor to a contemporary. Of course, I should have used the word "really" cyclist. There's something clever about riding a cycle, and unless, as our quoted contributor suggests, you ride your bicycle every day in the year, have no other hobbies, and spend your spare seconds keeping it clean, you cannot expect to become a member of the elect "realies." Not so many years ago a cycling writer, in giving advice to cyclists on how to tour for a fortnight for half-a-crown, advised his readers (if any) to travel light, travelling light, in his estimation, meaning carrying half a comb and a tooth-brush, and stealing the hotel soap!

In that famous old musical comedy "The Belle of New York," there is a song which is apropos the "realies." One of the lines in the song goes: "Of course, you can never be like us, but be as like us as you are able to be!" The rabid cyclist who is usually a plus-foured train traveller, or motorist, will tell you to be a real cyclist, but he doesn't ride a bicycle himself.

That "Amnesty"

I HAVE received the following quaint notice signed by the secretaries of the N.C.U. and the R.T.T.C.: "The N.C.U. and R.T.T.C. announce that the general amnesty offered to all persons ceasing their association with the British League of Racing Cyclists or its constituent parts is still in operation.

"Both bodies wish to make it clear, however, that this amnesty offer will cease to apply to any person who participates or assists in any further event not held under the jurisdiction of the N.C.U. or R.T.T.C."

Quite apart from the misuse of the word "amnesty," we do not advise any member of the British League of Racing Cyclists to whom the notice is really directed, to take the slightest notice of it. The N.C.U. and the R.T.T.C. are not the bodies to issue such a notice, and we advise the B.L.R.C. to continue with its good work without reference to either of these bodies. I understand that copies of our leading articles on the subject of massed-start have been circulated all over the country.

Herbert Charles Scotto

"BERT" SCOTTO, a well-known clubman in the early days of the century, died on January 16th, aged 66 years. He was a member of the London Central C.C. and the Raleigh C.C., and frequently followed and assisted "Goss" Green and others on their record rides, and was a skilful steersman of his tandem for pacing on the Crystal Palace track.

He served during 1914-18 in France in the Royal Engineers, and subsequently practised as an architect in Maidstone. He was a private member of the S.R.R.A., a life member of the T.A., and an early member of the Roadfarers' Club.

B.C. and M.C.M.T.U. President

AT the annual general meeting of the British Cycle and Motor Cycle Manufacturers and Traders Union, Ltd., Mr. C. Gilbert Smith (Norton Motors, Ltd.) was again elected president of the Union for the ensuing year. In all he has already served as president of the union for a period of three years.

At the same time Mr. G. H. B. Wilson, O.B.E., A.F.C., J.P. (Raleigh Cycle Co. Ltd.), and Mr. A. E. Dover (Dover Ltd.), were elected vice-presidents.

C.T.C. President and Chairman

HIS Grace the Duke of Argyll has been elected president of the Cyclists' Touring Club in succession to the late Duke of Portland. Engineer-Admiral E. O. Hefford has been re-elected chairman of the council, and Mr. B. C. Young is again vice-chairman. The vice-presidents of the club for 1944 are Admiral Hefford and Messrs. P. Brazendale, W. H. Crang, J. T. Lightwood and F. J. Urry.

S.R.R.A. Annual Lunch

THE lunch held by the Southern Road Records Association at "The Railway Hotel," Purley, on Sunday, February 13th, 1944, can, I think, be considered a success from all angles in that the attendance, the food, the drinks and the speeches were good; in fact, they were of the usual high order which one has come to expect at any function organised by this association.

The 46 who sat down included representatives from a number of clubs, including the Norwood Paragon, the Belle Vue, the Kentish Wheelers, the Kent Road Tricycle Association, Medway Road Club, the Balham C.C. and the S.C.C.U.

The toast of "The S.R.R.A." was in the able hands of Arthur Slade, the president of the Kent Road Club, and the toast was, of course, responded to by Arthur Whinnett, the hon. secretary and treasurer, who is meeting with success in his efforts to keep the association alive and in working order in readiness for activities in the record world which it is hoped will be resumed as soon as hostilities cease.

The toast of "The Record Breakers" was proposed by Sydney Amey, the general secretary of the S.C.C.U., and responses came from W. G. Phillips, of the Vegetarian C. and A.C., Stan. Butler, and Tom Vickery, who was making attempts on records as long ago as 1899.

Charlie Bowtle welcomed the visitors and press, and responses came from A. E. C. Harrison, of the Tricycle Association and Medway Road Club on behalf of the visitors.

The toast of "The Chairman," Mr. J. Dudley Daymond, was proposed by W. H. M. Burgess, of the Anerley B.C., and received amidst a good deal of enthusiasm.

Norwood Paragon Officials

GENERAL Secretary, F. A. Burton, 21, Ashleigh Road, Anerley, S.E.20. Road Secretary, A. Gordon, 25, Hevers Avenue, Horley, Surrey. Social Secretary, R. W. Tugwell, 888a, London Road, Thornton Heath, Surrey. Path Secretary, S. U. Harrison, 7, Laurel Street, Dalston, E.8.

Raleigh Record

IN connection with the Raleigh Cycle Company there is a Half-Century Club. It has a membership of ten employees, each of whom has served for 50 years or more.

The first of the members to die is Mr. A. Marshall, who recently died at the age of 73.

Sir William Rootes delivering his speech on Post-war Road Policy. Major H. R. Watling, O.B.E., J.P., is in the chair. Mr. H. G. Wells is on his left.

Wayside Thoughts

by

F. J. URRY

Sheepstor, Dartmoor village.

The Call of Spring

SPRING is on the threshold and the year is looking fine, considering the parlous conditions pertaining in this war-weary world. The thought of holidays arises automatically with the advent of the blackthorn bloom and the bird song, for who can resist the temptations to think of far-away places when there is warmth in the sunshine, and a south-westerly breeze breathes beneficence over the land? We work, yes, and the tie and the toil has sapped some of the joy from life, and the long winter of blackout has frayed our good tempers; so it is little wonder if we all look forward to a break, a few hours of real freedom to carry us to those spots of which we have been dreaming through the dark days. But how shall we get away? If one reads the signs aright—and that is not difficult surely—it is only the cyclist and the walker, and especially the cyclist, who will have the freedom of the road. He can kick off from his own doorstep and return thereunto at the appointed time, without asking any kind of travel assistance from the overburdened transport people. The value of a bicycle—always great but too often unrecognised—has been magnified enormously in these difficult times, for it presents to its owner an advantage that is inestimable, particularly if that owner is fit enough to range afar, and take from his brief holiday the passing glory of its hours. Those of you who ride mainly for the convenience of movement I would adjure to try the fine adventure of touring, to change your county for a brief spell, to pass beyond the confines of the daily journey and so make a wider contact with this lovely land, never lovelier or more capricious than when spring decorates its outlines. It may need in you some measure of resolution if you have never gone awandering; but these are the days of good resolutions, so be you worthy of them.

Seeking Accommodation

THE question of accommodation along the road has frequently been raised by people who have felt inclined to take me at my word and try cycle touring, and it is certainly a pertinent question when one hears so much of the difficulties concerned with holiday-making. Personally I have found no trouble, although I have not always been fortunate in acquiring the accommodation I would like. My *modus operandi* is to write for a place within fairly easy reach of home, and if the holiday is of short duration, make that my nightly anchorage after exploring the countryside within striking distance. If the holiday runs over the week I usually try to fix three or four days at each of two such places and thus obtain a wider field of roaming. There are still numerous farms and cottages strewn about the land whose owners are willing to attend to the needs of the stranger within their gates providing he is not too fussy, and books the accommodation well ahead. I know from experience that such homely places, while not perhaps possessing the amenities of the Grand Hotel, present the visitor with a far better table, that meal-times can be arranged to fit your desires, that jolly good lunches are packed for wayside devouring, and if you are that way inclined, the inglenook of an evening is a place where you can learn much country lore and many a local legend. For preference I would choose the farm, for I like the fare it can provide; for I think it is true that the country folk in the scattered areas do better in the way of wartime provender than we do in the crowded cities. Take with you if possible a little tea, sugar, butter or "marg.," and anything in the tinned line that will make you a wayside lunch—cheese is a good standby—and having done these things there is little to fear. If you are of the adventurous spirit that is willing to risk accommodation, if you hate writing to fix your places (and many cyclists do), then seek your spot for the night not later than tea-time, and having found it explore the immediate neighbourhood till the fall of dusk.

Cycle Touring

THERE is much to be gained by joining one of the organised bands of wheelfolk to whom you owe the present freedom that cyclists enjoy, and thus help yourself and millions of others to so preserve that freedom that the game of cycling shall go on from strength to strength as the means by which ordinary people can enjoy the blessed things of the countryside without possessing the means of meeting the more expensive methods of travel, and incidentally being the healthier individual as a result. For I believe cycle touring is the happiest form of holiday-making extant, should be encouraged among old and young, and be the main means of bringing home to the people the wonders and glory of the land of their birth. Certainly to-day it is the one means of making holiday travel as comfortable or as vigorous as you want it to be, with the dictation of time and place and distance under your own hand.

Tell the Lads

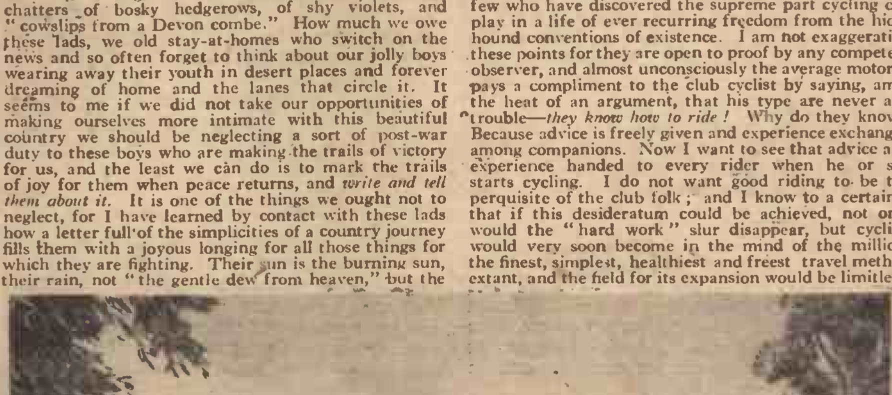
ALL of which has been suggested by a streak of warm sunshine falling on me as I rode to work. What a miracle English sunshine can work in the hearts of men. Before me is a letter from a lad I know who is standing to attention in India, and through it runs the nostalgia of an English spring wherein he chatters of bosky hedgerows, of shy violets, and "cowslips from a Devon combe." How much we owe these lads, we old stay-at-homes who switch on the news and so often forget to think about our jolly boys wearing away their youth in desert places and forever dreaming of home and the lanes that circle it. It seems to me if we did not take our opportunities of making ourselves more intimate with this beautiful country we should be neglecting a sort of post-war duty to these boys who are making the trails of victory for us, and the least we can do is to mark the trails of joy for them when peace returns, and *write and tell them about it.* It is one of the things we ought not to neglect, for I have learned by contact with these lads how a letter full of the simplicities of a country journey fills them with a joyous longing for all those things for which they are fighting. Their sun is the burning sun, their rain, not "the gentle dew from heaven," but the tropic downpour washing away comfort and adding a pang to life. Perhaps because I am grown older I see these things more clearly, for even the very minor prophet must serve the apprenticeship of long years; and what I see is a happier condition of enjoyment and kindly health for all folk who trouble to discover the joy of real cycling, its freedom, its aliveness, its rhythm, its introduction to beauty, and its ever laughing pleasure. No, I am not exaggerating, it has been all these things to me, and now at this very moment of writing I verily think it is more to me than all the games I have played.

Knowledge versus Ignorance

I KNOW, none better, the woeful ignorance of the great general public on the virtues of this pastime that means so much to me. I have always known it, but these war years have burned in that knowledge by the process of many thinking people taking to cycling "as the next best thing," but neglecting to buy the right type of machine or endeavouring to discover how to ride it with ease and grace. With what result? The majority of such folk say "cycling is hard work," and I've no doubt it is to the individual pushing too high a gear, sitting on the wrong kind of saddle in an attitude reminiscent of that plaything of my infancy, a monkey up a stick. I wonder if the industry realises the harm done to the pastime by this positive propaganda of the ignorant who go about denouncing cycling and bemoaning their petrol-less fate! I doubt it, and the few to whom I have mentioned the matter ask me with raised eyebrows, "what can we do about it?" It positively makes me tired to think a great game is traduced by people who use it only for a convenience, and is not assisted as it should be by manufacturers, whose interest surely lies in the creation of as many ardent cyclists as possible.

Slovenly Riding

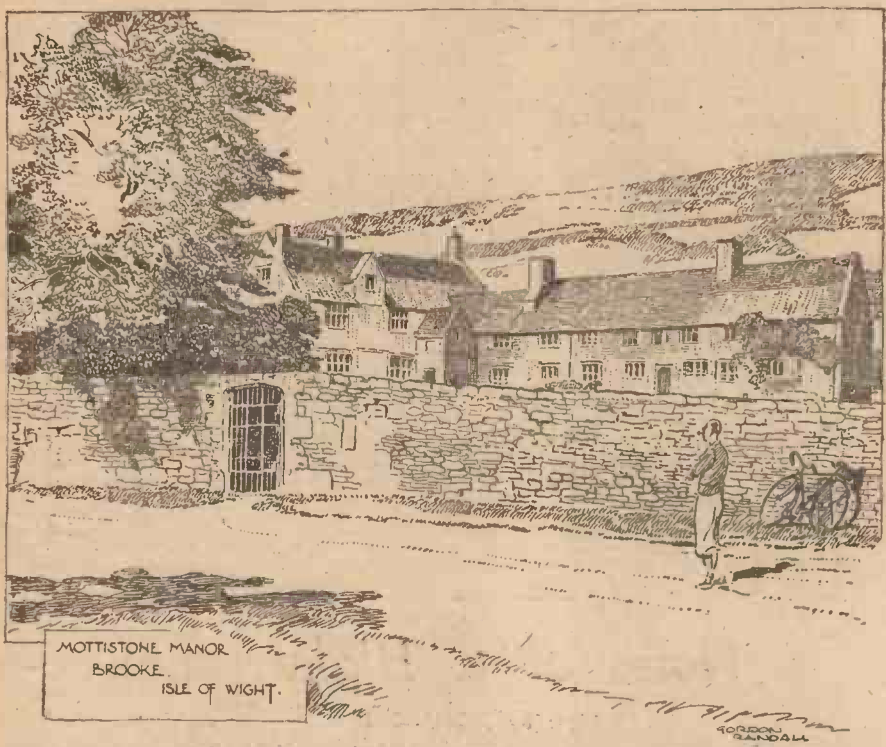
I FULLY acknowledge the convenience of the bicycle as a daily rider to work and home again, a total of fourteen cycling miles most days of my life, but I resent intensely the attitude of so many people who smile in a superior manner when one mentions the art of cycling. It is so ridiculous. You can no more ride a bicycle slovenly and expect to get the best from it, than you can play golf or billiards without paying any attention to style. That most people ride slovenly than otherwise is an observable fact, so much so, indeed, that when you see a bicycle being ridden by an individual as the machine should be used, you remark on it. It has become an accepted thing to say a man can ride a bicycle if he can preserve balance and steer a straight course; which, of course, is just nonsense, for that performance merely constitutes the rudiments of the business. And it seems to me no more—probably a greater number—than seventy per cent. of bicycle riders never go farther along the road towards the making of the perfect cyclist. If the G. P. won't trouble to play the game properly, then cycling will remain "hard work" except to those of us who love this easy rhythm of manly, healthy travel; which means the comparative few who have discovered the supreme part cycling can play in a life of ever recurring freedom from the hide-hound conventions of existence. I am not exaggerating these points for they are open to proof by any competent observer, and almost unconsciously the average motorist pays a compliment to the club cyclist by saying, amid the heat of an argument, that his type are never any trouble—*they know how to ride!* Why do they know? Because advice is freely given and experience exchanged among companions. Now I want to see that advice and experience handed to every rider when he or she starts cycling. I do not want good riding to be the perquisite of the club folk; and I know to a certainty that if this desideratum could be achieved, not only would the "hard work" slur disappear, but cycling would very soon become in the mind of the million, the finest, simplest, healthiest and freest travel method extant, and the field for its expansion would be limitless.



Winchester: the hospital of St. Cross, from the banks of the Itchen.

CYCLORAMA

By H. W. ELEY



Cycle Cleanliness

HAVE been struck recently by the poor treatment which many cyclists seem content to give their machines. An inspection of cycles in a factory cycle shed will convince one that many riders seem to think that a cycle never needs cleaning; that rust is a good thing to allow on plated parts; and that gross neglect is the best way to get easy cycling. Now, busy though a man may be, he can surely find a little time to give his bike that very small amount of attention which is necessary if the machine is to run as sweetly as its makers intended it should! I commend a "spot of cleaning" to those riders who neglect their mounts . . . they will be pleasantly surprised at the greater ease of their riding.

U.S. Soldiers Awheel

FROM observation in a provincial town where there are some hundreds of American soldiers, I have come to the conclusion that our American cousins are quite keen cyclists. . . . I see many of them awheel, and they seem to be keen to see something of the English countryside while they are with us. And what a good and desirable thing it is! Even in early March the English scene is good and satisfying, and I hope that many of us will try and go riding with these boys, and tell them something of the matchless story of the English roads, and towns, and old landmarks by the wayside. Cycling is a truly fraternal thing, and I am sure that many cycling Englishmen would be happy to go for spins with our cousins who must, at times, feel very lonely in what is, to them, a strange and curious country.

Welcome Rain

"FEBRUARY Fill-dyke," may, or may not, have lived up to its name, but my recent talks with farmers indicate that we "could do with a drop of rain"—and when it comes to matters of weather, I am always inclined to take the word of a farmer, for to him, rain and snow, and hail and sunshine, are vital things—connected with his livelihood, and not merely caprices which may interfere with some passing engagement or enjoyment. And there is something good and clean about rain . . . I love to feel it on my face as I walk the highroad; I like to listen to it gurgling in the gutters, and, best of all, I like to see the rainbow which so often follows a shower. So, let us not grumble at the rain . . . it may make all the difference to those crops which are such a vital part of our salvation in these red days of war. . . .

Lack of Snow!

I TALKED, the other day, with an old countryman, and our conversation turned to that eternal topic . . . the WEATHER. Both of us remarked that this had been a winter novel because of the lack of snow. True, some mornings one has seen a feeble attempt at snowing, but I cannot recall one good "fall" in the Home Counties or the Midlands—the areas where I spend my time these days. Now, personally, I think it has been all to the good that we have *not* had snow; the fuel problem is still with us, and in any case snowfalls make for transport difficulties . . . and transport has enough burdens to carry just now! But how I loved to hear that old countryman talk of the "terr'ble" snowstorms of his youth! I wondered . . . because I have a feeling that not even the fiercest storms of the 'eighties surpassed those snowstorms and blizzards which visited us in the first two winters of the war. The fact is that age is apt to gild the picture, and underline the scene.

County Dialects

EVEN in these days of standardised speech, and scorn for country dialects, one still finds enthusiasts for the talk of the shires, and the pleasant dialects of our differing counties. I talked the other day with a man whose accents betrayed that he came from the West Countree . . . and I found that he hailed from Somerset. Now, I have always vowed that of all England's pleasant counties, Somerset was one of the very fairest! What glories it contains! What romance lives on its borders! Glastonbury, with all the romance of the Holy Grail, and the Flowering Thorn; the magic Vale of Avalon, and all the fame and fancies of King Arthur and his Gentle Knights. Yes, Somerset is good . . . I love its lush meadows, and its wild, rugged Exmoor, with the red deer, and the spell of the Lorna Doone land where the great John Ridd fought, and rode, and wooed, and won. Men of Devon may not agree with this praise of Somerset—but one can love Devon and Somerset too, and because I yearn for Exmoor, does not mean that I am insensible to the weird lure of Dartmoor, or the beauty of the Devon coast. Some fine day, when one can journey far afield again, we may enjoy cider in Somerset, and cream in Devon . . . and in some inn in the latter county, sing with Devonshire men of the deeds of Drake. . . .

"Synthetic" Rubber Tyres

SINCE the loss of the Malayan rubber plantations we have heard much of "synthetic" rubber, and most of us have had pleasant visions of scientists and technologists producing, rather in the manner of conjurers, some wonderful product which completely nullified the tragedy of the Malayan loss . . . a product called "synthetic." Well, the experts tell me that it was not quite as simple as that, and also that the fact that a certain amount of "synthetic" is now available does not solve our troubles. Tyres cannot be made solely of "synthetic"—there must be a certain proportion of natural rubber; and therefore there is still the imperative need for continued economy in the use of rubber and in the treatment and care of tyres.

By the way, the cyclist should be interested to know that he can identify a tube which contains a proportion of "synthetic," because it is marked with a letter "S." I believe that covers containing "synthetic" are marked with a red patch or disc. Look for such markings! And remember that "synthetic" tyres need *extra* care!

The Best County

EVERY cyclist has his own ideas of the perfect village and the perfect county; the man from Devon will not allow that any county can beat his own land of the west; and the man from Sussex is equally vehement about the glories of his native shire; and as for the man from Lancashire, he will defend the beauty of the county against all comers, and prove that if you judge Lancashire by such places as Warrington and Bolton and Widnes—then you are doing a mighty injustice to the County Palatine. And it is true . . . Lancashire can show us some real scenic glories, as any cyclist who has toured in it knows full well. All this is because I heard the age-old argument about "the best county" being carried on with heat and good humour only last week . . . in an ancient inn not far from Maidstone. The singular thing was that there did not seem to be a "man from Kent" or a "Kentish Man" in the company to take up the case for that county, which was, in a way, the very cradle of English Christianity—that county which can show us the glory of Canterbury; that county which is richer than most in Dickensian memories and legends.

St Mary the Virgin. Adderbury (Oxon) "For Strength"

My Point of View

BY "WAYFARER"

Traffic congestion has never been anything like so severe as ignorant people make it out to be, and nowadays, of course, oneliness is the keynote of travel, taken as a whole. When we return to normal, after the end of the war, and our main roads are infested with the people who can afford to run motor-cars (together with a lot of others who can't, but do!) we cyclists may have to pin our faith to lane-riding, without in any way relinquishing our right to use the main roads. As a matter of fact, there is ample room on the roads of this country for all of us. A great deal of discomfort and trouble would be avoided if 100 per cent. of every class of road-user, whether afoot or awheel (and irrespective of the number of wheels), would adopt the golden rule of always doing to others as they would be done by. During this lull period, when the vast majority of motor-cars (other than military) are taking a long rest, would it not be a good idea to attune our minds to future possibilities? Somehow I think so.

Eclipsed

HARDLY was the ink dry on one of my recent paragraphs, in which I stepped-up battery lamps, than I was displaying my Identity Card to an inquiring policeman and he was laboriously jotting down the information he required. For why? Well, merely because I was cycling in the dark without a rear light! The battery had died on me a few miles back, and I had fitted a new one. This served for a period and then passed away—or else something went wrong with the bulb, and I didn't happen to have a spare with me. The difficulty of replacing the "innards" of battery lamps is only one degree greater at night than in the day, and so I rode on, until this inquisitive feller sidled up alongside and wanted to know all about it. We parted friends, of course, and I completed my journey as a cyclist and not as a pedestrian. A few days later a little note came from the police saying that on this occasion it was not proposed to proceed any farther, but . . . ! And so I shall have to be careful, as I usually am. Meanwhile, if you want to know my opinion of battery lamps, it is just as low as it can be!

Burnt-out

I OFTEN wonder what happens to some of the ultra-enthusiastic cyclists whom one meets from time to time, and especially do my thoughts go back to that sturdy youngster with whom I rode for a few miles on a Sunday evening three or four years ago. He was an ultra-enthusiast, if ever there were one. He told me that he generally did a ride of about 150 miles on a Sunday, irrespective of the weather (during the summer season, at any rate). When I asked him what he felt like on a Monday he admitted that he was a bit tired, but he went for a 25-mile jaunt in the evening—a "hair of the dog" you know—and then he felt all right. After parting from him I fell to wondering whether he was proceeding on the right lines. In other words, was he overdoing things; was he contracting indigestion through gulping down cycling in such quantities? I cannot answer the questions, but, having seen so many cases of burnt-out enthusiasm, I fear the worst. In my view—and I yield to none in my enthusiasm for and love of the pastime—it is a mistake to make cycling the be-all and the end-all of one's existence. The game has so many facets, so many possibilities—it can provide so rich an endowment of gifts—that it seems to me to be quite wrong to crown one's wheeling activities into a few months and then to be so thoroughly fed up that one fades for ever from the ranks of cyclists. This happens time after time. There are observers who say that the life of the average cyclist is two or three years, and it is to be feared that there is a measure of truth in the statement, which involves so great a loss to the pastime, and an immeasurable loss to the individual. Be an enthusiast, by all means—but avoid that ultra-enthusiasm which burns so fiercely that there is nothing left in a few months' time.

Cycling is a recreation for all ages and for all times. One's wheeling programme can be infinite. Why choke yourself with cycling: why not let it serve you right through your life, bestowing upon you the unfailing bounty it possesses? Think it over, my ultra-enthusiastic friends.

Seclusion

ON one of the bleakest of those bleak Saturdays in February I introduced an old acquaintance to a tea-place I had recently been patronising—a field cottage whose windows give one an acceptable glimpse of the Malvern Hills—and, in return, he brought me a new way home, avoiding main roads as much as possible. What a joy it was to be traversing lovely, secluded lanes—yes: lovely even in a month of greyness!—which were full of little hills and amply supplied with awkward bends and corners! Until we stopped to light up, a full hour after starting our journey, we did not see a soul. Then a motor-car came along, and we encountered hardly anything else before suburbia was reached.

PARS

Definition

SOME sapient individual—an alleged cyclist, too—laid it down recently that "the careless opening of motor-car doors is not a crime." Of course not. It is simply a genial way of showing your ignorance—of displaying your complete disregard for any other road-user!

Chestnut

I HEARD the other day, as something new, a joke which I first encountered at least 40 years ago. It concerns an ingenious lady cyclist who complained that her lamp went out every time she ran into anybody. No doubt this will be new to some people, though ancient history to me.

Take Care of Wartime Cycle Tyres

THERE are over ten million cyclists in this country, which means that there are over twenty million bicycle tyres in use. That amounts to a great deal of rubber so every cyclist must play his part in conserving this rubber to the utmost.

War grade tyres, of course, need extra care, and the best way of servicing them is to keep them inflated hard. So pumps should be used regularly and often to ensuse that the share of the nation's precious rubber supplies entrusted to cyclists is not wasted in any way.

Notes of a Highwayman

By LEONARD ELLIS

King Alfred's Grave

THERE are many who declare that Winchester is the finest old city in the world, and the tourist will agree at any rate that it has many claims to this honour. Winchester is not the only town in the south of England that makes a big point of keeping alive the memory of Good King Alfred. Wantage is said to be the birthplace and Winchester is generally regarded as his last resting-place. Here as in Wantage is a huge statue of the king reminding everybody that such a man really existed. Winchester is also connected with another great figure in English history, that of King Arthur, but here history and myth are so interwoven that it is quite impossible to sort the wheat from the chaff. One may see in the great hall at Winchester what is reputed to be King Arthur's famous round table, but here again we look with many doubts on the authenticity of the claim. However Winchester, with its glorious old cathedral, its wealth of old houses, its quaint city gates, and countless other attractions, cannot fail to provide endless interest for the visitor. We must not forget that Winchester was capital of England even before London, and there is something in the old city that shows that she has not yet forgotten the dignity that was once hers. The cathedral does not impress as some of the English cathedrals do, but on closer acquaintance one sees the dignified beauty of the old building with its wealth of Norman architecture. It is remarkable that the cathedral still remains to us, as almost within living memory the place was practically in a state of collapse. It had been built on inadequate foundations, and after hundreds of years it was found that walls were cracking and sinking and that the whole fabric was in danger of complete collapse. The work of underpinning the vast structure is one of the epics of salvage, as the boggy foundations were removed and replaced by concrete blocks, piece by piece, over a period of many years. In the cathedral are six ancient chests containing the remains of twelve Saxon kings and bishops. The remains are mixed together and it is impossible to point to any one of them and to be sure that it is the body of Canute, or Edmund, or William Rufus.

A Northern Epic

MANY miles from historic Winchester lie the Farne Islands, off the coast of Northumberland. Longstone Lighthouse on Longstone rock was the home of Grace Darling, whose feat of heroism will never be forgotten. In September, 1838, the good ship *Forfarshire* left Hull for Dundee. A fault in her boilers caused the ship to become unmanageable, and during the night she drifted on to the Hawker Rocks. The boat was broken into two parts and the captain and his wife were washed overboard. The cries of the survivors were heard in the lighthouse, but William Darling, the father of Grace, declared that it was impossible to do anything to help. Undaunted, Grace seized an oar, her father followed, and by great skill and courage they reached the rock and rescued the survivors. Five of the crew and four passengers were brought back to the lighthouse and looked after until the storm abated and they could be transferred to the mainland. There are many who deny that Grace Darling and her father were really responsible for this brave act, but such doubts are generally ascribed to local jealousy.

Norman Cloisters, Winchester Cathedral.

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