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NEWNES

PRACTICAL MECHANICS

APRIL 1939

6d
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Professor Hilton on November 19th, 1936 from the B.B.C. broadcast a warning. The warning was to the effect that while there are many really good and reliable Colleges teaching by correspondence, there are many others which are colleges by name only. He said some so-called colleges rented a couple of rooms in a large building in a well-known street. Some made great promises which they did not intend to fulfill. Some claimed successes they could not prove. In some cases the names of prominent men were quoted who were in no way connected with the working of the College.

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FAIR COMMENT

A Letter from the Editor

ONE of the pleasant aspects of this journal is the cordial relationship which exists between the readers, the contributors, and the Editor. I must regret to say that I extremely resent daily bears tribute to the almost family feeling existing between us, and to the esteem in which this journal is held. We, of course, encourage correspondence from our readers, and reciprocate the kindly thoughts so many of them express. Occasionally, however, we receive a letter of the other sort, and where the criticisms are well founded or based on a sincere desire to help in the interests of other readers, most careful attention is given to the suggestions made.

Criticism Welcomed

In isolated cases we receive a letter from a reader who does not choose the happiest of phrases. This is such a rare occurrence that it is all the more noticeable, and usually such a letter goes into the wastepaper basket. The other day, however, we received a letter from K. B., of Birmingham, relative to last month's leader, in which I recommended those who wished to qualify for good positions in engineering, and kindred trades, to go in for a practical training. As a result of this, K. B. wrote that he thought it was in bad taste for this leader to appear opposite an advertisement for a correspondence course. K. B. of Birmingham is apparently under the impression that editorial opinions are flavoured by the advertiser. Such a point of view is, of course, distinctly quaint, and it becomes the more ludicrous when you remember that a correspondence course is intended as a valuable and reliable means of acquiring knowledge in your spare time—knowledge which in the ordinary course is only obtainable through the usual colleges. I do not think that there is one correspondence course which disagrees with the views expressed in my leader that those who wish to qualify for the big jobs cannot short-circuit practical training. The gravamen of my article was that a practical training is necessary. I have advised on many other occasions that this should be augmented by technical study, and correspondence courses. Apparently, however, K. B. is under the impression that you need not bother with practical training, but only have to undertake a correspondence course in order to become a really experienced and qualified person.

Editorial Policy

YOU will remember that I had to deal with this correspondent and his inability to understand what was or was not a master clock, and also with his statements which savoured of the individual who visited the Zoo but did not believe the hyena, that the slave clocks to be used in connection with our master clocks could only keep time with themselves but not with the master clock. There have been many hundreds of these clocks built in the last few months, and we have received numerous letters from readers who state that the system is working perfectly and keeping perfect time. In a later article, on this subject which appeared on page 259 of our issue dated February, 1939, we explained this matter in detail to indicate where K. B. had misunderstood the matter. He now thinks that I have committed "a grievous blunder of choosing a page immediately facing a full-page advertisement offering purely technical tuition by post for an editorial urgently advising its readers to take a course of practical training in preference to technical instruction." Here, again, K. B. cannot have read the article with care, for in no part of that article did I suggest that a reader should choose practical instruction in preference to technical. The grammar in the above quotation is K. B.'s.

Advice

OUR views on careers are regularly sought by parents and schoolmasters, and many hundreds of readers have made good in their chosen profession by following our advice. We are always glad to give it, for in these difficult times a timely hint as to the best course to pursue can avoid wasted years in blind-alley occupations.
“Frozen” Petrol

MR. A. JORDANOFF, a Bulgarian war pilot, has proposed the use of “frozen” petrol for aircraft to reduce the risk of fire. During a demonstration of the fuel in America, the fuel was so cold that it took a blow-lamp 14 seconds to ignite it.

Mr. Jordanoff’s process consists of an alcohol and dry-ice cooling system which reduces the petrol to 150 degrees Fahrenheit below zero. The petrol is non-inflammable at this temperature but is still liquid enough to flow out of the tank into a heating apparatus which makes it suitable for engine consumption.

THE MONTH IN SCIENCE AND

World’s Most Luxurious Train

THE Linke-Hoffman works at Breslau, have just completed for the King of Greece what is claimed to be the most luxurious train in the world. The coach in which the King will travel is a “traveling throne-room,” whilst special devices are fitted to the bed which eliminate vibration. Wireless and telephone are also provided and the temperature in the train can be always kept at the same level by means of electricity.

A Powerful Locomotive

A LOCOMOTIVE has been constructed at the railway works in Valenciennes which is claimed to be the most powerful in the world. It weighs 160 tons when loaded with fuel and water.

It will operate on the African coast line and will be fueled by wood instead of coal, as wood is plentiful along the coast.

Television and Fog

It is not always possible to have ideal weather conditions when televising an outdoor scene. It has now been proposed to “flood” fog-obscured objects with a searchlight beam from which all light rays have been filtered except the infra-red.

In this way it is hoped to focus on the television camera mosaic a picture which can be scanned and reproduced subsequently on a receiver screen.

This is, of course, an up-to-date extension of the nocto-vision experiments undertaken by Baird in 1928 on a low-definition standard.

A Transparent Book

DR. T. J. JONAS, a dentist of Chicago, has invented a transparent book. The pages consist of thin sheets of cellulose material, each page carrying a coloured picture building up an idea in step-by-step sequence. As the pages are turned, the pictures superimpose themselves upon each other to form a composite whole. Dr. Jonas invented the book idea as a form of visual education, and hopes to have public schools adopt the idea for an easier means of teaching school subjects.

The basic idea was conceived by its inventor when he was a student in Vienna some years ago. Unfamiliar with the language, he made sketches of surgical operations during lectures, adding drawings step by step. The pages of his notebook being thin, he found he could see the sketch on the preceding page without turning back, and the thought of an entire operation procedure developed in step-by-step picture sequence with transparent pictures occurred to him. He now uses it in his dental school.

Radio For a Dog

ZOE, a wonder Alsatian police dog, attached to the Sydney (New South Wales) police force, brought to fruition recently a two-year-old ambition of her trainer, Constable Denholm of the Bourke Street Police Barracks.

With a miniature receiving set strapped to her back, Zoe performed numerous tricks at the direction of Denholm, who was secreted at a microphone 30 yards away. She walked up and down ladders, turned a tap on and off, put on her own collar and took it off again, fired a revolver, and filled a billycan from a tub of water.

An Automatic Navigator

WHAT is known as an automatic navigator for aircraft has been built by Mr. J. A. McGillivray, radio superintendent at Air Service Training, Ltd., Hamble.

By means of this robot it will be possible for a pilot to know where he is within a radius of two miles, whether he can see land or not. His position is shown by two pointers which intersect on a map or chart fitted inside the plane. Briefly, the apparatus consists of two automatic direction-finders which operate continuously and simultaneously.

Most Powerful Lighthouse

A LIGHTHOUSE capable of throwing a 29-mile beam was recently put into operation on the island of Ushant, off the Brittany coast. It is said to be the most powerful lighthouse in the world.

New Electric Iron

A SYDENHAM firm are now manufacturing a new type of electric iron which will be welcomed by housewives. It is cordless and functions automatically on being put on a stand beside the worker.

Water Speed Record

A NEW Blue Bird speedboat is now under construction in which Sir Malcolm Campbell will defend his water speed record of 130.9 m.p.h. later in the year. No decision has yet been reached where the attempt will be made and the boat is being built in secret.

A boat is being built in Italy in which Count Rossi will attempt in the summer to beat Sir Malcolm’s record. If he is successful Sir Malcolm will endeavour to recapture the record. Otherwise he will try to improve on his present record.

New Design of Postage Stamp

THE Postmaster General announces that stamps of two new values, 7d. and 8d., are being included in the King George VI series of postage stamps, and are now on sale.

The stamps, like the 5d. to 6d. stamps of...
the new series already issued, are printed in photogravure, but the design is different. The design, which is the work of Mr. Edmund Dulac, consists of the head of His Majesty set in the centre of the stamp against a dark background of hexagonal shape. A hexagonal frame of lighter shade surrounds this background, and includes, as part of its decoration, a crown placed directly above the head, the value of the stamp in words beneath the head, and the words "Postage-Revenue" at the sides. In the corners of the stamp the four heraldic emblems, the Rose, the Thistle, the Daffodil and the Shamrock complete the design. The colour of the 7d. stamp is yellow-green and that of the 8d. violet-red.

A Radio Buoy
An ordinary buoy, containing a miniature radio transmitter designed to guide the transit of shipping regardless of weather, has been placed in the main ship channel of Boston Harbour by the lighthouse service. The radio equipment powered by batteries, is placed in a watertight container and sealed in the buoy. A small aerial extends from the buoy, radiating code signals on frequencies assigned to this lighthouse service. The value of the device depends on its ability to operate continuously. If successful it will be installed in other harbours.

550 Miles Per Hour
The Supermarine Spitfire planes, one of the fastest lighter aircraft on issue to any air force in the world, are being turned out in large numbers at Eastleigh. The machines have a top speed of 380 m.p.h. During diving tests these planes attained speeds of between 520 and 550 m.p.h. Air experts have expressed the opinion that the limit diving speed of an aeroplane is about 500 m.p.h. A "shock wave" develops at that speed and prevents further acceleration.

"Absolute Zero"
At the Kamerlingh Onnes Laboratories for Low Temperatures Research at Leiden, Holland is to be found the coldest spot in the world. It is contained in a thermos flask in which a temperature only a fraction above absolute zero was attained (representing some 490 degrees of frost) by exposing liquid helium to a magnetic field. Absolute zero, that is lack of any amount of warmth whatever, is, in terms of temperature 273.12 degrees Centigrade or about 491 degrees of frost. They are not far from it at Leiden, the lowest temperature obtained so far is 273.076 Centigrade which means that only 0.44/1000th degrees are in between Absolute Zero and the present result.

A "Flying Box Car"
A NEW aeroplane designed by a U.S. aircraft designer may revolutionise modern warfare. The plane is constructed similarly to the huge box-like lorries used in transport business. The tail of the plane swings open, and all types of bulky freight, or even small tanks can be loaded or unloaded with ease. The plane is a high-wing monoplane with twin motors, and is fitted with the newly developed tricycle landing gear, which enables the plane to remain in a level position on the ground.

Research Helps Safety On the Roads
The Ministry of Transport has made road research one of its foremost cares.
Road Machine No. 3 is the name given to this machine whose business it is to destroy experimental road surfaces.

This weird vehicle is used for measuring surface irregularity. The arrangement of the wheels is to reduce the possibility of errors.

Skidding, apart from carelessness of drivers and the general public, must be considered the main reason of road accidents, and to put an end to it a staff of scientists is busily engaged examining and compiling knowledge on the surfaces of roads.

By far the largest section of work, however, is dealing with bituminous materials of road construction. The main problem involved was the fact that the testing of such materials in practice on the highways took long periods of time, amounting generally to years. The scientist overcame this difficulty by the construction of a number of road machines. Some 500 yards of main road near the laboratory were made available on which a series of 40 different road carpets which had shown defects in practice was designed and laid on a concrete foundation. The road machines are now used to test the different carpets which are examined after each test with scientific precision.

As British roads are well trafficked, the road engineer is concerned with conditions demanding a very high degree of surface perfection. It is hoped that Science will help to satisfy this demand and thus make the roads safe for their users.

New Refrigeration Equipment

DELCO have designed and built an especial direct current motor to operate the refrigeration equipment on the Coronation Scot, shipped by L.M.S. for exhibition at the New York World’s Fair. The motor is 1 1/2-h.p. and is totally enclosed. The windings are designed to take care of the wide variation in voltages encountered in railway work.

The train’s refrigeration equipment consists of three two-door cabinets supplied by Frigidaire, two measuring 2 ft. 4 in. wide and one measuring 4 ft. wide, used for storing wines and general foodstuffs.

The evaporators are of the direct expansion type known as the Frigidaire FSC-13TF and are fitted with three ice-making trays giving 6 lbs. of ice in cube form per freezing. In conjunction with these three evaporators Frigidaire supplied one of their latest type Flowing Cold Compressors, Model F2-50, Freon Fully Automatic Air-Cooled Compressor. The Delco motor and compressor are fixed beneath the floor of the restaurant-car, and are slung from the framework on special iron girders.

While the train is running, the electric supply is taken from direct driven generators and when the train is stationary the supply is then automatically switched off to a battery which is charged while the train is running.

The refrigerant is Freon-12, standard for all Frigidaire equipment, and is non-toxic, non-odoriferous and non-flammable in use.

New Power Station

A £3,500,000 super electric power station is to be erected at Strongford, Stoke-on-Trent. It will be part of the national grid scheme.

Explosion-proof Airship

THE American Mechanical Engineering Co. have submitted plans to the United States Navy for the construction of an all-metal airship that will be proof against lightening, fire and explosions. The airship will be capable of a speed of 100 miles per hour and would be filled with helium, a non-inflammable gas. It will be unusual in design, and be shaped like a raindrop. A rotary many-bladed fan in the nose and propellers underneath would propel the airship.

Jump-start Autogiro

MR. R. A. C. BRIE recently demonstrated the jump-start autogiro flying machine, type C.40, at the Army Staff College, Camberley. No forward run is needed for the machine when taking off, and it lands almost vertically. The Navy have already placed an order for this machine, and it is possible that the Army will also adopt it. It is a two-seater machine, and appears to be of greater utility than any helicopter that has so far been produced.

A vacuum flask in which a temperature only a fraction above absolute zero was attained (representing some 490 degrees of frost) by exposing liquid helium to a magnetic field. See para. on page 349.
CHEMISTRY, that most absorbing of practical sciences, is one which, to a large extent, may be followed under even the crudest of laboratory conditions.

There is, indeed, no reason why the amateur adherent of this essential science should forgo practical experimentation merely because he has not access to a conventionally designed and furnished laboratory. Given the necessary interest in the subject, and, of course, a small amount of financial aid, a chemical workbench may be fitted up almost anywhere.

Experimenters deny such a convenience indoors have not infrequently fitted up workbenches for experiments in corners of outhouses, sheds, and other similar structures, whilst not a few hardy enthusiasts have even gone so far as to conduct the whole of their experiments out of doors!

There are few adherents of practical chemistry, however, who will not be able to fix upon some convenient room, shed or outhouse in which to conduct their experiments, and it is for such enthusiasts that this series of articles is being written.

"Fume Cupboard"

Naturally, the home experimenter must take every care not to let the practice of his hobby cause annoyance or distress to other folk. The amateur chemist has no excuse for preparing evil-smelling gases, as, for instance, sulphurised hydrogen, in any indoor apartment. In the absence of the orthodox laboratory "fume cupboard" such preparations must invariably be made out of doors, or, at least, in an outhouse where the unavoidable "stink" can affect no one other than the enthusiastic experimenter himself.

Similarly, no domestic utensils should be used for the purpose of chemical experimentation. Many of the chemicals which the experimenter will handle, although they may not be included in the front rank of poisons, are nevertheless harmful even in traces. Hence risks of their getting into food should never be taken.

The precise design of the home laboratory will primarily be governed by the available accommodation. The amateur who is able to devote an entire room to his hobby, and who is able to command gas, water and electricity, supplies is, indeed, experimenting de luxe. More numerous, however, are the individuals who can merely afford a single bench in a corner of a room, cellar, or outhouse for their experimenting. Yet, despite the apparent crudity of this arrangement, much excellent chemical work can be done on a solitary bench of this description, and, after all, the experimenter in such conditions can always look forward to the day when he is able to extend his accommodation and equipment, or find fresh surroundings for the latter.

For the majority of chemical experiments, a plain wooden table or bench cannot be improved upon. The table or bench surface should be quite smooth and it should be regularly waxed in order to render it water-repellent and reasonably chemical-proof. For such a waxing purpose a few candle ends dissolve in linseed oil, turpentine or white spirit form a cheap and effective preparation.

The Bench

If a choice of position for the bench or table is possible, let it be one in which there is plenty of available light, such as under a window. Here there is not only ample light, but the window (and the window-sill) itself can be made to function quite effectively as a fume cupboard for "stink" experiments, the necessary apparatus being set out on the outer window-sill and the window closed during the course of the evil-smelling experiment.

Chemical bottles, containers, etc., should not usually be stored on the workbench itself. It is far better to have the various bottles on conveniently situated shelves, for in these circumstances there will be no danger of the bottles being knocked over or their contents contaminated with drippings from broken test tubes and other vessels.

"Stock" chemicals which are not in frequent use are best kept in a cupboard. Every chemical and every bottle containing any substance or material should be clearly labelled. Poisons, such as ammonia, mineral acids and other substances, are legally required to be sold in ribbed bottles so that they can be distinguished from innocuous substances, even in the dark. On no account, therefore, should this procedure be departed from in the amateur's
Fitting the Laboratory

Some method of heating is absolutely essential in the home laboratory. If the experimenter is fortunate enough to be able to command a gas supply, he will then require one or two small bunsen burners and, perhaps, a diminutive gas ring. Other experimenters, devoid of gas supply, will find that a spirit lamp burning ordinary methylated spirits will make a good substitute for the more orthodox bunsen burner. Quite an effective spirit lamp can be made by selecting a wide-necked bottle having a screw-down metal cap and by fitting a short length of brass tubing through the metal cap. Through the brass tube is threaded some cotton wool reaching down into methylated spirit contained in the bottle.

If a water tap and sink are absent from the laboratory, a large jug can be used for the water supply and a suitable basin for the "sink." A bucket will be necessary in which to throw away waste fluids (except acids, which must be disposed of down an outside drain) and a wooden waste box should also be provided.

The actual equipment of the home laboratory will depend upon the actual size and arrangement of the laboratory and the financial resources of the individual experimenter.

Fitting the Laboratory

It is possible to expend a small fortune in fitting up a laboratory, and, on the other hand, it is possible to provide "workable" equipment for simple experiments in a home laboratory at a cost of under ten shillings. The amateur experimenter, as a general rule, should obtain his apparatus and chemicals as he requires them, instead of trying to improve quite a good deal of laboratory equipment. Test-tube stands, for instance, may be made very cheaply by drilling holes in a strip of plywood and fitting two horizontal supports. Likewise, expensive bottles (apart from the necessary ribbed "poison" bottles) need not be acquired for laboratory work; flasks, glass funnels, beakers, test-tubes and evaporating basins, however, are necessary, and these should be purchased from any reputable firm of laboratory and chemical suppliers.

The amateur, if he is not known to the chemical-supplying firm, may nowadays have some difficulty in obtaining a number of chemicals. Within very recent years the laws governing the sale of many types of chemicals have undergone drastic revision with the result that the purchaser of chemicals must be able to convince the supplier that he requires his supplies for bona fide purposed.

A Simple Experiment

To grasp this essential difference, let us perform the following simple experiment.

Mix together two parts of flowers of sulphur and one part of coarse iron filings. A grey-green mixture will result, and if it is examined under a magnifying glass, particles of sulphur will be seen existing side by side with the individual iron filings. What is more, if we take a magnet, and stroke it through and through the sulphur-iron filings mixture we shall find it easily possible to remove all the iron filings from the mixture, leaving the sulphur behind.

Obviously, therefore, this greyish-green substance is very definitely a mixture of sulphur and iron filings which may readily be separated into its two ingredients.

Suppose, now, that we half-fill a glass test tube with this iron filings-sulphur mixture and heat it strongly in the flame of a bunsen burner or spirit lamp. The sulphur will quickly melt, but before long, the contents of the tube will suddenly glow at a red heat, this glow spreading throughout the mixture.

On cooling, the test-tube will have to be broken in order to extract its contents. Such contents will be found to be very different from the simple mixture of sulphur and iron filings which originally went into the test-tube. In appearance a greyish coke-like mass, the tube's contents will be found to contain no free particles of sulphur and none either of iron. This coke-like material is actually a compound of iron and sulphur, and it is termed iron sulphide.

Chemical Action

Under the action of heat, the atoms of sulphur and the atoms of iron have combined with each other to form this new material, iron sulphide, from which, by ordinary methods, neither the iron nor the sulphur may be recovered.

We now have a working idea of the nature of a mixture and of a chemical compound. The ingredients of a mixture can be separated and they do not lose their separate identity. When, however, substances, under the influence of heat or through other agencies, form compounds, the components of the compound lose their separate identity and cannot ordinarily be recovered from the compound.

Here, in this sulphur-iron combination we have a good example of chemical action, that mysterious process of atomic linking by means of which all the hundreds of thousands of known chemicals are brought into existence. Chemical action consists of the linking up of atom with atom. Sometimes, as, for example, in the experiment which we have just made, this atomic linking takes place with such fierce energy that the reacting or combining substances are heated to redness, and, even, to whiteness.

A piece of magnesium ribbon burning in air is another good example of chemical action, the magnesium atoms chemically combining with the oxygen atoms in the air to form a white, powdery substance, magnesium oxide, which is the "ash" of the burnt magnesium ribbon.

This "ash," or magnesium oxide, contains one part of oxygen and one part of magnesium. Yet we cannot distinguish the magnesium and the oxygen as such in the magnesium oxide. For they are so linked up as to lose their separate identity. Magnesium oxide, therefore, is a compound of magnesium and oxygen, not a mere mixture of the two.

Sodium

Sodium is a metal which is so soft that it can be cut through like cheese with a knife. Immediately the bright cut surface of a lump of sodium is exposed to air, it turns white, becoming covered with a layer of sodium oxide.

Here we see a well-defined chemical action going on; at ordinary temperatures and without requiring any external aid such as heat. It is on account of its intense avidity for oxygen that metallic sodium is always kept under oil, for if it were exposed to air, it would very rapidly combine with the atmospheric oxygen, forming sodium oxide and with the consequent disappearance of...
TOOLMAKING AND TOOL DESIGN—5.

The Principles and Methods of Making Press Tools, Jigs, Gauges and Fixtures

By W. H. DELLER

The workpiece shown in Fig. 24 is drilled, in the base and through one side. The side hole is counter-bored after drilling while the work is still in the jig. Actually the example can represent a casting or drop forging and the only machining performed on the part prior to drilling is that on the bottom surface. This consists of milling the base and the slot extending from end to end of the part. In such a case as this it would be correct to assume that the base would be machined to a dimension taken from the top of the boss and therefore the hole in the base would need to be approximately central the part would be positioned endwise in the jig by means of a clamp engaging it.

A Jig for Handling the Part

A suggested method of handling the part illustrated in Fig. 24 is shown at Fig. 25. As will be seen the "built up" method of construction is employed. The side plates are of cast iron machined on both sides and are slightly relieved in the centre bottom to leave feet at the ends. At the top (as drawn) the plates are cut away in a similar manner but to a greater extent to permit easy access to the clamping screw in the swinging clamp member. The bottom member is of steel and has a machined tongue to register the slot in the base of the work-piece. It is intended that the tongue should clear the bottom of the slot by a slight amount. Therefore the sides of the tongue should be undercut at their junction with the base in order to provide swarf clearance. This part carries the bushes for the blind holes shown dotted in Fig. 24 and should be subsequently hardened and finished by surface grinding. Needless to say in any event, the surfaces which abut on to the side plates require to be parallel.

The side plates are attached to the base member by means of studs passing clear through the side plates and base member. Hardened jig feet in the form of blind nuts screwed on to the end of the studs secure the parts together. Additional security is provided by dowelling the parts on both sides.

At the top the jig side plates are separated by means of shouldered studs as illustrated in Fig. 26. These studs are accurately machined over the shoulders to a dimension equal to that of the width of the base member. At their outer ends these studs are provided with feet similar to those at the bottom.

Swinging Clamp Member

The swinging clamp member shown in a raised position in Fig. 25 is illustrated in Fig. 26. This may be machined from steel or made from a casting. In width this part requires to be slightly less than that of the base member in order that it will work freely between the side plates. The hole in the boss should be large enough to pass the largest diameter of the shanked stud freely but without unnecessary slackness.

The vee block portion should be large enough to position the bossed portion of the work. A slot at the front end receives a swinging clamping screw. A slot at the back end of the clamp clears a pin fixed into the stud, as in Fig. 26, and its purpose is to prevent the clamping member from falling completely over when raised beyond the vertical. The pin is therefore positioned suitably to accomplish this object. The boss on the swinging stud is treated in the same manner as indicated in the illustration of the jig.

By reference to Fig. 28 the action of the clamping member is made clear. A stop pin in the base member roughly determines the position of the part in an endwise direction before the clamp comes into operation. The pin, however, should be so placed that the vee block will tend to draw the part away from it otherwise the boss may not be centralised. After the clamp is tightened down on to the boss the pressure-screw is tightened to hold the back end of the casting down on its seating. This screw is provided with a swivelling pad to avoid marking the surface of the job. The side plates are bored to receive the bushes. Should the fittings require to be "hardened" both holes should be fitted with liners to house the "slip-bushes" otherwise one side only requires bushing and a clearance hole provided in the opposite side plate to clear the counter-boring cutter.

In order that the jig shall lie properly on the feet, one set of feet need to be surface ground, after securing, from one side plate and the opposite set of feet ground while the jig is resting on the finished set. The top set of feet should also be surface finished after the jig is assembled.

Alternative Clamping Arrangement

The device illustrated in Fig. 29 may be substituted for the swinging stud. It consists of a pair of short links separated by a tubular distance piece. A simple cam has pins machined on either side to suit the smaller holes in the links. Where this method is adopted two short distance pieces will be required to centralise the links on the stud. The slot at the front of the clamping plate will be replaced by a simple tongue. A short handle forms the means of operating the cam and is so positioned that when the clamp is secured it does not project above the jig feet.

Attention must be drawn to the fact that although the free end of the swinging clamp has no definite abutment against which to rest, it is not intended to take care of a wide range in variation of depth from the boss to the base of the work. Therefore even if a wider tolerance is permissible this dimension should be kept within 11/2 in.

Surface Condition of Work

Where the surface condition of the work...
Saws That Will Last

THE metal and wood cutting saws generally used by cabinet-makers and locksmiths have undergone many improvements in line with modern developments in technical processes. Nowadays, for instance, best diamond-studded tungsten alloys and can cut the hardest materials. Another innovation is in the form of circular saws with exchangeable teeth of hard metal, recommended more particularly for cutting abrasive material, and also stone, artificial resin, grey cast iron, porcelain, etc.

Guillotine Cutting

In the majority of cases the circular shears have been used generally up to the present for cutting rolls of paper in a lengthwise direction, but just lately the guillotine has been adopted for cutting substances such as paper of all thicknesses, films, foils, ribbons, etc. A specialist firm have produced a very simple and effective means of guillotining which make use of glass-hard steel bushes to take the counter-thrust of the sheared member of the bushes being optional and their width anything that may be required. The shaft holding the knife is not driven and the individual knife rollers which are carried by spring-loaded holders can be set very easily, the spring pressure being adjustable to suit whatever kind of material has to be cut. The knives can also be easily detached for sharpening without any need to remove the shaft from its bearings. A particular advantage of this new design is that the knife rollers ensure clean and accurate cuts on account of the novel type of fixing used for them, and the glass-hard thrust surfaces may also be used for years without any fear of ridges forming in them. At ordinary cutting speeds the knife will cut approximately 500 miles of cigarette paper or 250 miles of toilet paper, or even as much as 622 miles of typewriter ribbon before having to be re-sharpened. The outstanding feature of this type of machine is the ease and rapidity with which the width of cut can be altered and the through the process. At the same time the "Perawin" is passed through special filters which remove all dirt, dust and soluble matter it has taken up, so that after it has been purified in this way it is ready for use over again for the next lot of articles. The mechanical material is on very well-thought-out lines and comprises the cleaning drum, two speed driving motor, and the heating and filtering arrangements, all in a compact form which takes up but little space.

Ring Cutters in Two Parts

SHARPENING the knives on rollers and heavy roll-cutting machines has always been a very awkward operation which takes up a great deal of time—either the entire machine is to be lifted out of the machine so as to lift up the knives, or else they have to be sharpened as an overtime job when the machine is not working. A ring cutter has now been produced which

Some of the Interesting Gadgets which were Exhibited for the First Time at the recent Leipzig Fair

knife changed for sharpening without having to remove the shaft.

Chemical Cleaning

CHEMICAL cleaning—the removal of spots, grease, gum, tar, etc.—is a science in itself, on which a big branch of industry has grown up, and development is to be found in this line also, both of a chemical, as well as a mechanical nature. A new cleaner now on the market is "Perawin," a non-poisonous and non-explosive chemical which is absolutely harmless to fabrics or other materials. Cleaning machines are made with drums capable of taking from 26 lbs. to 330 lbs. weight of articles to be cleaned, the cleaning being done by washing them in warmed "Perawin" which dissolves all grease and cleans them. The chemical is removed from the drum afterwards by centrifugal force, and it is only very seldom that an article calls for any further work, so thorough is the cleaning process, in spite of the way the articles are protected when going as distinct from the usual circular or plate knife, can be changed in a few minutes at any time without having to lift out the shaft. This ring cutter is made in two parts, but operates without any gap and with great accuracy nevertheless, owing to the special type of connector fitted. Where the nature of the material to be cut (e.g., paper) is such as to require the knives to be sprung, a leaf or thrust spring can be fitted in the back of the cutter ring without any further alteration. The method of fixing the ring cutters to the shafts is instantaneous and does away with bolts altogether. The shape of the knives are such as to be grooved on a circular knife-grinding machine or else on any ordinary lathe of the kind found in any workshop. The predominant advantage of this is the great saving of time in changing the knives, as well as the very much longer life of the knives in comparison with ordinary ones of the plate and circular types; the rings are, moreover, made from high-grade special alloy steel which has wonderful cutting properties.
Colour Photographs On Paper

By G. L. Wakefield, A.R.P.S.

Building up Photographs in Colour by the simple Superimposition of Three-Coloured Images in Blue-green, Magenta and Yellow.

Most keen photographers have tried their hand at colour photography with one of the transparency processes such as Dufaycolor or Kodachrome, but very few attempt to make paper prints in natural colour. These are not so difficult to make as is generally supposed, and the amateur who is accustomed to methodical working will have no trouble in producing good results at low cost. In addition to the attractiveness of the colour print, there is no more fascinating occupation than that of building up a picture of myriad hues and tints by the simple superimposition of three coloured images in blue-green, magenta, and yellow.

There are several methods by which a colour print can be made, but they all demand a set of colour separation negatives as a basis, so these will be discussed first. The subject is photographed three times through three filters, blue-violet, green, and red. During the three exposures the subject must remain stationary, so it can be seen that we are limited to scenes in which no movement occurs, but in spite of this there are a host of good pictures for the colour photographer. Any landscape can be tackled on a still day, and architecture offers great scope. Indoors still-life of all kinds can be photographed either by daylight or artificial light.

**Camera Used**

Any type of camera is suitable, but one taking rollfilm is most convenient as the film can be quickly changed between exposures. A rigid tripod will be required so that the camera can be kept perfectly still while the picture is being taken. This will ensure that all three negatives will be exactly the same size, for any variation will cause lack of register in the final print. The tricolour filters, blue-violet, green, and red can be bought for a few shillings in the form of gelatine film. A set should be obtained large enough to cover the front of the camera lens. Fig. 1 shows a camera fitted with a simple sliding filter holder that enables the filters to be changed between exposures without danger of jolting the camera. Fig. 5 shows how the holder is constructed using thin card and glue. The filters are mounted between thin cards as shown, and in doing this, care must be taken not to mark the filters in any way, otherwise the definition of the negatives may be impaired. The completed holder should be painted with Indian ink to make it a matt black.

Panchromatic roll-film must be used for colour work, and while any good make is suitable, Ilford Hyper-sensitive roll-film is recommended because with this, the exposures through the three filters are approximately equal.

**Film Factors**

Packed with all roll-films will be found a leaflet giving the multiplying factors for different filters, and the factors for the tri-colour filters are grouped together. The factors for the film mentioned above are:

- Blue-violet: 6
- Green: 5
- Red: 5

For practical purposes the factors for this film can be called 6 for all three filters. This means that we can give equal exposures to the three negatives, thus avoiding the...
newnes Practical Mechanics

Assuming that a suitable subject has been selected, the camera is set up on the tripod, the legs of which should have been wedged in the ground if possible. Focusing should be carried out in the usual way, and the filter holder and filters placed on the camera lens. The red filter should be in position.

Then, the actual exposures given must be:

<table>
<thead>
<tr>
<th>Filter</th>
<th>Multplied by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue-violet</td>
<td>x 7</td>
</tr>
<tr>
<td>Green</td>
<td>x 9</td>
</tr>
<tr>
<td>Red</td>
<td>x 11</td>
</tr>
</tbody>
</table>

It will be seen that in such a case we are confronted by some awkward fractions which cannot be given by the automatic shutter speeds.

The exposure necessary with the film in use, but without any filter, should be found by means of a reliable exposure meter. This figure must be multiplied by six to allow for the exposure without a filter being 1/6th of a second.

The three exposures should be made between gusts. It is pretty certain that the exposure without a filter is 0.03 of a second.

The completely exposed film can be developed either in a tank or a dish using a bright orange safelight can be used for enlarging on to a normal bromide paper, and to simplify the job of deciding what development is complete, the film should be desensitised first.

The negatives can be identified with their respective filters before the film is cut up.

Exposure

If the subject is a landscape with trees that tend to be blown dry film from absorbing moisture from the air and expanding, perhaps unevenly.

Before hanging to dry, the film should be hardened in a 5% per cent. solution of formaldehyde for ten minutes. No further washing is necessary after this, and the film can be hung up to dry in a place as free from dust as possible. The hardening will prevent the dry film from absorbing moisture from the air and expanding, perhaps unevenly.

The negatives are now ready to be printed, but before cutting the film into separate exposures, the colour of the filter used for each should be marked clearly by scratching with a sharp point in the margin.


growth


electrolyse for ten minutes. No further washing is necessary after this, and the film can be hung up to dry in a place as free from dust as possible. The hardening will prevent the dry film from absorbing moisture from the air and expanding, perhaps unevenly.

The negatives are now ready to be printed, but before cutting the film into separate exposures, the colour of the filter used for each should be marked clearly by scratching with a sharp point in the margin.

"Kent's Mechanical Engineers' Handbook."


This volume, which is one of a series of five, is the eleventh edition of this well-known work, and covers very exhaustively the various sources of power used in modern engineering. The book is divided into seventeen sections, the subjects dealt with including Air, Water, Heat, Combustion and Fuels, Steam, The Steam Engine, The Stirling Engine, Condensing, and Cooling Equipment, Refrigeration and Ice Making, Heating, Ventilating and Air Conditioning, Internal Combustion Engines, Gas Production, Transportation, Electric Power, and Power Test Codes. The last section is confined to Mathematical Tables. Some of the more important sections are sub-divided under various headings, for example, the contents of Section 3—Heat, are classified under the following headings:—Measurement of Heat, Heat Transmission, Evaporators and Evaporation, Dryers and Drying, Heat Insulation, and Thermodynamics. The book should prove indispensable to engineers and draughtsmen.


Like its companion volume, Power, this work is divided into sections, twenty-eight in all, covering the very wide field of design and shop practice, as applied to present day engineering. During the past ten years the development of many new materials of engineering, and the improvements in tools and machinery, have made a good deal of the data in the earlier editions obsolete, and the book, therefore, has been practically re-written, to bring it thoroughly up-to-date.

any of the usual developers or the following:

Methyl 20 grains

Hydrogen 60 grains

Sodium Sulphite (cryst) 13 ounces

Sodium Carbonate (cryst) 14 ounces

Potassium Bromide 16 grains

Water up to 1 litre

The above stock solution is diluted with an equal quantity of water for dish development, and to simplify the job of deciding when development is complete, the film should be desensitised first. This is done by running it for two minutes through a 1:5000 solution of Pinacyanol Green, and then transferring to the developer without intermediate washing. After this treatment a bright orange safelight can be used for watching the progress of development, instead of having to work in darkness as normally one must do with panchromatic emulsions.

Negatives for colour work should be kept soft in contrast, and over-development avoided at all costs. The soft type of negative is the one suitable for enlarging on to a normal bromide paper should be aimed at.

An ordinary acid-fixing bath should be used, and washing should be thorough. Before hanging to dry, the film should be hardened in a 5% per cent. solution of formaldehyde for ten minutes. No further washing is necessary after this, and the film can be hung up to dry in a place as free from dust as possible. The hardening will prevent the dry film from absorbing moisture from the air and expanding, perhaps unevenly.

The negatives are now ready to be printed, but before cutting the film into separate exposures, the colour of the filter used for each should be marked clearly by scratching with a sharp point in the margin.

"Modern Electrical Engineering." Vol. III. By F. J. Camm. 400 pages; 379 illustrations. Price 6s. Published by George Newnes, Ltd.

This is an extremely valuable book, packed with facts, figures, tables and formulae for the mechanic, fitter, turner, draughtsman, engineer and designer. It deals with Measurement; Powers and Root$ of Useful Factors; Trigonometrical Functions; Metric System; Imperial Weights and Measures; Mechanical Drawing; Principles of Mechanical Drawing; Blueprints; Reading and Using the Micromer and Vernier; Drills and Drilling; Special Cutters; Reamers; Other Cutters; Taps, Dies, etc.; Files and Filing; Marking Out for Machining; Lathe Tools and Tool Angles; Dapping; Between Centre Turning; Screw Cutting; Lathe Equipment; Lathes and Centres; Lathe Tool-Bits; Grinding Operations; Grinding in the Lathe; The Dividing Head; Gear Making; Soft Soldering; Silver Soldering and Brazing; Soldering Aluminium; Making Spot Welders; Riveting; Polishing and Finishing Metal; Hardening and Tempering; Case Hardening; Chemical Colouring of Metals; Electro-plating; Chemical Plating; Spray Method of Coating Surfaces with Metal; Rust-proofing Iron and Steel Bolts; Nuts and Screws; Pattern Making for Castings; Casting Small Parts: Sheet Metal-work; Repousse Work; Shaperworking and Setting Woodworking Tools; Wood Finishes; Woodwork Joints; Silting Glass; Battery Charging; How to Obtain a Patent; Work- Shop Receipts; Glues, Cements and Adhesives; Repairing Gear Teeth; Temperature Recording Paints; Tables. The book is well indexed.

The "Practical Mechanics Handbook" showing one of the many well-illustrated chapters.
THE STORY OF THE THERMOMETER

The Eventful History of a Universal Instrument

James Prescott Joule

Of all the measuring instruments of science, none, perhaps, has attained such a universal degree of common usage in everyday life as the thermometer. Yet the thermometer, even in its crudest form, is hardly more than three centuries old. A few of the ancients, it is true, as, for instance, the celebrated Hero of Alexandria, seem to have devised instruments which effected crude thermometric measurements, but, for all practical intents and purposes, the fact of heat being an accurately measurable entity does not seem to have dawned upon mankind until the time of Galileo at the beginning of the seventeenth century.

First Known Thermometer

Although there is a little doubt about the matter of the thermometer's origin, it is to the famous Italian physicist and astronomer, Galileo, that the invention of the first working thermometer is nowadays ascribed. Whether Galileo's idea was an entirely original one, we have no means of knowing. Certain, however, is it that this famous scientific worker produced the first known thermometer or heat-measurer. In its earliest form, Galileo's instrument consisted of a long narrow tube with a bulb at the end which dipped below the level of a quantity of water contained in a glass vessel. On heating the glass bulb, the air therein expanded and pushed the water in its stem downwards.

In his later instruments, Galileo dispensed with the separate vessel of water and employed simply a tube having a bulb at one end and an open reservoir at the other. This instrument, Galileo filled with oil or wine. In principle, of course, it was precisely the same as his previous instrument, the upper glass bulb being heated and the expanding air within it pushing the liquid down along the vertical tube.

As a matter of fact, Galileo's instruments were not thermometers pure and simple. They were barometers, as well, for the liquid-level in the vertical tube was affected by the external pressure of the atmosphere, although Galileo does not seem to have realised this.

Galileo's instruments were made about the year 1601-2. After this date we have to skip a period of some fifty years until, about 1657 we find that some now unknown and possibly very humble genius employed by the Scientific Academy at Florence has hit upon the idea of making heat measurements by means of the expansion of a liquid sealed with a tube.

The Modern Thermometer

Here we have the first germ of our modern thermometer and the prototype of all our present-day liquid-expansion instruments. About the previously mentioned year, the Florence Academy was turning out on a semi-commercial scale crude thermometers consisting of a narrow glass tube having a bulb blown at one end of it. The bulb was filled with wine, alcohol or oil, and its tube was sealed off at the end. Under the influence of temperature variations, the column of liquid in the tube expanded or contracted. No one, however, appears to have thought of attaching a scale to these early thermometers. Individual owners, it would seem, noted the height of the liquid column on hot summer days and made a mark on the tube accordingly. Physicians who used these crude instruments would mark the stems at places corresponding to the bodily temperature of their patients in various stages of fevers, but there was no standard thermometric scale by means of which accurate readings could be made.

It was our own Sir Isaac Newton, who, in 1701, first introduced the practice of calibrating thermometers; that is to say of marking their stems at the freezing and boiling points of water. Apart from this, however, Newton did little to popularise the use of the thermometer. His thermometric "scale" was clumsy, inadequate and hopelessly impracticable.

Mercury Thermometer

The introduction of the mercury thermometer was the next step in the evolution of the instrument. Roemer, the Danish
astronomer who first determined the speed of light, constructed the first mercury-filled thermometer in the year 1708, although Halley, the English Astronomer-Royal, is said to have originally suggested the notion. Roemer's thermometers, however, were crudely made and they attained very little popularity.

Undoubtedly the first individual to construct really serviceable thermometers was Gabriel Daniel Fahrenheit, of Amsterdam. Fahrenheit is worthy of the title of "Father of the Thermometer," for it was he who raised the thermometer from the status of a mere trilling toy to that of an accurate, reliable and exceedingly useful instrument. Realising that mercury was the best of all liquids for thermometer use on account of its low freezing and high boiling points, its regularity of expansion and its non-clinging properties, Fahrenheit set himself to produce first-class instruments of this type. He took up thermometer manufacture in 1714. At a single stroke, he improved upon thermometer construction enormously by making the bulbs of the instruments cylindrical in shape instead of spherical, thereby enabling the mercury in the bulb to gain or lose heat more rapidly than was possible with a spherical bulb.

Fahrenheit

Fahrenheit, too, was the first man to provide a scale for his thermometers. He inserted the bulbs of his instruments in a mixture of ice and salt of definite proportions and he marked 0 (Zero) at the level to which the mercury columns sank under these conditions.

He next took the temperature of the human body, and marked his thermometer 96 degrees to correspond with this. Then he found that instruments so marked showed a temperature of 32 degrees when immersed in melting ice and 212 degrees when placed in boiling water. Thus it is that we obtained our present-day Fahrenheit scale on which 32 and 212 degrees represent the freezing and boiling points of water respectively.

In Recent Years

It is interesting to note that of recent years many attempts have been made to replace mercury as a thermometer metal, the clear convex surface which is so characteristic of the ordinary mercury column. Of the many specialised types of thermometers are inadmissible although, no doubt, some non-clinging gallium alloy may ultimately be used in place of the pure metal.

Although the Fahrenheit scale is used in everyday life in this country and in America, the Centigrade scale, introduced by Celsius in the latter part of the eighteenth century, is a much better one and is employed by scientific workers the world over. On the Centigrade thermometric scale the freezing point of water is taken as 0 (Zero) degrees, the boiling point of that liquid being 100 degrees.

One seldom comes across the Réaumur scale nowadays, but at one time it was common. Réaumur, shortly after the time of Fahrenheit, marked the freezing point of water on the thermometer as 0 (Zero) and the boiling point as 80 degrees. Other "freak" scales there were also, but they attained but little use.

Fahrenheit's belief in the superiority of the mercury-filled thermometer was amply justified, for, towards the end of the eighteenth century, practically every thermometer which was manufactured conformed to this specification. It is true, of course, that thermometers filled with coloured spirit are still made on the mass scale at the present day. Such instruments, whilst being amply serviceable for everyday household use, cannot possibly compete in accuracy with the mercury-filled instruments, but they can be produced at a considerably less cost.

Of the many specialised types of thermometers which have been devised and manufactured since the pioneering days of Fahrenheit it is impossible to make mention. Electrical thermometers, which depend for their action upon the increasing resistance of a special electrical element, with increase in temperature, have been much to the fore in recent years for high-temperature measurements, as have, also, those thermometric instruments which estimate high temperatures by measuring the heat radiations with the aid of a thermo-couple. Despite, however, all these modern devices, the simple mercury thermometer constructed on lines initiated by old Gabriel Fahrenheit, still remains unequalled for absolute reliability and extreme accuracy.

"Mechanical" Instruments

The modern tendency in household thermometers has been in the direction of "mechanical" or "dial" instruments in which the temperature readings are indicated by a pointer moving across a dial. Such instruments work upon the principle of the expansion of a curved strip composed of two dissimilar metals. Actually, the first of these mechanical thermometers was made as far back as 1810 by a French watchmaker, Abraham Breguet by name. Breguet's first dial thermometer comprised a sensitive arrangement of gold, silver and platinum strips, in virtue of the expansion of which a pointer was caused to revolve around a circular scale. Breguet's thermometers had some measure of popularity, but, due to the minute size of their construction, they were exceedingly expensive articles. They were also unreliable and were easily thrown out of adjustment. Consequently, the mercury-filled thermometer experienced very little competition from Breguet's ingenious device, as, indeed, for all scientific purposes, it has done from any similar and subsequent "mechanical" device.
Pilots operating the great 18-ton sub-stratosphere aeroplane will gaze upon many innovations which are considerably in advance of present-day equipment.

**IMPORTANT** indications of what the high-altitude-operating transport planes of the future will offer in safety and comfort are contained in the first detailed description of the giant, multi-motored, sub-stratosphere-flying, 30-passenger Curtiss-Wright "CW-20" luxury liner now nearing completion in the St. Louis (Missouri, U.S.A.) airplane factory of the Curtiss-Wright Corporation, made public by C. W. France, vice-president and general manager of that organisation. The new 'plane dwarfs all present-day bi-motored transperts.

Most revolutionary of its innovations, many of which are considerably in advance of present-day equipment, is an amazing "tell-tale" device which automatically checks the functioning of 47 details of the "CW 20" operation for the pilots and, supplementing the so-called Sperry "automatic pilot," is virtually a "fourth pilot." It marks one of the aircraft manufacturing industry's principal contributions to date in simplifying the air line pilot's work and hence adding to safety.

**Danger Signals**

This device is similar to the indicating signal systems used by the railroads and the electrical power industry to warn of danger or improper operation, and is essentially a panel of lights situated on the instrument panel in full view of both pilots, and electrically connected to the various vital operating parts of the 'plane in such a way as to report constantly on their functioning. It indicates everything, from engine temperature to whether the stewardess shut the passenger-cabin door.

If the pilot wishes to land, he simply presses one of the 10 pre-selector switches marked "land." Lights immediately show on the "tell-tale" panel to indicate what adjustments are necessary. As the landing gear is lowered, that light goes out, and as the landing flaps, ailerons, and elevators are operated, their corresponding lights flash out. The pilot cuts his engines, handles any other details indicated until the panel is dark, then lands.

The "tell-tale" panel checks every operation, providing for taxi-ing, take-off, cruising and landing, and further enables the pilots to quickly check on either of their two 1,600-h.p. Wright Cyclone engines simply by pressing switches for the "right engine" or "left engine." Lights immediately appear on the panel to indicate any improper operating condition.

**Complicated Operations**

To further eliminate for the pilots those complicated operations which the Civil Aeronautics Authority finds often causes "pilot fatigue" and resultant errors in operation, Curtis-Wright engineers have developed facilities for the new low-mid wing, all-metal "CW-20" which reduces
An artist's conception of the Curtiss-Wright Model 20 Transport in flight. This 'plane, powered with two 1,600 h.p. Wright double-row Cyclones, has a top speed of 237 m.p.h.

the number of pilots' controls 37 per cent. below those required on modern air liners; provided large, hubless, spokeless wheels, assuring full vision of all instruments; centrally placed essential instruments in duplicate to prevent strain on pilots; installed single-movement control levers for operating flaps and landing gear; duplicated radio systems to assure continued communication, and developed radio microphones which retract into ceiling wells and cannot interfere with operation of the controls. The spacious cockpit will accommodate a third member of the crew.

Landing gear retracts in from five to six seconds, can be lowered in three seconds, cannot retract while the 'plane's weight rests upon it, and will absorb vertical decent at the rate of 900 ft. per minute, the result of gear with an 18-in. shock-absorber travel developed by Curtiss-Wright engineers, the same who designed aviation's first retractable landing gear for a commercial 'plane and the world's first sleeper 'plane. The tail wheel also is retractable.

Three years of extensive research and flight testing by the engineers who designed the famous Curtiss' planes operated in every branch of America's air forces, have produced a monoplane type of wing which provides complete stability and control of large load capacity. Luxurious accommodation, economical operation maximum safety, and high operating speed, Mr. France pointed out that it also is available in types sleeping 20 passengers or seating 35 passengers. Its nacelle and centre section, he revealed, are designed to accommodate engines with ratings up to 2,000 h.p., while its ground and fuselage clearance is sufficient to permit the use of large diameter propellers to accommodate such horsepower.

While the pilots enter through a special hatch in the cockpit floor, passengers board the new transport through a door which opens from the top of the fuselage, pass the stewardess' large food galley, then gaze upon a roomy, indistinctly lighted, air-conditioned cabin which provides head room for persons over 6 ft. tall, and is equipped with 30 luxuriously upholstered, reclining chairs. Unlike present-day operating air liners, the "CW-20" offers separate wash-rooms and toilets for men and women, all fully equipped even to an outlet provided in the men's room for an electric razor.

Conversation may be carried on in a normal manner, Curtiss-Wright engineers having soundproofed the cabin to reduce the noise level to about sixty decibels, approximately ten decibels lower than that of any other air liner now in operation.

Marking still another radical departure in accepted transport design, engineers have solved the cargo space problem by providing beneath the cabin floor four roomy compartments with a total capacity of over six hundred cubic feet, which give easy access and reduce load-balancing complications. Three accommodate baggage, express and mail, while the fourth is for storing accessories.

The heating system differs from those employed in the past by operating completely independent of the engines and providing the passenger cabin and lounge, vestibule, galley, pilots' cockpit, and even the cargo compartments (the latter to prevent goods from freezing in transit) with temperature of 70 degrees F. when the outside temperature is as low as 40 degrees F.

To simplify the pilot's operation of the 'plane, engineers have developed the above pictured "telltale" device which automatically checks the functioning of all instruments and vital parts of the 'plane, and, supplementing the so-called Sperry "automatic pilot," is virtually a fourth pilot. Experts say it decreases "pilot fatigue" and hence increases air line safety.
5,000 Years Hence

The 71/2-ft. Time Capsule constructed of cupaloy, the result of five years' research to make copper as hard as steel.

FIVE thousand years from now historians of the future will receive an 800-pound metal letter, a cupaloy Time Capsule containing information about us and our times. It will be deposited fifty feet below the surface of the New York World's Fair grounds by the Westinghouse Electric and Manufacturing Company and officials of the Fair.

And if future historians do find the Capsule, major credit will go to a Canadian geophysicist, Sherwin Kelly, head of Geophysical Explorations, Ltd., of Toronto, upon whom the Westinghouse Electric and Manufacturing Company called to provide information for discovering the Capsule by electro-magnetic prospecting.

Mr. Kelly's message to the future is to be published in a specially prepared Book of Record of the Time Capsule, which will be preserved in libraries, museums, and other repositories throughout the world. The book is printed on special rag paper, with specially compounded permanent ink, and will be bound. It is expected that some copies will survive for 5,000 years, and will guide future historians back to the spot where the metal Capsule waits. In addition to exact latitude and longitude, given accurately enough to locate a spot less than an inch in diameter on the earth's surface, instructions are given for building and using geophysical prospecting instruments to locate the Time Capsule.

The Message

The message to the future, signed by Mr. Kelly, is as follows:

"Though in all probability methods more sensitive than any we have to-day will be employed in the future to seek for metallic bodies beneath the earth, it is possible, too, that this will become a lost art. It is therefore suggested that the Time Capsule may be discovered by detecting the secondary electro-magnetic field induced in it by a strong primary electrical field created at the surface of the ground."

"Construct a loop some ten feet in diameter, composed of several turns of well-insulated wire, fashioned in such a manner that it can be moved systematically over the area within which the Capsule is believed to lie. While the loop stands vertically, pass through it an alternating current of 1,000 to 5,000 cycles, using a power source of approximately 200 watts. The primary electro-magnetic field thus set up around the loop will intersect any metallic material in the vicinity such as the Capsule, and induce in it a secondary current. This current will produce a secondary electro-magnetic field which will distort the primary field of the energising loop. This distortion, properly interpreted, will indicate the location of the Time Capsule.

How Radio will help Future Scientists to locate a buried "Time Capsule" containing the Records of our Generation

A Second Coil

"To investigate this phenomenon, construct a second, smaller coil, approximately a foot in diameter, made up of a large number of turns of insulated wire. To the coil should be connected an amplifier which, in turn, is connected to some type of current indicator, such as a galvanometer or telephone receiver. Some means should be provided for accurately measuring the strike or direction of the coil in the horizontal plane, as well as its dip or deviation from the vertical position. On level ground, where there is nothing to distort the primary field, the current generated in the small, or pick-up, coil will be at a minimum (that is, produce the least distortion of the galvanometer needle or the least sound in the telephone receiver) whenever the plane is perpendicular to that of the large coil.

Conversely, maximum current will be observed when the two coils are in the same plane. It is well to take both observations as a check-up before beginning the search for the Capsule. If the instrument is working properly, the positions of minimum and maximum current in the pick-up coil should be at right angles to each other."

"In exploring for the Capsule, observations may be made with the pick-up coil in two ways."

"First : Take measurements in the plane of the energising loop, moving farther and farther away from it in short stages of 5 or 10 ft. Do not work too close to the energising loop. If during this survey, the pick-up coil encounters metallic material it will be noted that the positions of the coil do not correspond to those described for an undistorted field. The divergence from the normal dip will be at a maximum over the hidden body, whereas the deviation from the normal strike will increase as the metallic substance is approached, reverse to a maximum in the opposite direction as the spot is passed over, and then decrease as the coil moves farther away.

Within a Few Feet

"Second: Take readings along lines at right angles to the measurements suggested in the first method above. These readings should be taken approximately 5 to 10 ft. apart, extending 50 to 100 ft. each side of the plane of the energising coil. The lines of observation should cross the first line every 5 ft. Observe the position of maximum current in the pick-up coil. In an undisturbed field the coil should stand vertically. As the metallic body is approached the position of maximum current in the pick-up coil will again become vertical. As the coil passes beyond it will reverse, and point in the opposite direction. The strike will undergo a maximum deviation from its normal position as the Capsule is passed.

"By a combination of these two methods it should be possible to locate the position of the Capsule within a few feet."

What the Capsule Contains

The 5,000-year Westinghouse Time Capsule will contain books reproduced in micro-film, statements of this age's scientific engineering, industrial, social, religious and philosophic achievements. It will also contain specially preserved small articles that modern wear or use; motion picture film illustrating how we look, act and talk; photographs of famous people and things of our time, and messages from great men of our age for the future.

The Capsule is lined with a Pyrex glass envelope of copper which has the strength of steel and high resistance to corrosion. The inner crys is lined with a Pyrex glass envelope set in waterproof plastic. This crypt will contain film and articles, preserved in an inert gas (nitrogen). --Radio News
A STREAMLINED WAKEFIELD MODEL

This is a streamlined plane of 206 sq. ins. and to Wakefield formula, which is:
1. Mainplane area 200 sq. ins. plus or minus 10 sq. ins.
2. Minimum weight 8 ozs.
3. Maximum Tailplane area = 33 per-cent. of total wing area.
4. Maximum cross-section = overall length of model

First, carefully draw the plans full size.

Fuselage
The fuselage is streamlined and is built of 24 -sq.-in. balsa stringers cemented on to formers, cut from 1/8-in. sheet. Carefully cut all the formers, and sand to make sure that there are no rough edges to harm the rubber motor. Cement the top and bottom stringers in position first, and then add the other stringers, checking the fuselage for trueness. Cement the 1/8-in. strip balsa between the two stringers for the undercarriage tubes, and below the wing mounting, as shown. The stringers above the wing mounting are now cut away, and a piece of 1/8-in. sheet balsa about 1 in. wide is cemented on the top of each side of the fuselage.

Then cut the stringers above the tailplane away and reinforce with 1/8-in. sheet balsa as shown. Also cement two cross-grained pieces of 1/8-in. sheet balsa for the 1/8-in. bamboo peg used for holding the rubber motor in position.

Plank the nose of the fuselage between formers Nos. 1 and 2, with 1/8-in. sheet. The 18-s.w.g. brass tubes for the undercarriage are now cemented in place and a paper tube, about 1/2-in. diameter hole, is cemented at the end of the fuselage. Cover with two layers of tissue, the grain of the paper tube at the rear of the fuselage, and the hatch should fit tightly between the formers Nos. 5 and 8.

The Tailplane
The tailplane has a span of 17 ins. and is divided from 4 ins. to 31 ins., giving an area of 66 sq. ins.

The leading edge is 1/8-sq.-in. balsa set in diamond, the mainspar is 1/4-in. by 1/4-in., and the trailing edge 1/4-in. by 1/4-in. shaped to the airfoil section. The ribs are cut from 1/8-in. sheet balsa, and are spaced 2 ins. apart. The section used is Clark "Y."

Bend two tips from bamboo and cement in position. Two small hooks are bent backwards and forwards along the fuselage. Cover with tissue, dope, and when dry apply two coats of banana oil.

This Model is Extremely Stable and Capable of Good Flying Performance

The Wing
The wing span is 47 ins., with a constant chord of 5 ins., giving a total area of 206 sq. ins. The dihedral is 32 ins., and the sweep back 1 in.

It is constructed in two halves, with a leading edge of 1/4 sq. in. set in diamond, and mainspar of 1/8-in. by 1/4-in., and a trailing edge 1/8-in. by 1/8-in. shaped to the airfoil section.

The ribs, which are spaced at 2-in. intervals, are cut from 1/8-in. sheet, and the section used is Scarff R.A.F. No. 32.

Crack the leading and trailing edges for the dihedral and sweep back, but cut the mainspar to shape. Cement well, and reinforce the mainspar with thin plywood.

Bend the tips from bamboo, and cement in position. Make two paper tubes, about 1 1/2 ins. long and 1/4-in. diameter hole, and shape two bamboo dowels to fit. Cement one dowel or tube into each half as shown. Cement the bamboo pegs used for wing fixing, and reinforce the wing at A and B. Cover with strong white tissue, dope, and apply two leading edges of banana oil.

A piece of 1/8-in. balsa is cemented just behind the leading edge to give the wing the necessary incidence. The height of the tips over the wing can now be made from two layers of 1/8-in.

The Fin
A shaped former is cemented at each end, and the hatch should fit tightly between the formers Nos. 5 and 8. The rudder is 8 ins. high, with a width of 2 1/2 ins. at the tip and 5 1/2 ins. at the base. Shape a piece of 1/8-in. sheet balsa to fit on top of the tailplane, for the base of the rudder, and cut the ribs which are streamlined in section from 1/8-in. sheet balsa.

Cement the leading edge and front spar (which are both 1/8 sq. in.) to the base, and then fit the ribs to them at 11/16-in. intervals.

The Rudder
The rudder is 8 ins. high, with a width of 3 1/2 ins. at the tip and 5 1/2 ins. at the base. Shape a piece of 1/8-in. sheet balsa to fit on top of the tailplane, for the base of the rudder, and cut the ribs which are streamlined in section from 1/8-in. sheet balsa. The rear spar (1/4-in. by 1/8-in. balsa) and the shaped trailing edge (1/4-in. by 1/4-in.) are then cemented in position.

The Undercarriage
Streamline the bamboo and bend all the wire fittings from 18 s.w.g. to 16 s.w.g. and cement these fittings and fix a cross piece of light bamboo, to give the required width of track.

The wheels are made of three laminations of 1/8-in. sheet balsa, sanded to a streamlined shape, and bushed with 18-s.w.g. tubing.

The Propeller
Lay out the block as shown in the drawing, and test for balance.

Carve carefully and when completed make sure that it balances perfectly. Cover with tissue and apply one coat of thick banana oil. Test again for balance, and fit 16-s.w.g. bush. Be careful not to carve the blades too thin near the spinner. The freewheel is self-explanatory.

The noseblock is built up of 1/8-in. sheet balsa, and is fitted with a 16-s.w.g. bush, and a ball-race is fitted between the propeller and noseblock.

The trimming weight (about 1/2 oz.) can be made of lead, which can easily be beaten into a streamlined shape which fits the fuselage.

This weight runs on thread, which is tensioned by a rubber band at the rear of the fuselage. Be sure that this weight does not slide too easily on the thread, and does not sway when the model is flying.

The model flies best on 18 strands of 1/4-in. flat rubber about 48 ins. long, "White" rubber tensioned, and well lubricated. The model is trimmed by moving the weight backwards and forwards along the fuselage.

The wing and tailplane are fixed by rubber bands passing round the fuselage. The rudder is fixed by the peg fitting into the paper tube at the rear of the fuselage, and a rubber band being passed round the fuselage from the hook on the leading edge.

The model is very stable and flies well, the best results being obtained when flying in wide circles against the torque.

Weights

<table>
<thead>
<tr>
<th>Fuselage</th>
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<tr>
<td>Wings</td>
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<tr>
<td>Tailplane and Rudder</td>
<td>4 ozs.</td>
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<tr>
<td>Propeller</td>
<td>1 ozs.</td>
</tr>
<tr>
<td>Rubber</td>
<td>21 ozs.</td>
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</table>
Constructional details of the streamlined Wakefield model. A full-size blueprint is available from the offices of "Practical Mechanics" for 2s 6d.
HEAT TREATMENT OF TOOL STEELS

With Special Reference to Highly Alloyed Types

By L. Price

The above title covers a large amount of a very important branch of the science of metallurgy, and to deal with it in detail, it would be necessary to write a very lengthy treatise. Although the subject matter of this article is not new, it is thought that whilst there is a vast amount of available literature, much literature is too technical for the “small” user who is concerned with his products, and consequently does not want to have to make a detailed study of his tools.

.90% Carbon Steel

One of the most widely used—and abused—tool steels is the ordinary .90% carbon quality. The heat treatment of this steel should present very little difficulty. Care must be taken in heating to, and at, the quenching temperature (760° C.-780° C.) and that the attainment of temperature has not been too rapid, or that soaking at this temperature has not been maintained for too long or too short a time. Further, the actual quenching must not be “slipped.” The reader might be inclined to say, “Heat treatment is easy when there are so many difficulties?” but when much time and money have been spent in preparing a tool, it is not the consideration of these difficulties of major importance?

With regard to the first difficulty. The tool must not be placed in a furnace which is already at the required temperature. This may sound obvious, but it is a process adopted nevertheless, with the result that the tools often crack owing to uneven expansion. This danger may be minimised by first warming the tool in front or on top of the furnace, and then placing it in the furnace, which should be at a temperature of about 500° C. The temperature should then be raised slowly, allowing at least as much time to attain quenching temperature as will be allowed at that temperature for soaking. Even longer may be required by very large masses.

Quenching

The second difficulty—soaking—is sometimes perplexing to the hardener, especially if the tool is of an intricate shape and has varying thicknesses of metal. In such cases, slow and uniform heating are essential to prevent warping and spalling of corners, etc. When the quenching temperature is reached, a good rule is to allow ½ hour to ¾ hour per 1 in. of thickness for soaking, taking into account the thickest parts.

Finally, there is the consideration of quenching. Most failures occur at this stage, but it is not always fair to blame the actual quenching. The difficulties dealt with above are perhaps the major causes, especially that of insufficient soaking, which, it will be readily appreciated, leaves the steel in a very unsatisfactory condition. The hypoeutectoid solution of cementite does not begin until the required temperature (760° C.-780° C.) is reached and then requires a minimum time. Hence, if this time is not allowed, it will be seen that the result is incomplete change of pearlite to austenite throughout the mass instead of the completely formed solid solution, austenite. The phenomenon of hardening is accompanied by a volume change (in the transformation of the austenite to hard martensite) and hence the seriousness of insufficient soaking will be seen, for not only will it result in “soft-spots,” but there will also be a tendency to cracking. Where possible in quenching, the thicker portions should be the first to enter the water, thus making the rate of cooling as uniform as possible. This precaution is necessary in order to reduce the danger of cracking. With some tools it might be advisable to quench on a falling temperature, i.e. allowing the temperature of the surface of the tool to fall slightly, though still above the critical temperature before quenching. In this way the quenching speed of the whole of the tool is made more uniform. Quenching in this manner tends to eliminate the tempering effect which the hot interior has on the already cold and hard exterior, and consequently produces uniform hardness.

Normalising Treatment

So much for the actual hardening of this steel. It might be advisable at this stage, however, to mention that successful hardening is greatly enhanced if, with all steels, a normalising treatment is given prior to hardening, in order to release machining stresses which are a frequent cause of distortion. Holes, such as bolt holes, should be plugged with clay, or asbestos wool, and if possible sharp angles should be avoided in the design. Intense stresses are set up at sharp corners, and these may be sufficient to crack the tool either in quenching or immediately after quenching. Stresses are unavoidable, and a wise plan is to remove the tool from the quenching medium when it is hand warm and temper it for a short time to relieve these stresses. Dies and punches may not be required in the “glassy” hard condition, and so it will be necessary to increase the temperature or perform tempering. With this steel, however, it is rarely found necessary to exceed 250° C.

Cold-Heading Die Steel

This steel, which is used quite extensively in cold-heading operations, differs very little from the one dealt with above. It has a carbon content of .90/1.0% and a vanadium content of 20%. The effect of the vanadium is to give increased hardenability, grain refinement and resist ance to shock. It also raises the hardening temperature to about 810° C. The same precautions as mentioned above in .90% carbon quality steels should be taken with this type.

Oil-Hardening Die Steels

The chances of breaking of tools are considerably lessened when oil-hardening steels are used, since the quench is not so drastic. For a typical example an oil-hardening non-shrinking die steel will be taken. It has an analysis as follows:—

- Carbon 0.90/1.10%
- Chromium 0.50/0.60%
- Vanadium 0.25%
- Manganese 1.2/1.5%

The dimensional changes in hardening are very small, hence the property of non shrinking or non distortion. The hardening temperature generally adopted is 760° C.-780° C., although the steel may be hardened from 800° C. without any grave consequences. This may lead to a slight coarsening of the grain, however, which should be avoided wherever possible. The “golden rule” is, therefore, to use the lowest permissible temperature in all heat treatment.

The same procedure and precautions in heating and method of quenching as with the .90% carbon steel are advisable, although the allowance of a little longer time for soaking may be beneficial. Water quenching must never be adopted. With regard to the tempering, this is, of course, decided by the purpose for which the tool is to be used, but it is carried out in much the same way as with a carbon steel.

(To be continued)
Quoit Tennis is an Excellent Substitute for Ordinary Tennis and a Hard Court can be Built in the Average Suburban Garden at Little Cost.

"Keep fit" is the slogan of the hour, and it is certain that good health is the most precious thing anyone can possess. Regular outdoor exercise is the keystone of fitness, but it is not easy for the town dweller to obtain this in its more attractive forms. The gardens of the well-to-do are now fitted with hard tennis courts, but these cost too much for many of us, and require more space than can be found in the average suburban back garden.

Quoit tennis is an excellent substitute, as a hard court can be made at very small cost. It will go in a very small garden, and the construction of it will provide interesting work during several week-ends. The game is very similar to lawn tennis, but a rubber ring is used instead of a racquet and ball. It is a very fast game and includes a lot of bending and stretching, which is just the thing to prevent middle-age spread, and to safeguard a youthful figure.

The size of quoit tennis courts is not fixed. The commercial firms who build them make a doubles court 50 ft. by 25 ft., the outside lines being 40 ft. by 18 ft. Many of us, however, have learned the game at sea, and the size of court used on most liners is 24 ft. by 14 ft. outside lines, with, of course, a surround and runback beyond this.

When constructing my own court I used 24 ft. by 14 ft. outside lines with five feet of runback at each end, and three feet at ground, flooded in winter, and so the containing wall is 2 ft. 6 in. high to allow for ample drainage. The wall is made of concrete, the mixing being 1 cwt. of cement, 2 cwt. fine gravel and 1½ cwt. broken up clinker. This is thoroughly mixed, then turned over twice when dry, and twice when wet. Enough water is added to make it wet but not runny. Previously the footings for the wall are cut out, making a trench 6 in. deep and 6 in. wide, and 1 in. planks are fixed on each side to hold the concrete. The wet mixture is shovelled in and well rammed down. As my own wall was high, I inserted two strands of barbed wire which ran the whole way round, and were twisted together at the ends, thus binding the whole together. Drainage holes were made at intervals by inserting tapered pieces of wood, which can be knocked out when the concrete has set. If it is intended to make a surround of netting, the posts must be inserted while the concrete is wet.

Laying the Court

I used a number of short pipes which were let into the concrete, and these served as slots to hold the uprights, which were thus removable for alterations or repairs, but they can be bedded in the concrete if desired. The retaining walls of wood should be left for ten days to allow the concrete to set well, and if the weather is frosty the top of the concrete should be covered with old sacking or frost will ruin the set.
down, we next lay the court itself. I used boiler clinkers, but domestic ashes will do quite well. These were sifted through a sieve. For an ordinary court, on dry ground, coarse ashes or cinder should be laid to a depth of \(\frac{3}{4}\) in., raked smooth and rolled down, and 1 in. of fine ashes are placed above this and well rolled. The rolling is much more effective if done after heavy rain. We next come to the final surface dressing, which can be obtained from the various firms who build hard courts. I used En Tourt Gas red dressing, which was placed on the ashes to a depth of 1 in., well watered and rolled, the cost is 59s. 6d. a ton, and a small amount of their fine dressing (7s 6d. a sack) is scattered over the first layer, well watered and rolled, but better results can be obtained by heavy rain than any amount of watering.

The fixing of the lines is quite simple. They can be bought from sports dealers at about 3d. per foot in long strips of lead, drilled with holes and painted white. They are simply nailed down.

A wire-netting surround is not necessary, but it is a great convenience. Mine is 9 ft. high, made of 3-in. interlink wire netting, supported by old gas pipes which are stayed by wire stays.

I then obtained a number of old pipes, and even if you do not get them for nothing, it should be possible to get them at scrap metal price. The pipes were dropped into the slots and were stayed by stout wire stays.

The net can be bought from any sports dealer. It is held in position by strings tied to the uprights. The top is 6 ft. above the court. The court is likely to be a little loose at first, as it takes time, watering and rolling, to make hard courts really firm, but they allow play in all kinds of weather, and even after heavy rain.

The best treatment is to water it with a solution of caustic soda, or weed killer. This should be applied after heavy rain but not during rain. Take 9 lbs. of soda to 15 galls. of water. Remember the soda will injure skin, so keep it off your hands or clothes.

If a hard court as described is well looked after it is possible to play in all weathers, even shortly after heavy rain, but not when the surface is thawing after severe frost. When the frost has gone, the nails must be pressed down and the court well rolled.

The court is likely to be a little mushy, spread on a light layer of the coarse surfacing material. If it is too loose and gritty dust on some of the fine surfacing material. These dressings are most effective after heavy rain, and should be well rolled in.

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**Pilot Reaches Speed of 575 M.P.H.**

*An all-metal, single-seat type, this pursuit plane is similar to the Curtiss P-36A, the standard Pursuit plane of the U.S. Army Air Corps, and like it carries as standard equipment, a Curtiss electric propeller which held the speed of the engine to normal operation during the 575 miles per hour dive which started at an altitude of 22,000 feet (6,700 m.).*

**Curtiss Hawk 75A Pursuit plane, one of a large number now being constructed for the French Air Force by the Curtiss Aeroplane Division of the Curtiss-Wright Corporation in its Buffalo, N.Y., factory, recently exceeded all known speed records for terminal velocity dive by free-diving over 575 miles per hour (925 Km./H.), in acceptance tests. It was the fastest speed at which any man-propelled machine has ever travelled.**

While National Aeronautic Association officials declared that no Federation Aéronautique Internationale records even approach this speed, experts supervising the flight test pointed out that the plane probably exceeded a speed of 600 miles per hour since it dived so fast the marker on the Recording Air Speed Indicator exceeded the range of the instrument and actually moved off the graph-paper roll.

Flown by the Curtiss organisation’s chief test pilot, H. Lloyd Child, one of America’s outstanding flight engineers, the new Curtiss Hawk began its dive at an altitude of 22,000 feet (6,700 m.) and reached its great speed during a free dive of 9,000 feet (2,700 m.). Pilot Child, declared that “he felt no ill effects and did not realise that he had set a new speed record.”

The terrific speed was recorded on instruments installed by the French Government’s representatives who witnessed the flight. A photographic record from the French-Recording Air Speed Indicator, which charted the terminal velocity dive, presented a series of wavy lines representing the plane’s climb to 22,000 feet, and featured two sharp upright lines. One, tracing the dive, extended completely off the margin of the graph while the other represented the decreasing speed following the pull-out.

In his report to Curtiss officials, Pilot Child revealed that at no time during the dive did the engine speed exceed 2,550 revolutions per minute. Its normal rated speed in level flight. Engineers attributed this to the unlimited blade pitch range of the plane, Curtiss electric propeller which prevented the engine from exceeding its normal rated r.p.m. and thus avoided any unusual strain on it during the dive.

Previously, one of the limiting factors in the speed at which an airplane could dive was the engine’s r.p.m.’s, as overspeeding results in serious damage to the engine. With propellers of limited pitch range, the engine often exceeds allowable limits before the airplane reaches maximum speed in a dive, with the result that unlimited dives often have been restricted by propeller design rather than the strength of the airplane structure.
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says

Pioneer Pete

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<td>Sandringham</td>
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Combined Gun and Camera

THE United States Patent Office has granted a Patent for a combined gun and camera. This firearm and motion picture photographic apparatus includes a trigger on the gun to which is pivoted a supplementary trigger. When this supplementary trigger is pressed, the photographic apparatus is actuated to cause pictures to be taken. Further pressing of the supplementary trigger will discharge the firearm.

I have no information as to the object of this twin-shooting weapon, which is decidedly problematical. It might be useful for photographing an enraged wild beast and shooting him before he has time to resent the insult.

Snares for Snails

If it were possible for a dumb creature to bring an action for libel or slander against schoolmasters and philosophers who, to point a moral, so often vilify it, the snail would have an excellent chance of recovering heavy damages. The alleged dilatoriness of this familiar member of the mollusc family is proverbial. Yet, considering that it carries its streamlined domicile—a kind of portable air-raid shelter—its pace really entitles it to a prize for velocity.

But, although one may admire the snail's architectural skill, this creeping thing must be regarded as a foe in our gardens. To prevent its depredations, a Frenchman has decided to photograph an enraged wild beast and shooting him before he has time to resent the insult.

INVENTIONS OF 1938

The number of applications by inventors for British patents during 1938 shows a definite advance compared with recent years.

The expansion in aircraft production has resulted in a large number of devices relating to aeroplanes. Amongst these are several for counteracting spinning and for mounting batteries of guns in wings and protection from ice formation, which is a frequent cause of accidental firing upon landing.

The extended use of electricity for factory and domestic work continues to inspire inventors to supply a great number of new electrically-operated devices.

Also inventions relating to converting vehicles for gas protection purposes.

A safety pocket operated some distance from the pocket by means of a zip fastener has been patented.

Also a portable lethal chamber, the size of a Gladstone bag, specially designed for animal welfare work.

A scoring board for darts with a magnetically adjusted indicator makes a great appeal to dart players.

A ladies combined lipstick and mirror which necessitates the use of only one hand, should have a big sale.

Inventors have applied in this country for patents comprising only one pair of spectacles. Dual compartments protect against friction and means is provided for maintaining bows in position.

Mechanical Educator

A SWISS has applied in this country for a patent for an educational appliance for teaching arithmetic. He points out that, hitherto, the initial lessons in mental arithmetic are given by the teacher by verbally setting a task or writing it on a blackboard. The former method has the drawback that it may prove a strain upon the teacher's vocal organs. And the latter system necessitates the back of the schoolmaster being turned, which may be prejudicial to discipline. Referring to various calculating apparatuses which have been tried, he mentions that these have the disadvantage of displaying a large number of figures, which, when arranged in tabular form, the task imposed loses its clearness, and the attention of the scholars is diverted from the problem itself.

The new educational appliance takes into consideration the fact that the interest of children is naturally held by things which...
are movable. An interchangeable band provided with numerals is moved past a window opening. In the neighbourhood of this, members are furnished to take small interchangeable tablets, each of which nearest to the window has an operating sign, while the most remote carries a number. And the whole is arranged in such a manner that the number at any time visible in the window, the operating sign and the number in the vicinity of the window represent the task. Thus the interest of the pupils is kept from flagging and they are attractively taught at least one of the three "R's."

Make-Up for Cricket Bats

The longevity and effectiveness of a cricket bat depend largely upon its resilience. It seems that it has been the practice to treat the blade of a cricket bat as carefully as a lady makes up her face. When new, prior to use, it is freely oiled and "faced," in order to hardest the surface of the blade, to render it pliant and to prevent splitting. The treatment has been repeated at frequent intervals during the life of the bat. Even with this treatment, the blade has a "cussed" tendency to split or chip at the edges, becoming also gradually heavier.

One of the objects of an invention for which a patent has been applied is to provide a process for impregnating the blade with rubber, the use of which will dispense with the necessity for the oiling and "facing" operations. It will also furnish a permanent binder for the cell structure of the blade, enabling it to withstand the shock of impact, and thus increasing its durability.

Rubber Kettle Holder

The old-world cloth kettle holder which was peddled in the days of Queen Victoria is still often a subterfuge for aims. But it now has a powerful rival in the shape of an adjustable holder, for which a patent has recently been applied.

Many domestic articles are provided with metal handles, e.g., kettles, cooking pans, flat irons, etc. But, owing to their shape, they are not comfortable to handle for a long period; or, being composed of metal, they convey heat too readily and are liable to make handling inconvenient and painful.

To obviate these disadvantages, the inventor has appropriately devised a lady—has devised a moulded strip of resilient, insulating medium adapted to lie along the outer side of a handle and having inwardly turned flanges lengthwise. These flanges are so moulded that their free edges press firmly against the moulded strip between the corners at the junction of the flap parts and the remainder of the strip.

The handle may be made of vulcanized rubber with plain or beaded edges. And, if desired, an advertisement may be incorporated therewith.

Anti-Germ Screen

Portable screens in hospitals are not a novelty. One example is covered with non-transparent material, so that the patient is invisible from the external point of view. Screen sections of glass in wood and metal frames have also been in use. But they are inconveniently heavy, and cannot with ease be adapted to varying conditions. The latter magnet is energised when the photo-sensitive apparatus is in darkness. Thus the illumination will be adjusted according to the nature of the circumstances.

New Valve for Compressors

The valves of large compressors call for special features which are not easy to realise, and if they are not forthcoming, the deficiency is plainly noticeable in the life of these parts of the machine. For instance, the continual shocks to which plate valves are subjected lessen the wearing resistance of the material to a considerable extent, and so a well-known firm in Western Germany have introduced a new type of valve. One feature of these valves is a novel arrangement of the springs as well as of the entire valve slot guides which reduces the mechanical stresses on the material considerably; another is the employment of a special alloy steel in their construction which renders them highly resistant to the continual shocks to which plate valves are subjected. And these cranks are so arranged that they drive the flywheel. The two cranks are formed as of the entire valve slot guides which are subjected lessen the wearing resistance of the material to a considerable extent.

Tracing Machine for Ski-ing

In the same way that a child can, on dry land, learn the actions necessary in swimming, so there has recently been devised an apparatus to facilitate the art of ski-ing. The appliance comprises a flywheel on an axis symmetrically arranged between two parallel axes each carrying one pair of bicycle-like pedal cranks. The two cranks are attached symmetrically arranged between two parallel axes each carrying one pair of bicycle-like pedal cranks. The two cranks are attached to the rear shoe as firmly as the front shoe is attached to the platform.

RAINBOW RUBBER

MOTHER-OF-PEARL—sometimes called nacre—which is the lining of oyster and other shells is undoubtedly a thing of beauty. An inventor has thought out a way of causing articles made of hard rubber to produce the same irradiant effect. This phenomenon is explained to be caused by the surface breaking up the light rays, assuming that the light is white light. But it is stated that, up to the present time, this mother-of-pearl appearance has not been produced on the surface of hard rubber. The foregoing inventor has manufactured an article comprising a moulded, coloured hard rubber compound containing arsenic sulphide, the surface of which presents distinguishable areas which reflect light with different degrees of intensity, depending upon the angle from which the article is viewed.

To render more efficacious the preparatory training for ski-ing, the motion of the feet upon the blades allows the mobility of the heel relative to the platform.

An apprenticeship on this contrivance will qualify the pupil for an brilliant display upon the scintillating snows of St. Moritz.

Automatic Car Light Switch

There has appeared an improved device relating to systems for automatically switching on and off vehicle lights particularly those used for parking purposes. In systems of the latter kind, when the vehicle is standing on a public road, it is necessary to obtain the automatic illumination at nightfall, and this switching off when daylight reappears. On the contrary, when the car is in a garage, the lights should not be switched on in darkness. In this way, unnecessary consumption of electric current is avoided.

In connection with a photo-sensitive apparatus for switching lights on and off, the device referred to has made its advent. It is characterised by the fact that the current of the lights is controlled by a circuit breaker. This includes a pendulum adapted to be applied either against a permanent magnet so as to close the circuit, or against an electro-magnet for keeping the circuit open. The latter magnet is energised when the photo-sensitive apparatus is in darkness. Thus the illumination will be adjusted according to the nature of the circumstances.

PRACTICAL LEATHERWORK AND OTHER ALLIED CRAFTS

By Fred Jaco

This handbook not only deals exhaustively with the leather-working but other crafts such as Appiique, Gesso, Raffia, Batik, stencilling and rugmaking. It contains 96 pages and 179 photographs and diagrams.

From all BookSELLERS, Is. or by post Is. 2d. from the publishers, George Newnes, Ltd., (Book Dept.), Tower House, Southampton Street, Strand, W.C.2.
In an ordinary reciprocating engine the work is done by the pressure of the steam against a moving piston. In a turbine there is no element corresponding to the piston, but the mass of the steam itself is set in motion by its own elasticity. Since the density of steam is small, the velocity attained is consequently high, and the problem of the designer is to use the momentum of the rapidly moving steam for the production of work. This may be done in several ways. Jets of steam may be caused to exert an impulse on moving blades, or advantage may be taken of the reaction of the steam on the moving orifices from which they emerge, or a combination of both principles may be employed. The simplest type of impulse turbine is that invented by Dr. Gustav de Laval. This consists of a single bladed wheel acted on by one or more jets of steam, as shown in Fig. 4. To abstract the greatest possible amount of work from the steam in this way, the blades would have to travel at almost half the speed of the steam. With ordinary boiler pressures the steam would issue from the nozzles at something like 4,000 feet per second, and considerations of centrifugal force prohibit a blade speed even approaching half this velocity. The efficiency of a single impulse wheel cannot, therefore, be high, and turbines of this design are, in fact, only built for comparatively small powers when efficiency is not of primary importance.

**Pioneer Turbine**

To reduce the steam velocity to a figure appropriate to practical blade speeds, Sir Charles Parsons devised the principle of compounding, which was a characteristic feature of his pioneer turbine of 1884, and is now universally employed. In a compound turbine, the total fall in pressure of the steam from the boiler pressure to the condenser vacuum is made to take place by a series of steps or stages. By employing a sufficient number of stages, the velocity acquired in each stage may be kept as low as desired, and the blading may therefore be made to work under conditions of maximum efficiency.

All commercial turbines are compounded in this way. A compound impulse turbine consists of a number of bladed wheels fixed to a shaft, each wheel running in a separate compartment of the casing, as shown in Fig. 2. The steam enters the first compartment through a set of nozzles, and has its acquired velocity abstracted by the wheel in that compartment. It then passes through another set of nozzles into the second compartment, where its freshly acquired velocity is again abstracted, and so on along the whole turbine. The number of compartments or stages may be anything from about a dozen to forty or more, depending on the steam conditions, the speed of rotation and the efficiency desired.

As an alternative to the impulse principle, in which steam from fixed nozzles acts on moving blades, it would be possible to construct a turbine to develop power from the reactive force of a moving jet. This was the principle employed in the classical Aeropile of Hero of Alexandria, and it is also characteristic of the Barkers Mill, or reaction water turbine. A few steam tur-
bears have been built along the same lines, but the best efficiency obtainable is very low, and the type does not exist commercially.

**Moving Blades**

The name of reaction turbine is now always applied to machines in which the moving blades are propelled partly by the impulse of steam issuing from fixed jets, and partly by the reaction of the steam issuing from moving blades. This similarity of form and principle of the De Laval steam turbine, shown in Fig. 7, in which the blades and their distance pieces are welded and boxed into groups before being fitted in the turbine. Each group consists of from eight to twelve blades, and constitutes a short arc of the whole circle of blading. The longer blades, towards the exhaust ends of the l.p. cylinder, are rolled integrally with their roots, which act as spacing pieces. The tips of the radial clearance blades are thinned to knife-edges which would be harmlessly rubbed away in the event of accidental contact while running.

The blade tips may be a quarter of an inch or more, while the axial clearance on which the leakage depends may be safely kept down to 0.006 of an inch. As these axial clearances are controllable by an adjustable thrust bearing, they can be maintained indefinitely.

To prevent erosion from water particles in the steam, the blades at the exhaust ends of the l.p. rotor are fitted with shields of tungsten steel.

The l.p. cylinder of the turbine is of cast iron, as it is not subjected to great changes in temperature or pressure. The rotor is built up of thick discs shrunk on to the shaft. The discs are controllable by an adjustable thrust bearing, they can be maintained indefinitely.

The shaft is trepanned through its centre to allow the blades to be fitted and to allow the necessary large forgings to be provided. The rotor is then closed at the end by a thrust bearing which is an instrument giving an illuminated magnified view of any portion of the interior.

A turbine consists of two cylinders in tandem. The l.p. cylinder is of the double flow type, where the expansion takes place in the nozzles, and the steam leaving the nozzle leaves the moving blades at the same pressure as that at which it entered them. In the Parsons turbine the fixed steam jets are produced by stationary blades which act as nozzles, and as an equal pressure drop takes place in both fixed and moving blades, these are unchanged in the l.p. cylinder. One consequence of this is that a very large number of pressure stages can be accommodated in a reasonable length, so that the steam velocities are small, the stresses in the blades are low, and the action of the blading is very efficient.

**A Modern Turbine**

A modern Parsons turbine has a capacity of 20,000 b.h.p. at 2,000 r.p.m. as shown in Fig. 6. The turbine rotor is composed of two cylinders in tandem. The steam enters the h.p. cylinder through the fixed steam jets and passes through the blading of this cylinder. The steam exits from the h.p. cylinder at a pressure of 600 lbs. per sq. in., superheated to 600 deg. F., and is expanded into a condenser with a vacuum of 28.75 inches at the maximum load of the machine. The high-pressure cylinder contains two cylinders in tandem. The steam enters the h.p. cylinder through the fixed steam jets, passes through the blading of this cylinder, is condensed and expanded in the condenser. The high-pressure cylinder is a casting of molybdenum steel, on account of the superior qualities of this alloy as regards resistance to the effects of steam at high temperatures and pressures. It is as nearly as possible of uniform thickness and rigidity, and at a further precaution against distortion by temperature stresses, the heavy flanges along the horizontal joint are swaged through at the boltholes in order that the cylinder shall not be subject to any constraint by the relatively cooler flanges. The rotor is a hollow forging, integral with the shaft at one end and closed at the other by a forging which is extended to form the second bearing. It carries fifty-one rows of moving blades, and as these are, of course, an equal number of rows of fixed blades, the steam has to undergo no fewer than 102 successive partial expansions during its passage through the cylinder.

**Steam Economy**

Except for a few of the larger rows of blades at the outlet end, all the blading of the h.p. cylinder is of the Parsons "end-tightened" type. Both fixed and moving blades are provided with sharp-edged overhanging nibs which are almost in contact with the foundations of the blade row. This type of blading secures the necessary sharpness of the blade tips, so that the blading cannot be damaged by contact due to vibration of the turbine or distortion of the casing. Such blading is invariably employed for the high-pressure portion of Parsons turbines, where the density of the steam is sufficient to make the control of leakage important, and where distortion effects are most likely to be encountered. The clearances over the blade tips may be a quarter of an inch or more, while the axial clearance on which the leakage depends may be safely kept down to 0.006 of an inch. As these axial clearances are controllable by an adjustable thrust bearing, they can be maintained indefinitely.

In the remainder of the h.p. cylinder, and throughout the l.p. cylinder, where, owing to the increased volume of the steam, a little leakage is of less importance, radial clearance blades are used. The "end-tightened" blading and most of the radial clearance blading is of the segmental type, shown in Fig. 7, in which the blades and their distance pieces are welded and boxed into groups before being fitted in the turbine.
...
in one of the bearings, and steam tightness is secured by carbon-packed glands. The two rotors are united by a flexible claw coupling, which connects the l.p. rotor to the shaft of the alternator. The governor and oil pump are driven by a worm-gear housed in the pedestal of the h.p. blading. The governor is of the centrifugal type, and acts by controlling the oil pressure in a pilot circuit, allowing more or less oil to escape according to the speed of the turbine. The oil pressure is fed to the bearings, and for the operation of the steam valves, of course, unaflected by the action of the governor. Any variation of the oil-pressure will bring about the immediate closing of both the main stop-valve and the two governor valves, thus ensuring shutting off steam from the turbine. The oil-pressure can be released by the operator at any time if he wishes to shut the turbine down suddenly, and it will also be released by the action of an emergency governor in case of the turbine speed attaining a predetermined value. When the turbine has been stopped in this way, the main stop-valve cannot be reopened until the proper oil pressure has been restored by the auxiliary oil pump.

There are two governor valves, one of which controls the admission of steam to the belt A until the most economical load of the turbine is reached. After this point, the second valve opens automatically and allows live steam to enter the belt B, thus short-circuiting the first section of blading and increasing the turbine output. The two remaining belts are for the extraction of partially expanded steam from the turbine for feed-heating. Altogether four tappings of steam are taken for this purpose, which is thus raised successively to a total temperature of 310 deg. Fahr. before passing to the boilers.

**AROUND THE TRADE**

**Novelties Now**

On The Market

The Anglepoise Lamp

POOR lighting in the home or office causes one's work to suffer through eyestrain and fatigue. This can be overcome, however, by using the Anglepoise lamp, which can be adjusted to any position and thrown a powerful beam on to the work only, and not into the worker's eyes. It is sold in various types. There is the clamp lamp which can be clamped into any desired position at a moment's notice, the bracket type for fitting to a wall, etc., or, if desired, it can be obtained on a stand. The lamp is a workmanlike job and has a solid metal base, chromium plated arms and tireless springs for perfect balance. It is sold in various colours—red, green, orange, black, blue, cream and all gold—which is the standard finish. With chromium-plated arms, base and shade it costs £3 10s., with gold arms, base and shade, £2 18s. 6d.; with chromium plated arms and enamelled base and shade, £2 18s. 6d.; and dull black arms and enamelled base and shade, £2 10s.

Pocket Humatograph

WEATHER changes are largely due to the moisture in the air. Perhaps you have a thermometer to tell you how hot or cold it is, but your health and comfort is affected more by humidity than by the temperature. There are two governor valves, one of which controls the admission of steam to the belt A until the most economical load of the turbine is reached. After this point, the second valve opens automatically and allows live steam to enter the belt B, thus short-circuiting the first section of blading and increasing the turbine output. The two remaining belts are for the extraction of partially expanded steam from the turbine for feed-heating. Altogether four tappings of steam are taken for this purpose, which is thus raised successively to a total temperature of 310 deg. Fahr. before passing to the boilers.

**BOOKS RECEIVED**

"Commonsense and A.R.P." By Major-


ONE of the pressing needs of the moment is the adequate protection of the public against air raids. Many schemes have been proposed by the Government, but this book has been specially written for the public to tell them how the wartime remains to provide shelters by making use of the materials at immediate disposal, instead of expending large sums of money on concrete, sandbags, etc. Other subjects dealt with include Air Raid Risks, High Explosives Ideal Shelters, Fire Precautions, First Aid, Decontamination, and Communications. The price of the book is 1s. (by post 1s. 2d.) from C. Arthur Pearson, Ltd. (Book Dept.), Tower House, Southampton Street, London, W.C.2.

"Everyman's Astronomy." By Mary

Proctor, F.R.A.S. Published by The

Scientific Book Club, 246 pages. 2s. 6d. net.

This book, which is written in non-

technical language, contains a fascinating collection of astronomical facts which should make interesting reading for the intelligent layman. As is well known, the author has made a life-long study of astronomy and the subject is dealt with in a very entertaining and lucid manner. Celestial Photography; The Future of the Moon; The Great Meteor Crater of Arizona; and A Photographic Map of the Universe are among the subjects dealt with in some of the seventeen chapters of the book, an important feature of which is the remarkable collection of photographic illustrations.

**NEWNES PRACTICAL MECHANICS.** April, 1939
It is Sometimes Desirable to Change Existing Lighting Schemes by Introducing a New Type of Lamp or General Lighting. This Article tells You How this may be Accomplished.

Fig. 1—A Standard lamp of black and silver design.

Fig. 2—A modern version of the old or drop type candle lamp.

MANY pleasant effects may be obtained in a room by carrying out improvements on the existing lighting arrangements. In some instances it may only be necessary to alter the positions of lamps, obtaining quite a different aspect and colour contrast, whilst at times it is refreshing to completely change the scheme by introducing a new type of lamp or general lighting.

A new 2 or 5 amp electric light point will provide a suitable fitting for wall light or serviceable little table lamp, and although the centre drop type of lighting predominates in most homes, it is quite possible to get over the annoying concentrated glare effect by the introduction of other lamps, reducing the power (wattage) of the centre and balancing up with these other lamps.

Wall lights offer a particularly good approach to even distribution, but it is desirable to have light wall-paper unless very distinct contrast is required, but, failing the use of wall lights, separate lamps can be positioned to give very nearly the same artistic effect. Standard lamps are of two types, the reflecting ceiling type and the more conventional shaded pattern about which we propose to deal.

Apart from the question of clear illumination with even distribution, the secondary consideration is style, and invariably simplicity rules.

Standard Lamp Design

The standard lamp shown in Fig. 1 is a black and silver design, and it will be noticed that the softening effect to the otherwise hard appearance, is accomplished by fitting at equidistant points down the tube, black rings, these serving to relieve or break the monotony of the silver. The shade illustrated is included in this pictorial so that the "contour" question can be exemplified, and although details are not given of this particular style, the data on the construction of another type of adaptable drop or standard shade, given later, will show the methods to adopt should it be desired to make one up.

The base of this standard comprises five separate pieces of wood arranged in accordance with the diagram, Fig. 3, whilst by this method, the four fancy supports are better secured without the unsightly appearance of too many screw heads, these supports serving to strengthen the assembly.

The supporting plates shown in Fig. 5 are made from two sheets of 18 S.W.G. aluminium.

The design should be first of all drawn out on a piece of paper squared to the size of the uncut aluminium plates, then with a scribbling tool the curve can be pricked through on to the aluminium, using the same drawing for both plates. Next a line should be scribbled from corner to corner as depicted, and the plate should then be cut along this line.

Bending the Plates

The resultant triangular sections can now be cut off with a pad saw, the remainder of the curve in each piece being filed down with a half-round file. To bend each plate to obtain the fixing flanges, the bending lines, represented dotted in the diagram, should be scribbled, and a light scoring made along these, bending between two pieces of wood let in to the jaws of the vice.

The drillings should be carried out before bending. Allowance should be made as indicated by "X" for the sinking of each design plate before scribbling the fixing hole positions in the tube flange.

With regard to the base blocks, it will be seen that 7-ply wood is used for the base proper, 5-ply being used for the quarter blocks.

The standard chromium-plated brass tube is to be fitted into the large base, and a hole should therefore be drilled right through this block, but as this base is not provided with feet (although they can be fitted if desired), the flex lead from the socket will have to be taken through a 4 in. diameter hole, drilled into the tube near the base.

Now a final word on the decorative rings and assembling, the rest of the detailing being self-explanatory from the diagrams. The sleeves are to be held in position by
grub screws, but as the exact position for these rings is optional, drillings have not been included for the grub screws in the brass tube. Dowel wood or thick ebonite tubing cut to the approximate proportions shown serve admirably, and in the case of wood, it should be possible to obtain a really good finish with glossy paint or enameled. After fitting the sleeves, the light socket assembly should be wired and screwed to the tube as shown in Fig. 7.

Switch Socket Mount

The switch socket mount "R" is fashioned from a piece of 18 S.W.G. aluminium, being drilled for 4BA clearance at "P" in each flange "F." A 4 in. hole should be made centrally at "T" for the fixture of the switch socket, this allowing the threaded portion "E" to be passed through and secured by the flex clamp sleeve as shown.

Short 4BA round-headed screws clamp the switch socket mount to the tube by the two 4BA tapped holes "O" after wiring up.

The base assembly can next be attempted, fitting each design plate 1 in. flange into each recess with short countersunk wood screws. When the tube is fitted, the quarter blocks Fig. 3 (a) automatically centre themselves, but it will be necessary to adjust the relationship of the base corners, thus a trial assembly will be advisable at this point to mark off the hole positions in the base block, for fixing the quarter blocks by well countersunk wood screws let up through this base.

Three 4BA Csk. hd. (nickel finished) screws are used for fixing each plate and the base can then be completed by painting with two under coats and two coats of black Japan enamel, and finally a piece of baize should be neatly glued to the bottom.

The wiring is quite simple, the only point which requires emphasizing being the inclusion of a third wire in the lead for earthing the metal-work of the lamp. Decorative effect can be obtained either by the use of a silk fringe or silk tassels by the inset (a) in Fig. 6.

For preference the lighting power should be kept below 60 watts for average conditions of use, and the overall measurements should allow the light bulb to be centred well away from the glass and back plate "G," so as to obtain even distribution and prevent effects of overheating.

The flex lead also should be kept well away from the bulb, and although for clarity this is shown as a lead-covered lead in the illustration, it is desirable when possible to pass a flex lead through the bottom of the frame via a rubber grommet. The frame design is made up from brass angle strips "B," these being held in the desired form by a clamping plate "E" of 16 gauge aluminium or brass and 4BA...
THE MODERN MOTOR ENGINEER

In view of the many recent developments that have taken place in Motor Engineering, it has been considered necessary to bring out an entirely new and revised edition of "The Modern Motor Engineer" to meet the demands of the garage manager and mechanic for a practical up-to-date book of instruction on all phases of their work.

BREAKDOWNS ON THE ROAD

A feature of special value is the section dealing with breakdowns on the road. Repairs are treated in great detail, and instruction is given in welding, sheet metal work, machinery and grinding. There is also a section on chassis frame strengthening and repairs.

THE SCOPE OF THE WORK

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with the essential requirements, and it's
very attractiveness depends on its sim-
plity. The assembly illustrated can be
modified to suite individual taste, but as
a guide the following constructional features
are given.

With the curved effect, "E," it will be
found simpler if two sections of identical
pattern are cut from either aluminium or
brass, but brass is preferable so that the
design can finally be soldered. A straight
edge can be obtained simply, and is possibly
the better way, by cutting the whole design
from a single sheet of metal and bending
to the given shape. "B" is a small brass
socket mounting cap which can be soldered
to the side plates, "A," after assembly.

esk, hd. screws, " F," let through clearance
holes in each strip at the base, and screwed
to the given shape. "B" is a small brass
socket mounting cap which can be soldered
to the side plates, "A," after assembly.

The method of interlocking the plates when
forced by soldering to the back tin plate
bracket "A" secured by screws and rein-
forced by soldering to the back tin plate
"C." This back plate should be soldered
down each side of the rear angle strips.
The glass retaining pieces "C" (two only
of which are required) are of tin and
soldered to the back plate as shown. These
glass plates should be drawn to the required
size on a piece of paper for the glazier,
whilst the choice of moulding design can be
made from the usually wide selection.
The method of inter-locking the plates when
fitting, is shown in the inset Fig. 9. There
is just one other important point concerning
the wiring, should lead-covered cable be
used, then it will be necessary to earth the
lead sheathing and the frame of the lamp.

A Hall Lamp
For a simple design of low-power hall
lamp or nursery night-light Fig. 11 falls in

CHEMISTRY FOR AMATEURS
(Continued from page 352)

the metallic sodium.

Supporting we cut a small fragment from a
lump of metallic sodium and fling it into a
basin of cold water, what happens? Imme-
diately the sodium touches the water, it
melts, assumes the shape of a small spherical
globule and swims rapidly around the
water with a persistent hissing noise, eventu-
ally disappearing completely with a
miniature flash of flame.

In this spectacular instance the sodium
is combining with some of the water atoms,
forming a substance called sodium hydro-
xide and liberating hydrogen gas. The latter
e escapes into the air, but the sodium
hydroxide (better known as " caustic soda ") dissolves in the water, imparting to it a characteristic slimy feel.

Here again, in this experiment, we have
witnessed a chemical action, whereby a
metal has combined with the oxygen and
a portion of the hydrogen contained in
water, and has set the remaining hydrogen
free.

Chemical Elements
Finally, in our introductory article of
this series, we come to the consideration
of what is meant by the chemical " ele-
ments." These are, as the term itself
implies, elementary bodies which cannot,
by chemical means, be further simplified.

The iron sulphide which we made in the
previous experiment is obviously not an
element, for we saw that it contains both
iron and sulphur. Neither, too, is magne-
sium oxide an element, since that compound
contains magnesium and oxygen.

However, the oxygen, magnesium, iron
and sulphur contained in the above com-
pounds cannot by any known chemical
means be resolved or split up into simpler
substances. Iron is iron through and
through. Sulphur contains nothing else
but sulphur. Magnesium is simply mag-
nesium and nothing else.

Hundred Elements
For this reason, iron, magnesium, sulphur
and oxygen are called " elements," since
they are elementary materials and cannot
be split up into anything simpler.

There are nearly a hundred of these
"elements," each totally distinct from
the other, each containing nothing but itself.
These elements are the "bricks" of
the chemist, the materials from which, by
dint of various combinations, he makes up
all his wonderful compounds. They are
Nature's own bricks, too, for all material
things are made up of one, two or more
elements.
CONJURING WITH DICE BLOCKS AND CUBES

By Norman Hunter
(The Well-known Conjuror of "Maskelyne's Mysteries" Fame).
Further Articles on the Secrets of Conjuring will appear Regularly and Exclusively in this Journal.

Fig. 1.—A solid cube fitted with a shell which exactly resembles it. One side is missing, enabling it to fit over the solid cube and the inside of the shell is painted dead black.

Method of Operation

The performer begins by having the shell inside the cover, where it appears to be part of the cover itself. The solid cube is thrown up and caught, rapped, and if desired given for examination. The cover is then dropped over to show that its purpose is to hide the cube. The cover is immediately removed but the shell is left behind on the solid cube, and the cover may then be examined. Cube and shell are then placed in a hat while a tray is shown. The cube is then taken from the hat and placed on the tray. Actually only the shell is removed, the solid cube remaining in the hat unknown to the audience. The solid cube is then tipped out of the hat, falling with a convincing thud on the floor. There are many variations and improvements to this simple method. One is shown in Fig. 2. Here the shell has a hinged top and the cover is twice the height of the cube. Exactly the same procedure is gone through as before but this time when the shell is vanished the performer may thrust his hand through shell and cover, the hinged top of the shell being swung back against the inside of the cover as shown in Fig. 3.

Another Effect

With this apparatus another and totally different effect can also be performed. A plain black cube is used but the shell is spotted with white spots like a regular die. At the outset the shell is in the cover with its lid open and the audience may be allowed to look right through the apparently empty chimney. The solid cube is shown and the cover placed over it, the hinged top of the shell being prevented from falling either by a little catch at the top of the cover or by working the trick on a tray very slightly tilted towards the hinged side of the shell. A number of white paper discs are now dropped into the chimney and, of course, fall upon the solid cube. The hinged top of the shell is now allowed to fall down and the cover is lifted, exposing apparently the same block now equipped with the white paper discs in the right places to make it a proper die.
In this case, the shell is not at any time cause a die and an orange to change places. Vanishing Orange

Another variation of the shell and cover is in having the cover open at both ends but the same height as the cube. The top of the shell is hinged with tape, sufficient play being allowed for it to fold right round outside the cover. The inside of the lid is decorated to match the outside of the cover. The vanish of the shell by this method is shown clearly in Fig. 4.

Modifying the Shell

Fig. 5 shows a modification of the shell, used with a very small die. In this case the shell has three sides only and is of a different colour from the solid die. The effect this time is a change of colour. Shell and die are held so that only the three sides of the shell can be seen, the hands being otherwise obviously empty. By stroking the die with the free hand, the shell is nipped off in the curl of the fingers and the die shown to have changed colour. The shell is disposed of behind some object on the table—in the act of picking up the wand to rap the die and prove it solid.

Another use for the box and shell is to change the apparently solid cube into a number of flags. This method is shown clearly in Fig. 4.

Vanishing Orange

Sometimes this apparatus is used to cause a die and an orange to change places. In this case, the shell is not at any time placed over the die but is, at the start of the trick, inside the box. An orange is dropped into the box which is closed, reversed and opened and the shell die with the orange inside is tipped out. The solid die meantime has been changed for a duplicate orange in some other piece of apparatus. Another use for the box and shell is to change the apparently solid cube into a number of flags. In this form of the trick the die shell is usually supplied with a sixth side which is hinged and opens with the lid of the box so that no reversing has to be done. Figs. 6 and 7 will make clear the details of these methods.

A very popular trick with a box and a die is that known as the sliding die box. In this effect the die is placed in a box having two marked faces front and back of each. The performer says that he will make the die vanish and proceeds to show that the box is empty by opening first one door and then another. The

The Conjuror begins by showing the cover empty. He then puts it down over the hidden block and takes away those in front. The borrowed article having been put into the lift box, this is dropped into the cover from the top. The sound of it striking the block already inside being similar to the sound the audience would expect to hear if it struck the tray, everything appears to be quite fair. The three visible blocks then go in on top of the lift. As the lift is already one block up, the apparent rise is simply a matter of taking off the top block when the cover is lifted (see Figs. 11 and 12). This is then allowed to slide gently to the bottom of the cover, which is put on the tray and the blocks again dropped in. This time a block goes in first, then the lift and finally the other two blocks. Apparently the lift is in the position at which the last stage of the trick left it, that is to say one from the bottom. Lifting the cover and with it the top block, however, reveals, of course, that the lift is now two blocks up. The final move is a repetition of the others. The extra block is got rid of into a bag behind the table or into some other convenient receptacle and everything may be freely shown. If the cover has not been prepared with a hole for lifting the block, all the articles can, of course, be examined.

I have performed this trick a number of times at Mastelyne’s and got a great deal of applause, however, hear the die sliding from one compartment of the box to the other and think they have guessed the secret. They ask for all four doors to be opened. At first the performer pretends not to understand and the excitement is worked up until finally all four doors are opened together and the die has vanished.
of fun out of it by persuading the audience to sing out "Up she goes," when the lift is supposed to rise.

Stock of Blocks

Another trick with a stack of blocks consists of having the blocks numbered from 1 to 4 and making them re-arrange their order to correspond with a similarly numbered set of cards. This is managed by having a shell to each block. The shells are open top and bottom and have numbers on them exactly like the blocks. The shells may be removed and the blocks alone exposed. (See Fig. 13.)

The performance of the trick resolves itself into arranging the blocks with the figures in a certain order and fitting the shells over them in a different order. By removing the shells the numbered blocks appear to change places. The blocks are then re-arranged and the cover put on, being exposed to the audience once more. A further change is thus effected by exposing now the backs of the blocks which are numbered differently from the fronts. The backs of the blocks being also numbered differently from the fronts, it will be seen that it requires only a careful planning of the movements and perhaps a note to aid the memory to enable the conjurer to keep rearranging the set of numbered cards and make the blocks always re-arrange themselves to correspond.

Letters on Blocks

The same trick is also performed with letters on the blocks, the letters in this case forming words when rearranged. The usual letters employed are T, S, R and A. With these various words such as ARTS and TARL can be formed and the climax is reached when the performer invites the audience to say puts an end to the trick.

Yet another trick which has recently found favour.

The shell is raised by having a shell to each block. The block is placed in the frame and a length of ribbon is threaded through both by means of a long bodkin. The conjurer pulls the ribbon backwards and forwards through block and frame to prove that all is as it appears, then the ends of the ribbon are given to two people to hold. While the ends are being held the magician quietly removes the block from the frame and the audience see that it comes away free of the ribbon, yet all the apparatus can be examined.

How it is Done

There is no trick about ribbon, block or frame, but the frame is lined with black velvet for ease of working. Prior to showing the trick a loop of black thread is fixed round one of the holes in the frame, on the inside, with wax. The loop is then laid along the inside of the frame and out through the opposite hole as shown in Fig. 14. The projecting end of the loop is usually knotted so that it can be found and gripped easily.

The ribbon is now, in front of the audience, threaded through frame and block as shown in Fig. 15. The position of the thread is shown by the dotted line. The ribbon is pulled backwards and forwards a few times. Finally after it has been pulled through side A, where the loop of thread encircles the hole in the frame, until only a foot or so hangs out at the other side, the conjurer grips the ribbon at side B but the knotted end of the thread loop. This he pulls vigorously. The loop draws the ribbon down between block and frame and out at the hole in side B (Fig. 16). To the audience the ribbon seems simply to have been pulled farther through the block and frame but actually it is now clear of the block and running round the frame. The thread loop is dropped to the floor unnoticed.

The trick is now done and the conjurer is in a position to lift the block free of frame and ribbon, when of course the apparatus may be given for examination, as no trace of the method used remains.

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NEWNES PRACTICAL MECHANICS

April, 1939
Over 110 clubs are now affiliated to the S.M.A.E. This encompasses a membership of several thousand, and it is hoped that by the end of this year all of the important clubs will become affiliated.

The Wakefield Fund

The Wakefield Fund at present stands at something under £100. All clubs are therefore asked to organise socials and other functions, and to donate the profits towards this fund. Several hundreds of pounds will be necessary to send the team abroad, and we have excellent prospects of bringing the cup back.

Records Passed

The S.M.A.E. have passed the following records: Indoor fuselage, Mr. L. A. Woodthorpe, 2 mins. 30 secs., and R.O.G. Mr. R. W. M. MacKenzie, 3 mins. 35 secs

New Competition

MESSRS. CATON, LTD., have offered a S.M.A.E. a trophy to be put up for annual competition. The first prize in connection with it will be 5 guineas, second 3 guineas, and third, 1 guinea. The competition is for the best flight of the year made either in, or out of, S.M.A.E. competitions.

The only stipulations are that the flights must be timed by S.M.A.E. timekeepers, and the competition is open for rubber-driven models only, and such must conform to the S.M.A.E. fuselage formula. The competition will be open any time during the 1939 Competition Season. The trophy itself will take the form of a barometer with shields on the base upon which to engrave the names of the various winners.

Vice-President of the S.M.A.E.

Mr. J. T. C. Moore-Brabazon, who has been associated with aircraft from the start in this country, has accepted the Vice-presidency of the S.M.A.E.

S.M.A.E. Headquarters

It is likely that the S.M.A.E. will be provided with office accommodation at the new headquarters of the Royal Aeronautical Society.

New S.M.A.E. Officials

The following are the S.M.A.E. officials for 1939: President, Dr. A. P. Thurstoun; Vice-Presidents, Duke of Richmond and Gordon, Major C. E. Bowden, C. R. Fairey, A. S. Hoilberg, B. R. Johnson, Percival Marshall, and Geoffrey Smith.

At the A.G.M., at which these appointments were made, it was proposed that Commander Perrin, Secretary of the Royal Aero Club, Captain Pritchard, Secretary of the Aeronautical Society, and Colonel Moore-Brabazon be invited to become vice-presidents. The Chairman is Mr. A. F. Houlberg, and vice-Chairman Mr. L. J. Hawkins; Hon. sec. Mr. E. H. Cosh, who has been elected a fellow of the S.M.A.E. and given an honorarium of £20. The Hon. treasurer is Mr. L. J. Hawkins; Competition secretary, Mr. J. P. Smith; Technical secretary, Mr. R. M. Bullock, and Press secretary, Mr. York.

New Method of Construction

An ingenious method of constructing model aeroplanes has been evolved by the Authentic Model Co. of 44, Leigh Street, Warrington. A tube is used, this running the entire length of the fuselage. The various bulkheads are threaded on to this thus ensuring perfect alignment. It is claimed that this method is lighter and stronger than the usual system. The tube also acts as a motor guard and protects the model from damage which would otherwise be caused by a breakage of the rubber motor. The range of models offered by this company includes the Miles Kestrel Trainer, and the Percival Mew Gull, both to a scale of ½ in. to the foot. This range will be increased shortly. The kits include all the necessary materials and blueprints.

The Kestrel kit costs 5s. and the Mew Gull 3s. 6d.

New Lines From Bonds O' Euston Road

BONDS O' EUSTON ROAD, LTD., list in their very complete Model & Experimental Engineering Handbook, the 1939 edition of which costs 6d., a number of new model aircraft lines. This company not only stock all the necessary parts for making all types of model aeroplanes, and has one of the completest stocks of model engines and parts in London, but it also supplies scale model kits. A new range in the latter are the Aeromodel Kits which include the Hawker Fury, the Miles Magister, the Foster Wicko, the Hawker Hind, the Tiger Moth, and the Leopard Moth. These range in span from 14½ ins. to 18½ ins. and the prices vary from 3s. to 6s. A cheaper line of kits of non-flying models are available at 9d. each, and include the Aeronca, China Clipper, the Curtiss Condor, the Hawker Fighter, etc., etc. Petrol engine enthusiasts will be interested in the Ohlson and Syncro Ace engines shown in the catalogue, and the kits of parts for petrol-driven models. Another item for the power-engine enthusiast is the stainless steel stranded wire. A further new line

Current News from the World of Model Aviation

The "Privater" petrol-driven model made from a Model Shop kit. The kit with all the cut out costs £3 15s. 6d. The engine which is a Syncro Special costs £3 7s. 6d. complete with airscrew.

Mr. L. Wilson of South Africa has made this model from instructions given in our May, 1934, issue, and Gordon, Major C. E. Bowden, C. R. Fairey, A. S. Hoilberg, B. R. Johnson, Percival Marshall, and Geoffrey Smith.

The "Privater Junior" also supplied by the Model Shop. It has a 4ft. 6in. wing span and is powered by a Trojan engine.
is the H.O. propeller in satin walnut, and light balsa wood, in diameters ranging from 8 ins. to 14 ins. There is also a compressed air engine plant. A copy of this catalogue should be in every modeller's hands.

**Flying Scale Model of the Hawker Hurricane**

Of the illustrations shows the realistic lines of the model Hawker Hurricane marketed by Aeromodels, Ltd., of 48, Lark Lane, Liverpool, 17. This has a wing span of 22 ins., and the very complete kit costs 5s., by post 5s. 6d. Their new lines include the Fairy Battle (27 in. wing span), and the Westland Lysander (25 in. wing span). The kit of the former costs 5s. 6d. and the latter 5s. The well-illustrated catalogue gives details of a number of other kits, including one for the Aero Lark duration model, the kit for which costs 5s. It is of 24 in. span and weighs 14 ozs. The firm supplies balsa, elastic, tissue, piano wire, screwdrivers, etc.

**New Frog Model**

Lines Bros., Ltd., are introducing the Frog Vickers Wellesley which is supplied in the winder box at 3s. 6d. and the flying construction kit of the Spitfire at 2s., and a similar kit for the Vickers Wellesley at 2s. 6d. They are also marketing the New Penguin non-flying scale models of the Hawker Hurricane, the Monospar Ambulance, the Westland Lysander, Blenheim Bomber, the Blackburn Skua, and Vickers Wellington.

**Hamley's New Lines**

Hamley's stock not only kits of parts and complete models, but all of the necessary materials and accessories including petrol engines. Their model aircraft department is in charge of a practical aeromodeller. Two new lines which I notice are the Gulfstream Glider, and the 32 in. wing span Lysander. The Gulfstream Glider is of 60 in. wing span, 36 in. long, weighs between 6 and 7 ozs. and the complete kit costs 17s. 6d. This includes all bulkheads ready cut out and slotted, all wing ribs, and numerous other ready-made parts. Also cement, dope, covering, strip wood, and blueprints. The glider complies with the S.M.A.E. rules for the King Peter Cup, and other contests. The model has an excellent performance, and it is of Messrs. Hamley's design. The construction is entirely of balsa, and is built on the Monospar system. The Lysander is complete in almost every detail including cabin arrangements, ailerons, elevators, and engine. When finished with a camouflaged dope a perfect replica of the prototype results. The bulkheads are cut to shape and slotted to take the springers. The model has a duration of 30 secs. It weighs 4 ozs. and the kit costs 15s. 6d. I notice that they are marketing the Monarch Petrol Model. This is well designed, the engine being totally enclosed. It somewhat resembles the Miles Hawk. The motor used is the Gwin aero 7 c.c. with outside exhaust, and the engine cowl is detachable. The kit includes wheels, timer, blueprints, dope, covering, bulkheads, and many of the parts are finished and ready for use. The machine is of 84 in. wing span, weighs 4 lbs. and the kit costs 5 guineas.

**Model Aircraft Supplies**

Model Aircraft Supplies Ltd., of 171, New Kent Road, London, S.E.1, have a most complete range of petrol engines and kits, the smallest model being the Buccaneer "48." This model, as its name implies, has a wing span of 48 ins. and is driven by the Ohlsson "23." The price of the kit including dopes and cements, with full-size drawings and printed parts, is £1 Is. 6d., carriage paid. The Standard Buccaneer with a wing span of 54 ft., chord 10 in., when in flying trim, weighs approximately 25 lbs. The price with dope and cement is 32s., carriage paid. The Berkeley Super Buccaneer has a wing span of 7½ ft., chord 14 ins., and a total weight of approximately 51 lbs., complete with dope and cement. 42s., carriage paid.

Both these latter two models are powered with the Brown Junior engine. The price of this engine is £3 2s. 6d., while the Ohlsson "23" is £4 2s. 6d. All three models are similar in appearance and have the same lines as the model illustrated.
THIS season's commercial receivers will feature mainly the push-button or dial method of tuning, and will consequently appeal to the non-technical members of the family. The idea is not new, as we have already explained, but the housewife who is at home all day will undoubtedly find that a receiver in which the operation of a switch or a button selects a station, without the problem of finding the right spot on the dial, is not only a time-saver, but also an advantage. Many housewives fail to use the standard domestic receiver as often as they would prefer, simply because they are rather confused by the number of controls, or are uncertain just how to set the tuning indicator.

Fortunately, it is a simple matter to follow this point, however, as should a new switch be operated without the former one being set back, the station will not be received and a glance will show that more than one switch is in the “on” position. For a simple receiver the ordinary on-off or two-point switch may be used, and naturally with such a receiver only two or three stations will be heard. With a more ambitious receiver, where about half a dozen stations or more can be tuned in, more than one tuning circuit will be in use, and thus multi-point switches will have to be used. Bulgin four-point toggle switches, type S.88, will enable four circuits to be switched, but care will have to be taken to avoid interaction where an H.F. and detector stage are controlled on one switch. Where three or more circuits are to be operated, or where the risk of interaction is to be avoided without modifying the wiring, the multi-contact rotary type of switch should be employed, and this will actually enable a neat automatic receiver to be built up on the lines of that illustrated in Fig. 1. This is a five-station set of the superhet type, with a volume control as the only additional panel device. The set is switched on and off by the right-hand control and the appropriate station selected by a ganged rotary switch of the Bulgin 8.154 type.

Circuit Arrangements
To make the use of these switches perfectly clear, we show in Fig. 3 the method of use, and in each case it should be noted that a switch or a contact for “manual” control may be provided, so that the normal tuning condenser may be retained for normal operation. In Fig. 3, two ordinary on-off switches are shown, the one marked “M” being used for manual operation or, in other words, switching in the ordinary variable condenser. This is a simple detector circuit and the reaction control would be brought out as a panel control merely to increase the strength of a weak station should it be required. The second switch brings into circuit an ordinary preset condenser with a maximum capacity of 0.005 mfd or 0.003 mfd, and this should be adjusted to one of the stations it is required to hear. The lock-nut attached to the adjusting screw of the pre-set should be

Buttons or Switches
The manufacturers are now able to supply complete push-button units which may be built into a receiver. The constructor can, however, make use of switches for station selection, and whilst these will operate in just the same manner, they have the disadvantage that when a change of station is needed the switch in use will have to be returned to its original position before the new switch is operated. This is the only drawback to the use of standard toggle switches. It is not a difficult matter to follow this point, however, as should a new switch be operated without the former one being set back, the station will not be received and a glance will show that more than one switch is in the “on” position.

Suggestions For Converting Existing Receivers For The Automatic Selection Of A Few Stations
When the station is accurately tuned, so that it will not move and upset the adjustment. A similar pre-set and associated switch should be provided for each station which can be obtained, and all the switches may be placed in a neat row on a small bakelite or ebonite panel inset into the cabinet on the lines shown in the cover illustration this week. If desired, to simplify matters the manual control switch may be placed apart so that it will not be overlooked when it is desired to change from manual to automatic.

Switching Several Circuits

In Fig. 2 a two-circuit device is indicated, and the Bulgin S.88 switch is shown here. Although the two pre-sets for each station are here shown in a line, they may, of course, be placed anywhere on the chassis, preferably close to the coils which they tune, and the leads run by the most direct route to each condenser. Some shielding may be found necessary, but where possible it should be avoided, as it will raise the capacity and, in some cases, may prevent the condenser from tuning low enough to obtain the required station. A similar scheme to this may be employed in a simple superhet, which will require two or three tuned circuits, but in this case the oscillation tuning condenser must be carefully placed, as it must not be capable of interaction with the remaining circuits.

Change-over Switch

It may be thought desirable in some districts merely to provide two stations for normal use, say the National and Regional. In this case the matter is simplified and a simple single switch of the change-over type may be employed. In Fig. 4 is seen how such a switch should be wired for a single circuit of the type indicated in Fig. 3, one pre-set being connected to each pole of the switch. In this case, of course, manual control is not available unless a separate on/off switch is used to bring into action the change-over switch, and this could be effected by a separate switch as shown in Fig. 5.

Plug and Socket

There is a further scheme which will avoid the necessity for returning a switch when a change is desired and which will ensure that all difficulties are removed. This consists of the plug-and-socket method and it is shown in Fig. 6. This scheme may be used to prevent unauthorised use of the set. For this, ordinary single-circuit jacks are used, and these cost slightly less than the ordinary toggle switches. Used in conjunction with them is an ordinary jack plug, and this should be provided with a short-circuiting wire, and the jacks should, of course, be arranged in a row fairly close together, as in the case of the switches. One contact on each jack should be joined to a condenser and the frames of each jack connected to earth. For manual control a separate jack may be provided and wired as shown in Fig. 7. The jack may be left in any plug, according to the station being received, and if it is desired to safeguard it against loss, two short lengths of flex may be attached in place of the shorting wire and these may be anchored inside the receiver at a shorting strip of metal.

At least one of the ideas mentioned should be found applicable to the various types of receivers now being used by our readers.

In view of the fact that the pre-set may work out of adjustment due to vibration or atmospheric conditions, a good plan is to mount all of the condensers on a strip in such a position that the adjusting screw may be easily accessible through holes in the cabinet or panel. Then an ordinary screwdriver may be used, as desired, for readjusting those which require it. Furthermore, although a reaction condenser may be brought out to a panel control, this may be avoided by fitting further pre-sets in the reaction circuits and adjusting these for each station, switching them by using double-pole or ganged switches. This idea does not, however, work very well with ordinary battery receivers owing to the variation required as the H.T. battery becomes discharged.

When using twisted feeders they should not be tuned, as standing waves on the feeder will produce excessive losses. If it is desired to tune the feeder, then the two wires should be kept parallel throughout their length. If, however, the feeder has to turn the corner of a house or make an angle for any reason, or if it has to run close to a large earthed body, then the twisted arrangement should be employed.
AROUND THE TRADE—

In The Model Railway World

April, 1939

NEWNES PRACTICAL MECHANICS

389

A realistic "00" gauge layout recently constructed for a customer by Multi-Models, Ltd.

Model Railway Exhibition

A s last year, this year's exhibition will be at Central Hall, Westminster, and will be from April 11th to April 15th. The same extensive space has been booked and visitors will be able to examine the exhibits in comfort. The exhibits not shown working, passenger-carrying track (free rides for all) and trade stands will be staged on the ground floor, and the many working track layouts and the cinema will be found in the basement, together with the lounge and refreshments.

There will be a greater number of working track layouts than last year, and many additional phases of railway operation will be demonstrated. Many of the exhibits are produced by members of The Model Railway Club Ltd.

Models of signal cabins, buildings, locking frames and signals will be exhibited, and hardly any object in connection with the operation of our railways will fail to be represented by one or more models.

The cinema (entrance free) will show a selection of films dealing with models and real railway subjects, and for the interest of the ladies and non-technical visitors, there will be films of general and comic interest.

Model Railway Accessories

The sketches on this page show a number of model railway accessories marketed by Bond's O' Euston Road. An interesting gadget is the nail presser (2s., postage 3d.), which enables you to lay track twice as fast, and you will not hit your fingers or the chair by mistake. Another advantage is that it is silent in operation. All you have to do is to place the nail in the chair hole or in the nail presser and simply press. A new all-metal nail presser (2s. 6d., postage 3d.) for Gauge "00" has just been produced in addition to the one previously mentioned which is not suitable for "00" gauge. Also shown in the sketches are some manganese bronze stamped main horns (4d. each), and tender springs and bogies; these are correctly equalised, and allow for realistic riding of the coach, the bogies being constructed with free running bearings running in brass side frames. The coaches are fitted with correct scale vents on the roof, flexible corridor connections, couplings, and are hand painted and lined.

This firm stock a large range in this gauge and recently they had a £400 order to supply a complete railway system in miniature to one of their customers. As well as a large amount of rolling stock no fewer than 23 locomotives were included in the layout.

All Metal Scale "00" coaches

HAMBLINGS have now introduced a new range of all metal "00" coaches that are to correct 4 m/m scale, and have many interesting and new features that are introduced to "00" gauge for the first time.

The coaches are all metal throughout, and have machine cut windows; these are correctly glazed with the top ventilating sections as can be seen on the photo produced herewith. The greatest innovation is the introduction of correct scale spring buffers that really do depress most realistically; this overcomes to a large extent the usual difficulty of buffer locking when used on sharp curves, as a result in the past it has been necessary to increase the amount of gap between coaches to prevent the buffers coming together on curves. On straight track a very much out of scale distance between coaches gave a bad appearance.

The next interesting feature is the spring horns (6d. each). These hot manganese bronze stampings are extremely clean and true and a touch of the file is only needed to fit the axle boxes, no other fitting or machining being required. As well as an extensive range of model railway accessories this firm also market scale castings for various types of locomotives.

Multi-Models

READERS interested in the popular "00" gauge should pay a visit to the extensive showrooms of Multi-Models Ltd., 10-11 New Burlington Street, Regent Street, London, W.1.

(Continued on page 399)
FANTASY is a magazine of popular fiction in the H. G. Wells-Jules Verne tradition—a magazine to stimulate the imagination in that most fascinating of all fields, the future. What Wells foresaw—the moving stairway and television—has come to pass. Verne’s “Round the World in Eighty Days” has been reduced to less than a week. FANTASY’s stories of the aircraft of to-morrow, of wars to come, and of scientific achievements of the future... these, too, are all within the bounds of possibility. FANTASY will entertain you as no other story magazine.

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THE TROJAN BEAM
CLIMATICA
VALLEY OF DOOM
VAMPIRE OF THE VOID
PEOPLE OF THE DEEP
THE DISCOVERY OF NIL

Special Science Feature
TERMINAL IN SPACE

Of all Newsagents and Bookstalls, or by post 1/2 from The Publisher,
OF all the mechanical and civil engineers who graced England in the spacious times of the last century, William Fairbairn was one of the most famed, yet, at the same time, the least spectacular. For Fairbairn, although he possessed inventive gifts which he used to the full, contented himself more with the least spectacular.

His mother, indeed, was a woman of great beauty who traced her descent from a noble Scotch clan. Her industry, it would seem, was amazing, for not only would she go out and till a portion of the family land, but she would also spin wool for the use of her numerous family and weave it up into articles of clothing, sheets and bedding.

From his mother William Fairbairn learnt his first lessons of industry and perseverance and, as he himself remarked, he owed to her the habits of sustained effort and forcefulness of purpose which so characterised him in his adult years.

Bad Times

Some years after Fairbairn was born, the family fell upon bad days, which resulted eventually in it having to remove farther north into Ross-shire in which county Fairbairn senior, aided by his brother, leased a farm for the purpose of sheep rearing. On this somewhat inhospitable farmstead, William Fairbairn lived his early days. To some extent, he was allowed to grow up a wild youngster, without any systematic instruction whatever. But, curiously enough, this semi-isolation seemed to serve him a good purpose, for he occupied his ample spare-time by constructing all sorts of mechanical toys with the aid of a small knife, a hammer and various odds and ends of wood and nails which he found lying about.

Afterwards, he was sent away for a time to live with an uncle who was a schoolmaster and under whose strict and spartan tuition he learnt the rudiments of arithmetic, bookkeeping and land surveying.

Owing, however, to the dire necessity of earning some pittance in order to contribute to the family's funds, Fairbairn, in August, 1803, was dispatched to Kelso, his birth-place, and there given work as a stonemason's boy. He remained at Kelso for only a few weeks, however, a rather serious accident which he met with in the mason's yard compelling him to give up his newly-found work.

Back, therefore, young William returned to his father's farm up in Ross-shire and, indeed, began to look black for the Fairbairn family. But, as usual, it was only the darkness before the dawn, for, before long, Fairbairn senior obtained a position as Steward of a farm belonging to the owners of the Percy Main Colliery, near North Shields. William, then fourteen years of age, was given work at the colliery and, in the following year—1804—he found himself bound as apprentice to a Mr. John Robinson, the millwright and engineer of the colliery.

His First Job

Young Fairbairn took up his new duties enthusiastically and almost passionately.

For years William Fairbairn worked away industriously in the colliery millwright's shop. Then, after his lengthy period of
Fairbairn Comes to London

Whether it was the impossibility of marrying and settling down with Dorothy Mar which unsettled him there is no means of telling. Nevertheless, the fact is that, after he met her, Fairbairn became more and more dissatisfied with his job at the Percy Main Colliery, North Shields, a dissatisfaction which grew so much that eventually it drove him out of the town and resulted in his embarking at North Shields on a coal boat bound for the Port of London.

On December 15th (or thereabouts) 1811, Fairbairn arrived in the east end of London accompanied by a fellow workman named Hall. Once in London, they possessed the sum of six pounds, their total and combined savings, and they put up for the night at a lodging house near the dockside.

Six pounds—even in the year 1811—did not last long between two hungry men seeking work in London. Before many weeks had elapsed, the two wanderers found themselves on a wet shirt, and two and with still no work in sight. Hogg reproached Fairbairn bitterly for ever thinking of the cities of Manchester and Salford. Indeed, remain cheerful and to rouse the flagging spirits of his companion.

Work At Last

Eventually the two did get work in London. It was at a ropery which had been newly built at Shadwell, and here Fairbairn had obtained an engineering post. He was a boy in a working day of twelve hours. Subsequently he obtained a post as a mechanic with the firm of Fairbairn and Lillie, Manufacturing Engineers.

But it was not all plain sailing yet. Fairbairn was only afforded to employ a single workman, and, to make matters worse, they had practically no machinery or equipment for their newly-established business. One prospective customer, indeed, before placing a valued order with Fairbairn, insisted in inspecting the latter's premises in order to satisfy himself that his partners were competent to undertake his work. Fairbairn, managed to assure the over-inquisitive customers of his ability to carry out his orders, and, by five o'clock in the morning until nine for several weeks on end, the "firm" managed to complete its first big commission within the appointed time.

Rapid Progress

That order provided the nucleus around which the firm of Fairbairn and Lillie subsequently grew. Within five years the firm had acquired stock and machinery amounting to £5,000 in market value and they were able to take reasonable premises in which to carry on business. Six years later the firm found itself with a cash balance of £30,000, whereupon Mr. Lillie withdrew from the business, leaving Fairbairn sole proprietor of the works.

The departure of Lillie from the firm appears to have spurred Fairbairn to further efforts. The opening of the Manchester and Liverpool railway greatly alarmed the English canal proprietors, who found themselves flung out of business by the railroad at an ever increasing rate. As they approached Fairbairn at his Manchester factory, the result being that he designed and constructed a small iron steam vessel for canal use, which craft he christened the Lord Dundee.
"MOTILUS" PEEPS INTO THE
MODEL WORLD

"Motilus"—Our Model Fan—Has Been Very Busy
with his Camera Again, and Among his Incursions
into the Model World was a lightning visit to the
Toy Section of the British Industries Fair

The boiler is filled three parts with water,
and an extension chimney, which attaches
to the ordinary engine chimney, is fitted.
This is for the auxiliary blower (either a
foot bellows or electric fan). The fire is laid
of fine wood, adding thicker wood until the
steam pressure is 15 to 20 lbs.

The boiler is filled three parts with water,
and an extension chimney, which attaches
to the ordinary engine chimney, is fitted.
This is for the auxiliary blower (either a
foot bellows or electric fan). The fire is laid
of fine wood, adding thicker wood until the
steam pressure is 15 to 20 lbs. Now the
ordinary steam blower (2) can be brought
into action and the auxiliary blower dis-
pensed with. Coal is added to the fire until
the pressure is brought up to 100 lbs., which
is the pressure at which the pop valves are
set to blow off.

Ready for a Run
Now the locomotive is ready for the run.
The driver opens the regulator very steadily.
If he jerks, the automatic release cocks on
the cylinders cannot get rid of the surplus
water quickly enough, and a shower will
emerge from the chimney. Nevertheless off
she goes, and the driver can adjust the
regulator to gain the speed he requires.
When mounting a gradient the locomotive
will need more steam so he opens her out;
while downhill, speed is kept up by her own
momentum. Also if the locomotive has
been correctly stoked she will make steam
instead of losing it, but never run with the
fire-box door open.

It depends on the length of the run, how
he will use the injectors (7), but if it is of any
length and the boiler requires feeding, the
water is always turned on first. Before you
open the injector the water must be over-
flowing from the overflow pipe. Then
simply open the steam valve shirkp and the
Some of the latest Penguin series of model aircraft

water will immediately be picked up to feed the boiler.

Some engines are fitted with steam brakes and some with vacuum brakes, but in either case the brakes operate by a lever on the left (9), and the reversing lever (10) pushes forward for the forward gear and backward for the reverse gear.

Model Ships

There is a revival this year of the novelty model ship enclosed in a bottle. The threemasted clipper ship shown on another page was made for Messrs. Bassett Lowke by an old seafaring man who lives on the coast, and keeps sea store in his life as he models gallant ships of the last century, when sail was still supreme. I examined one of these novelties closely and the ship is exceedingly well made, with all sails set, and mounted on a blue, foam-topped sea. An unusual setting for a Haig's dimple bottle!

Model of Whisky Still

Alcohol is not often combined with model-making, but this week I saw another instance of this—a model of an Irish Pot Still Distillery which was being renovated for the New York World's Fair. This model was first made for the Wembley Exhibition of 1925, and was then shown at the Glasgow Empire Exhibition last year. Mr. Twining, who made the model, told me some interesting facts about the distilling. Irish pot still whisky is produced in two parts—brewing and distilling. In the first brewing process, ground malt, barley, wheat, and oats are mixed with hot water in mash tuns and the resulting saccharine solution of wort is drained off, the grains cooled and run into fermenting vessels, where yeast is mixed with it, causing a fermentation which takes three days to complete. In the distilling process the alcohol solution or wash is pumped from the fermenting vessels into wash chargers through the red pump. This charge of wash is run in equal parts into each wash still. The furnaces are then lighted, and after two hours the wash begins to boil. The alcohol vapour is cooled and condensed by cold water circulating outside the coils, and passes through the spirit safe to the vats below. This first distillate is called low wines, and is collected in low wines receivers. The wash left in the stills is free from alcohol and is sold to dairy men who buy the spent grains from the brewing process for cattle feeding.

The low wines are now pumped into the No. 2 feints charger and are run into the feints still, where a second distillation takes place. Approximately one half is distilled off and collected in the feints receiver, the residue being valueless and discharged to the sewer. The feints are now pumped to the No. 1 feints charger and run into the spirit-stills for re-distillation, and the product of this—approximately 60%—is spirit or new whisky, and is pumped to the spirit stores sewer.

Several parts of this model work, though it produces no spirit! The furnaces flicker, and water runs from the taps in the spirit safe.

At the B.I.F.

And now for the British Industries Fair. The Toy Section seemed as well populated as ever, and I already saw in evidence models of the Queen Elizabeth—though these were mostly scenic. Messrs. Meccano had a gauge "0" and gauge "00" layout, and Messers. Lindsays a particularly fine display of aeroplanes. The photograph above shows some of the latest Penguin series—some of which are not yet in production. There is the Vickers Wellington—one of Britain's heaviest long-range bombers, the Westland Lysander, army 'plane used for reconnaissance and co-operation work (has guns in wheel spats), the Bristol Blenheim, Vickers supermarine Spitfire (sister 'plane to Hurricane and fastest single-seater fighter in the world), the Hawker Hurricane which has eight guns to converge on a spot in front of 'plane. Both these planes have retractable undercarriages. The three front models are the Blackburn Skua, latest type of bombing 'plane, with folding wing for hangarage space, and used on aircraft carriers, the Vickers Wellesley, and the Monospar Ambulance. There was also a sectional model of an Empire Flying Boat, showing control room, pilot's seat, instruments, etc., also radio set and workings. Directly below this is a compartment in which is stored marine gear for mooring. Then comes the mail compartment, and aft of this is the toilet saloon with wash basins, towel, etc. Aft of this is the first passenger saloon, and two others, also with furniture exactly to scale, and then the luggage compartment. All the windows are transparent, and the excellent detail is done by injection moulding.

Model Railway

The Trix gauge "00" train layout certainly was a stand to catch the eye, and when you examined the detail of the 16 ft. x 14 ft. layout, which could run four trains simultaneously, I think you would come to the conclusion more than ever that Twin Trains are remarkable. Among their new features for 1939 are three new locomotives—a double under Tank Locomotive with 3-4-2 wheel arrangement, 4-4-0 Midland Compound and similar L.N.E.R. models, and 4-4-0 S.R. Locomotive. Also I notice they are to have "Many-ways" Shops for adding to stations, with various interesting contents, electrically lighted, while in coaches they will have scale-model Pullman saloons and S.R. coaches. The autocontrol of the Trix Twin Railway will give a novel new control. There is an innovation for next season, Trix Ltd., have also issued a little service department bulletin which gives useful hints on maintaining locomotives, track and points in apple-pie order, including many necessary do's and don'ts.

Dolls Furniture

Another stand which caught my eye was that for "Pit-a-Pat" Dolls House Furniture, which is some of the best furniture in miniature I have seen. There were very complete sets on show for bedroom, dining-room, lounge, nursery, kitchen, bathroom, and scullery, besides such up-to-date articles as a radiogram, television set, garden couch hammock and nursery piano, which have only just been introduced.
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—by amazing new way

If you have never played a note—or if you learnt, but never got far—you will be able to read music at a glance and your own playing will surprise you. All the old difficulties have been "smashed" by the new scientific, amazingly simple Klavarskribo method replacing the cumbersome, difficult old method. Klavarskribo students play more music, better and with less effort after 3 months than after 3 years by the old method. This may sound exaggerated to you; but just read these extracts from recent testimonials—"Marvellous—a delight—wonderful—a revelation," etc. Students simply do not know how to find words strong enough to give expression to their praise for the method that brings them so much enjoyment. As easy and successful for children as for adults.

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for Piano, Reed-Organ or Accordion

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BROWN JNR. 'D'

Aluminium piston and rings. Motor weight, bare, 6½ ozs. 1½ h.p.
Height 4½ in. Length 5½ in. R.P.M. range 1,200 to 10,000.

MODEL AIRCRAFT SUPPLIES, LTD.,
171, NEW KENT RD., LONDON, S.E.1.
PAINTING A CYCLE FRAME

"W"ould silver amalgam, similar to that used by jewellers, be suitable for painting a bicycle frame if coated with a coat of cellulose afterwards?" L. M. (Yorks).

Ordinary jeweller's "silver amalgam" would be totally unsuitable material for treating bicycle frames with since, even when protected with varnish, it would not be durable in outside weathers. It would also, of course, be costly material to obtain and, even supposing it to be durable mechanically, it would quickly tarnish under all normal conditions. In general, amalgam surfacings on metals are useless in those cases in which the metal articles have to withstand severe wearing conditions.

HYDRAULIC RAMS

"W"hat is the formula for finding the output of a hydraulic ram?" N. C. (Norfolk).

You do not appear to have stated your query very clearly. There is, however, no simple formula for obtaining the output of a hydraulic ram from the sparse data which you supply. Perhaps, however, the following information may solve your problem.

If the piston of a hydraulic ram is, say, half an inch in diameter and the water-cylinder of the ram 1 foot in diameter, then the pressure of the water on the base of the water-cylinder will be to the pressure on the piston as a square foot to a quarter of a square inch, or 576 to 1. Therefore, if the pressure of the water be imparted to the piston of such a hydraulic ram, the cylinder-plate will be moved upwards with a pressure of 576 tons.

PURIFYING A SWIMMING POOL

"H"ow can I purify a swimming pool 25 ft. by 12 ft. by 6 ft.? I have been told that copper sulphate can be used. If so, how much and how often?" A. S. (Liverpool).

Unfortunately, you do not mention the type of impurity it is most desired to remove from your swimming pool water. If it is troubled with green algae and slimy, filamentous growths in the water, copper sulphate will prove an excellent eradicator, about a dessertspoonful of the copper sulphate being dissolved in a pond of the dimensions you mention. This treatment need not be renewed for six months or more, unless, of course, the water is completely changed within that period.

Other impurities are best rendered innocuous by dissolving two dessertspoonfuls of fresh chloride of lime in the water at intervals of, say, two or three months. The chlorine liberated by the chloride of lime, will completely sterilise the water. Suspended impurities, leaves, mud, etc., cannot be removed by chemical means, but must be removed by some sort of screening or filtration.

A WATER SOFTENER

"I"n an issue of a few months ago you publish an article on the water softener. As I am contemplating making a water softener could you supply me with a method for making a water of artificial zeolites?" W. C. (Ilford).

Artificial zeolites and other water softening "exchange" bases cannot be made at home, since high temperatures are required in their production. They may, however, be purchased fairly cheaply from chemical supply firms, such as British Drughouses, Ltd., Graham Street, City Road, London, N.1. "Permutit" is a well-known product of this description.

WOOL WINDER

"D"o you think that the enclosed idea for a self-adjusting, or drop-winder would be fit for patenting? The simplicity of the design makes me think that it could be manufactured quite cheaply." A. C. (Norfolk).

A non-adjustable holder for receiving skeins of wool whilst being wound into a ball is not novel. There has been such a device on the market for at least the last 20 years. You are advised to make inquiries from shops dealing in wool work materials.

The specific method of construction may be novel, but as it will not be possible at this date to obtain any wide protection on the device, it is not thought that it will have any chance of being made a commercial success.

CRICKET SCORE BOARD

"I" have designed a cricket score board, suitable for ordinary club cricket, and the principle of a perpetual calendar, i.e., the numbers being painted on canvas strips and operated by means of rollers. I enclose herewith sketches showing front and side views; the rollers shown in the latter are for operating the digits. Other rollers are, of course, incorporated to work the tens and hundreds. I have made a rough working model which I will send to you for inspection if you so desire." L. C. (Sussex).

The improved cricket score board is not thought to be broadly novel, and you are advised to make inquiries amongst prior patent specifications dealing with the subject. Even should a search not disclose the actual concept, it is doubtful if any patent of any commercial value could be obtained for the invention.

In order to support a patent, subject matter must be novel, as well as non-obvious and utility, are required, and it is doubtful if the subject matter in view of analogous arrangements is sufficient to support a valid patent; in any case, it is not thought to have any commercial possibilities, and therefore not worth the expense of patenting.

MERCURIC CHLORIDE

"H"ow can I make toluene from acetylene? Please give the chemical symbol for acetylene.

Can the impure hydrogen, which is liberated from electrolytically saturated water, be used along with carbon to form acetylene?" J. P. (Glasgow).

From a purely practical standpoint, you will not have much success in attempting to make toluene from acetylene, and we would not advise you to waste time in such
a useless endeavour. However, for your information, we may say that when acetylene ($C₂H₂$) is passed through a red-hot metal tube, a portion of it is converted into benzene. Now, when benzene is treated with methyl chloride in the presence of anhydrous aluminium chloride (Friedel-Craft's reaction) a portion of it is converted into toluene. We may thus summarise the above sequence of reactions:

\[
\text{Hot tube} \rightarrow \text{C₂H₂} \rightarrow \text{C₆H₆} \rightarrow \text{C₆H₅CH₃} \rightarrow \text{C₆H₅CH₃}
\]

Methyl chloride and aluminium chloride.

Yes, the impure hydrogen formed by the electrolysis of sea water might be used in the preparation of acetylene, but, as mentioned previously, chemical reactions such as these are (on the small scale, at any rate) of theoretical interest and not of practical use.

CELLULOSE THINNERS

"(1) WHAT is the formula for cellulose thinners?"

"(2) What is the food formula for removing a previously treated surface, whether cellulose or enamel?"

"(3) What is the formula for a surface primer to be used as a compound for use before cellulose spraying?" — S. W. (Glasgow).

CELLULOSE THINNERS

"I enclose here a rough sketch of a unio for light gauge tube."

"The idea is to obtain a swivel joint of full bore and one that is easily uncoupled with finger pressure."

"At present it differs from orthodox unions in that it has a spring which brings the two ground seats together."

"I should be glad to have your opinion as to whether you think it a fit subject for a provisional patent." — R. P. (Stoke-on-Trent).

THE improved union for light gauge tubes, if novel, which is believed to be the case, forms fit subject matter for protection by letters patent.

You are advised to file an application for patent with a provisional specification which will give you the protection of a "provisional patent," (as there is no such thing) for about 12 months at the least expense. If a complete patent is desired, a complete specification must be filed with 12 or 13 months date from application date.

SELF-CONTAINED TOOTH BRUSH

"I have devised a tooth brush which is self-contained and would like your opinion as to whether it is practical and worth patenting." — R. P. (Wiltts).

The improved construction of tooth brush is novel and forms fit subject matter for protection by letters patent. It is thought, however, that the broad idea of utilising the handle as a reservoir for soap in shaving brushes is not novel, and you are advised to make a search amongst prior patent specifications relating to reservoir brushes. There may be some difficulty in working out the idea on a commercial basis, as it is thought that the construction would be too expensive to allow of it being produced at such a selling price as to have any extension. It is thought that the difficulty would be encountered in getting users to take the trouble to refill the handle when empty.

In view of the above opinion it is questionable whether it is worth the cost of patenting.

MECHANISM FOR CINEMA PROJECTOR

"I enclose a drawing of a mechanism for supplying the intermittent motion to the film in a cinema projector (either home-made or professional). I think it is new and worth patenting." — E. S. (Honor Oak Park, S.E. 23).

THE improved mechanism for obtaining the intermittent motion in cinema projectors is thought to be novel and therefore forming fit subject matter for protection by patent.

If in practical application there are no difficulties it should have commercial possibilities. It is thought that if the spring is sufficiently strong to obtain a quick movement, there may be some jarring on suddenly stopping the gate, but a model of the mechanism might be worked out as soon as possible at the least expense. By such means you will obtain protection for about 12 months, during which time it should be possible to ascertain if the invention is likely to be of commercial value.
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Attach sheet of paper, with particulars, and your name and address (written in BLOCK letters), with date, to this announcement.

PERFUMERY PREPARATIONS

1. WHAT is the name and approximate cost of the 95 per cent. alcohol used in perfumery preparations?
2. Could methylated spirits be used in place of this alcohol?
3. Is petrolatum (white or yellow) an alternative name for vaseline and petroleum jelly?
4. Are the following oils similar: white oil, liquid vaseline and liquid paraffin?
5. Could either benzaldehyde or nitrobenzene (oil of myrrhane) be successfully substituted for almond oil? a d, if so, which is preferable?
6. Can you give me the name of a firm or firms who sell small quantities (about 1 oz.) of essential oils, such as neroli, rose, lavender, ylang-ylang, etc.,

THE alcohol you refer to is known as "ethyl alcohol, pure, 90 per cent."

The price, retail, is about 19s. per lb., duty paid, and for high-class perfumery preparations its use is really essential. Such alcohol can be obtained from Messrs. Harrington Brothers, Ltd., Oliver's Yard, City Road, London, E.C.1, or from Messrs. A. Boake, Roberts and Co., Ltd., Stratford, London, E.11. (2) Ordinary methylated spirit can NOT be used in place of the purer alcohol for toilet preparations, etc. It is possible, however, to arrange with your local Excise Officer and a firm of suppliers for you to obtain a purer grade of alcohol in bulk at cheaper rates. Either of the above firms would advise you on the necessary procedure.

THE USE OF THE NOMOGRAM

For Screw Cutting

A slip appeared in the chart accompanying the above article which appeared on page 294 of our March, 1939 issue. Through an oversight the chart was shown incorrectly spaced and we now show the correct chart, which should be used in conjunction with the article.

This Nomogram gives the required combination of change wheels to cut from one to twenty-four threads per inch on, lathes having guide screws of 1/4-in. or 1/2-in. pitch. In accordance with the principle of the Nomogram, a straight line drawn across the three scales joins three related points, but, in using this chart, it must be remembered that the portions of the scales lying between the graduations have no meaning. This is because, in the first place, change wheels go up in multiples of five teeth, and in the second place, portions of the "threads per inch" scale lying between the graduations, represent threads which cannot be cut with a simple train of wheels when the lathe

Alternatively, you might experiment with the use of iso-propyl alcohol, an alcohol similar to ethyl alcohol, but, not being dutiable, retailing at about 2s. 6d. per lb. For very many purposes, this alcohol is a good substitute for pure ethyl alcohol, and, like the latter, can be diluted with water.

Vaseline is a trade name. Petroleum jelly and petrolatum are identical with it.

Liquid paraffin (medicinal) is a highly purified form of higher-paraffin distillate, "liquid vaseline," being a similar preparation but of thicker consistency and containing hydrocarbon liquids of higher boiling point. "White spirit" is a purified form of mineral paraffin, of higher boiling point than ordinary paraffin oil. All these substances, however, have a common origin—the crude petroleum of the oil wells.

The answer to this question is in the affirmative. Provided that the benzaldehyde or nitrobenzene are used for perfumery purposes only. If, however, the almond oil is being used as an emollient, it cannot be substituted by the above two compounds.

Benzaldehyde is the odiferous constituent of oil of bitter almonds, in which it is present to the extent of about 99 per cent. It has a much superior odour to nitrobenzene, which, in truth, has a crude and nasty almond-like smell and is only used in the cheapest (and often worthless) preparations.

You can obtain small supplies of various essential oils from Messrs. Goodwin, Tidwell & Co., Ltd., Carramoon Street, Cheetham, Manchester.
to prototype. Another ingenious feature is that the complete floor and chassis of the coach is detachable quite easily, thereby enabling "detail" enthusiasts to model the internal furnishings of the coach.

We really can say that these coaches are good value for the money, the price being only 17s. 6d., and we should recommend all interested, to call and see these at Hamblings showrooms, 10 Cecil Court, Charing Cross Road, London, W.C. 2.

Complete Model Railways

GRESHAM MODEL RAILWAYS LTD. have one of the very few shops in the world that sell nothing but model railways. They make up, however, for this specialisation by the variety and attractiveness of the goods they stock. It is possible for the customer to buy a complete second-hand model railway here at a very modest figure, or should he so desire he can have made a super detail model such as we picture, the cost of which will, of course, vary with the amount of detail. This particular engine is an exact copy of one built for a Brazilian coffee estate by Messrs. Hudswell Clarke, Ltd., of Leeds, and is from drawings supplied by them.

Another feature of Gresham Model Railways, Ltd., is the issue of a monthly used models list, which is sent free to anyone interested. The address is:—Gresham Model Railways, Ltd., 79 Gresham Street, E.C. 2.

MODEL AERO TOPICS

Continued from page 388

60 seconds. The kit is absolutely complete with printed plans and several finished parts including a "Normac" Super Thrust ready-cased propeller and retails at 5s. An ideal beginner's model.

The Concor "Clipper" has a wingspan of 30 ins. and is a high wing monoplane of similar construction to the "Orlow." This model was introduced only nine months ago, but it is claimed that in short a time it has won many open club contests and the National Biplane Contest, an additional standard type wing being fitted for this purpose and the machine created a new British record for that class with a flight of 135.73 seconds. Over sixteen customers have recorded flights longer than six minutes duration with Standard Concor "Clippers." This kit also contains a finished "Normac" Super Thrust Propeller, a very complete range of which are illustrated in the new profusely illustrated Catalogue and Handbook, a copy of which will be sent on receipt of 5s. The kit of the "Clipper" retails at 3s. 6d.

Model Aircraft Stores

THIS company, of 127b. Hankinson Road, Bournemuth, who supply the well-known Comet and Spitfire model aircraft engines, also has a complete catalogue of everything necessary for model making. They list blueprints of popular flying models, gears, wood, piano wire, tubing, dope, banana oil, adhesives, technical books, compressed air engines, airscrews, construction kits, etc., etc.
**BUY, EXCHANGE OR SELL**

**TOOLS**

2. Steel Files, assorted parcels for General shop use, 3 doz. 9" to 12", 10/-; 2 doz. 12" to 16", 10/-. Car. For paid with 2/ order.—Below.
3. Bright Mild Steel, round, approx. 50 ft. assorted 1/2" to 1" diam., extremely useful for Grinding Drills, Small Gears, etc. Special selection, 2/ per doz.—Below.

- **Genuine Carborundum Wheels, 6" diam., 1" wide:**
  - 1" hole; 1/8" thick, carbonized; 3/4" thick, 5/8" thick, best grade, 5/-. Each.—Below.
  - 1" hole; 3/4" thick, 5/8" thick, 1/2" thick, best grade, 5/-. Each.—Below.


- **Three dozen Tungsten Hacksaw Blades to 12."**

**OUTSTANDING EARS CORRECTED ORO.**

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**TELESCOPES, MICROSCOPES, Scientific Instruments.**

- **Boat and Canoe.**
  - Kits from 27/6. All types completed. List stamps, trade.—Beattie & Co., Christchurch, Hants.

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- **New Brass and Steel Screws, etc.**
  - 100 Steel H.C. Bolts and Nuts, 1" to 1" diam., 6/-. 4" Drill, 1/9 to 5/32." 12 Drills, 3/9 to 1/5 Carbon. 10 Taps, various sizes. 2/9 any lot.

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- **Wanted for Prompt Cash.**
  - Miniature Cameras, Engravers and Accessories, Ciné Cameras, Projectors, Films, Microscopes, Telescopes, and Binoculars, small Lathes and Precision Tools.—Frank, 67 Saltmarket, Glasgow.

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PATENTS


PATENTS AND INVENTIONS


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Costumed on orthodox lines. Overall length, 121 in. Length of bed, 8 in. Maximum distance between centres, 61 in. Height of centres from gap, 2 in. The nose of the solid mandrel is in. in. 30 toolspades. Bearings adjustable for wear. Compound side rest has one sliding with gib and adjusting screws. Tailstock is of the sliding barrel type, and is fitted in position by a set screw.


Three-Jaw Self-Centring LATHE CHUCKS

A high-grade special iron of extra resistance to tensile and bending stresses is used for the manufacture of the bodies of these chucks. The jaws, scroll, pins, and screws are made from finest case-hardened steel. Diameter, 3½ in. Diameter of recess, 2.48 in. Bore, 14 in. Weight, 3½ lb. With two sets of jaws.

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Bench Type, Three speeds, sensitive feed, depth of feed, 3 in., spindle graduated in 10ths. Stop collar for regulating depth of drill. Three jaw, self-centring chuck, 6 in. capacity. Centre of chuck to pillar, 6 in. Positive broach bearings. Diameter of pillar, 11 in. Fitting and swivelling table, 9 in. by 9 in. Maximum distance, chuck to table, 10 in. Height to top of frame, 50 in. Weight with ½ h.p. motor, 67 lb.

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