WORK

An Illustrated Journal of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

VOL. IV.—No. 187.] SATURDAY, OCTOBER 15, 1892. [PRICE ONE PENNY.

WORK WORLD.

A RAILWAY from Tanga, on the east coast of Africa, to Kwa Abdallah, is to be commenced this autumn.

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On a year's work of the Steel Company of Scotland a loss of £13,653 appears, due to "strikes of workmen, high cost of production, and reduced prices of products." Such results must affect wages in the future.

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A wooden bridge for Alcaig Ferry is proposed at a cost of £8,000. We are inclined to think that it would be more advisable to erect an iron or steel bridge to secure durability and immunity from fire.

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The new printing types, made of malleable glass, preserve their cleanliness, and are said to wear better than metal. They can be cast with a sharpness of outline that will print more distinctly than is possible with the old style of type.

* *

Fireproof floorings for hospitals are now so constructed that the wards can be ventilated through tubes embedded in concrete in the flooring, these tubes being in communication with the external air by means of air bricks in the walls. The principle has been adopted for ventilating stables.

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Vertical milling machines, constructed on the pantograph principle, are being employed in the engraving of name plates, doing away with hand engraving to a great extent. The machine accomplishes in a few moments what it would take a good engraver the greater part of a day to do.

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Calculating machines are finding favour in the drawing offices of large engineering and shipbuilding firms. Where long calculations are to be made, the machines do away with mental labour. The work of two days' ordinary calculating is done by the machine in three hours.

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In the electric light installation at Ardrossan Harbour there are seventeen arc lamps erected at equal distances apart round the east and north sides of the Eglinton Dock, and in the Caledonian Railway Station on Montgomerie Pier. Each lamp has an illuminating power estimated at 3,000 candles.

* *

Electric instead of steam traction is to be used on the South Staffordshire tram lines. The overhead wire system will be employed. Each car, with its motor gearing and all appliances, will weigh only six tons, and accommodate forty passengers. The existing locomotives and cars weigh sixteen tons, and carry fifty-four passengers.

* *

When crude petroleum is heated, various oils distil over at different temperatures. Those which give with the least amount of heat are known as petroleum-spirit, naphtha, benzoline, and gasoline. The next to come over are the paraffin oils used for lighting purposes, while the heaviest of all are the oils used for lubricating and heating purposes.

* *

In a new method of photographing on wood the face of the block is whitened with a mixture of albumen and zinc white. The block is then coated with a solution of nitrate of silver in collodion, dried by heat, and the coating dissolved off by ether and alcohol. Another coating of the collodion is applied and dissolved off, after which the block is again dried and exposed under the negative. The print is fixed with hyposulphite of soda, washed, and dried.

* *

The largest order for rails that has been given out for months has been secured by the Barrow Hematite Steel Company; it amounts to 25,000 tons of rails and other railway materials for the Government of Western Australia. Messrs. Cammell & Co., of Workington, have orders for 5,000 tons of rails for South Australia; 7,000 tons for Norway; and 3,000 tons for the Congo. This last order was obtained after a sharp competition with the Belgian Rail Syndicate, who quoted 115f. per ton against 107½f. accepted by Messrs. Cammell.

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A new form of accumulator plate of some promise has been invented. A perforated ribbon of lead is entwined with an asbestos cord, and the strands thus formed are woven into a loose cloth. Several squares of this cloth, cut to a suitable size, are lightly compressed together to form a plate, and this is held in a lead frame. Four such plates, composed of three squares of cloth, 6 in. by 8 in., and each having a thickness of ⅜ in., only weigh 8 lb. The E.M.F. of each pair is the same as that of ordinary accumulator plates, but a discharge rate of 1 ampère hour per square inch of surface is claimed for the new plates. The disastrous effects of buckling, and consequent short-circuiting, are entirely avoided, and an unusual long life is claimed for cells fitted with these plates.

* *

Time has a material effect on the strength of cements. Bricquettes, two days old, having a tensile strength of 147 lb. to the square inch, showed, after thirty days, a strength of 318 lb. Other cements, showing a strength of 157 lb. at two days, increased in strength to 661 lb. in thirty days. Storing cement causes a loss of weight and strength. One cargo weighed on delivery 111 lb. per bushel, and its breaking strains at two, five, and thirty days were 96 lb., 236 lb., and 371 lb. respectively. After six months' storing the cement weighed 106 lb. per bushel, and its strengths at two, five, and thirty days were 109 lb., 178 lb., and 332 lb. respectively. After being stored a year the weight was 106 lb., and the strengths at five and at thirty days were 73 lb. and 250 lb. respectively.

* *

Tests of incandescent electric lamps prove that the resistance of the carbon filaments in these lamps increases with their use, and the candle-power of the lamps suffers a corresponding decrease. As a consequence, more power is needed to light the lamps as they increase in age. Lamps of high initial efficiency, taking only 1½ watts of energy per candle-power when new, deteriorate more rapidly than those requiring from 2½ watts to 3½ watts per candle-power. At the end of fifty-five hours a 16-c.p. 1½-watt lamp gave only a 2½-c.p. light, and consumed 4·26 watts of energy per c.p. A 2-watt 16-c.p. lamp gave a light of seven candles at the end of ninety hours, and consumed 3·99 watts per c.p. A 2½-watt 16-c.p. lamp gave a light of ten candles at the end of 150 hours, and consumed 3·58 watts per c.p.

THE COACHMAKERS' COMPANY.

BY A COACHBUILDER.

The old Chartered Guilds of Industry of London, inaugurated by our ancestors with intelligent forethought for the welfare of craftsmen of the trades prominent in the then small City of London, and endowed with funds to maintain and extend them in their beneficent influence on trade and the workmen's welfare, gradually lapsed from their sacred duty, and became moribund in all except lavish festivities for the exclusive few that controlled the funds of the Companies. Meanwhile, the sources of their incomes expanded with force and vitality, augmenting wealth, which remained dormant, except mainly for speculative purposes of profit, until within recent years, when some of the conscientious and enterprising members of those Guilds and Companies sought and obtained a partial application of the vast wealth accumulated to the intended purposes of the founders—to instruct and develop the technical industries nominally represented by those Guilds and Companies.

If the other seventy-five Guilds would emulate the Coachmakers' Company, reproach and obloquy would be obliterated from these old bodies. No institutions in the world are so well equipped by wealth, prestige of ancient authority, central position, spacious halls, and a numerous body of skilled craftsmen and learners anxious to participate in the good intentions of the founders of these companies. Well directed, their efforts would neutralise the narrowing of the craftsmen's minds by the effect of division of labour restricting the workman's energies and enlightenment to the section of toil upon which he is incessantly engaged.

The thoughtful members of the carriage trade in this Guild strive to broaden the men's ideas of the various branches of a trade that has such diversity in its composition: as working in various woods, leathers, cloths, silks; in metals like steel, iron, copper, bronze, tin, gold, and silver; in pigments, oils, varnishes, spirits, and lacquers; and other things, as ivory, indiarubber, and electric lighting. Of course, an education corresponding to these varied manipulative requirements must form the basis of the craftsman's work.

As demonstrative tests of the Guild's zeal and the workmen's capacity, for many years past annual exhibitions of drawings and specimens of work have been held in the Company's Hall, Noble Street, City. Each passing year shows increased ability of the competitors for prizes and honours awarded to successful aspirants.

At these exhibitions of the brain and hand-work of the ambitious and capable men of every branch of this high-class trade, the strength and weakness of the present system of divided toil are both conspicuous.

One year the prize was for foliage drawings, to show freehand drawing. Some excellent specimens were sent, drawn on paper; but one worker, who could not only draw on paper, but on wood, had, by his assiduity at the craft, carved an ornamental back-rail for a park phæton, such as was done in times when men made themselves masters of nearly all branches of the craft. It was not understood, so was put outside into a lumber-room; yet, when it was sent back to the carver, he was offered £20 for it, for its artistic merits, by an admirer of such work. That was in the early days of the Coachmakers' Company's exhibitions. He was before his time, for carving has since been accorded a place.

Recently, at a display of drawings of half-size views of a "Sociable," nearly all were exceptionally good, and by very young workers; but the evil of restricted knowledge was obvious in parts of the carriages to which the draughtsmen were strangers. Thus, the hind wheels of some had sixteen spokes, some fourteen, some twelve, and one only ten spokes. Thus, ignorance of how many spokes should be in a wheel for a carriage of fixed size and weight was obvious.

In others, the notion of a splinter-bar socket to uphold the pole of an open futchell carriage did not enter the draughtsman's head. Other blunders marred the completeness of otherwise very beautiful and excellent drawings.

Members of various branches of the trade competed, and the errors were most noticeable in men employed in big shops, where they are far more ignorant of the allied branches of the trade than in the small four- or six-handed shop, where there is more identity of feeling for the trade as a whole system of crafts than is fostered by the factory with many hands. Mark the word "hands," used by employers, as if brains were a matter not to be bothered about if they interfered with profits.

The judges who award the prizes should point out errors. They are themselves on their trial by their awards, when reviewed by capable workmen afterwards.

To G. N. Hooper, Esq., one of the late masters of the Coachmakers' Company, is due the credit of carrying forward so successfully and honourably these trade exhibitions at Noble Street, City. To all the judges during many years must be awarded high praise for their discrimination and impartiality in their awards for drawings and work.

The prizes of the Company are generally from £1 to £6, with supplementary prizes by munificent donors, for special exhibits, up to £20. Certificates for craft ability are added to the prizes, and to some the freedom of the Company.

To eradicate the evils of isolation of crafts, a cross-purpose prize of some value should be given for the display of handicraft of a worker in a branch not generally his regular work: as a wheel by a body-maker, a spring by a wheeler, a painted panel (fine-lined) by a trimmer, an under-carriage (in the wood only) by a smith.

These workmen, when in trade afterwards as master coachmakers, are expected to know all about every branch of the trade. How few do know practically! In early times in England one man could roughly do all branches. Even in this century men are known who can make every part of a carriage from the drawing—wood and iron-work, painting, lining, to the leather-work.

With the fewer hours of labour in the carriage trade—two work days a week less than prevailed fifty years ago—men have the leisure to learn more, but really learn less. This is partly due to a foolish notion of workers themselves—that each man should stick to his branch, so as not to interfere with the labour earnings of another branch. This frivolous, selfish feeling should be eradicated; but it is more difficult to get perverse views out of men's minds than it is to get profit-making knowledge into them. If men thought for a moment of the prospect of their becoming masters, or of emigrating, where often all branches have to be taken, as required, by a worker, they would feel their narrow-minded action recoil on themselves with merited severity; and masters of big factories would not have the discredit for ignorance far beyond the masters of some humble shops, who by perseverance have made themselves all-round craftsmen.

DESIGN AND DECORATION OF ALL AGES.

BY M. H. C. L.

Arabic.

In the seventh century after Christ a new power came into the world, which spread rapidly, and at this day has hold of a very large proportion of the human race—Mahometanism. Mahomet, the great prophet and leader, was born at Mecca in 569 or 570. At about forty years of age he announced himself as a prophet, and preached the unity of God, the immortality of the soul, and a higher and stricter morality than was in practice at that time by any of the neighbouring nations, of whatever belief. He gathered round him a band of trusted followers, who accompanied him when, in 622, he was forced to fly from his native land. In the following years he gained many victories over his enemies, was acknowledged sovereign, and on his death, left behind him a body of ardent and warlike men to spread the faith which he taught, according to their principles, by means of the sword. This was the beginning of Mahometanism, and with Mahometanism began Mahometan Art.

The term is a wide one, for the followers of Mahomet pushed their way the whole length of the southern shore of the Mediterranean and along the northern shore, excepting the Italian coast, as far as to Spain, where they founded an important kingdom. They also conquered Persia and a great part of India; and wherever they came they more or less transformed the native art.

The principles of their religion were severe and narrow, and can only be adequately judged from a study of the Koran—the book which Mahomet wrote, as he believed, under the direct inspiration of the Angel Gabriel. A very superficial idea of Mahometanism is founded on the latitude it allowed in the matter of wives.

Amongst the strict rules laid down for the conduct of life was the prohibition to make any representation of the living form. Not only was the human figure to be thus regarded as sacred, but the figures of animals, and even of vegetable forms! These were the strict principles with which Mahometan Art began. Its first exponents were the ex-Byzantines, who, it will be remembered, had always looked on the production of "graven images" of persons as wicked. The cutting off from the production of all plant and animal forms, however, would have reduced the artists to a sorry state. What was there left for them to do? Obviously to make use of the only elements of decoration left to them: geometrical forms. Accordingly geometrical decoration is the leading feature of Mahometan Art—the art, that is to say, in its purest state, confined to the restrictions imposed by the faith it was called upon to represent. The Arabs were the inventors of what is called practical Geometry, though the theoretical principles had, of course, been laid down long before by Euclid, and are supposed to have been discovered by the Egyptians.

The tendency to employ repeated geometric forms for ornament is innate in the human race, as has been shown in the paper on Savage Art. Indeed, for surface decoration it is impossible to produce any design, not distinctly naturalistic, which is not based upon geometrical forms, though the geometric basis may be so hidden as to appear only as a suggestion, or altogether escape

Arabic Design and Decoration. Fig. 1.—Canopy Edge, Fifteenth Century: Cairene Pulpit. Fig. 2.—Arab Ivory, Thirteenth Century. Fig. 3.—From Kal at El-Kebsch, Cairo. Fig. 4.—Pulpit Door: Cairo, Fourteenth Century. Fig. 5.—From Alhambra: Spain. Fig. 6. Arabian pierced Work. Fig. 7. From Court of Lions: Alhambra. Figs. 8 and 9.—From Alhambra. Fig. 10.—Inside of Mass Bowl, Fourteenth Century. Fig. 11. From Alhambra. Fig. 12.—Kufik Writing. Fig. 13.—Cursive Writing. Fig. 14.—Horseshoe Arch. Fig. 15.—Ogee Arch. Fig. 16. Cusped Arch. Fig. 17.—Detail of Ornament intermixed with Kufik Inscription: Alhambra.

the perception of eyes unaccustomed to analysis.

But the use the Mahometans made of geometry was definite and direct, far removed from the simplicity of the savage repetition of lines and curves, and entirely inscribed. These geometrical patterns were produced in great variety, and so intricate are many of them that it is a weariness to the eye to attempt to disentangle them, and a long contemplation of them gives one something of a nightmare effect! Fig. 4 is a comparatively simple form from the door of a pulpit, Cairene, probably of the fourteenth century. The repeated stars produced by this pattern are a favourite effect in Arabic Art. Besides purely geometrical forms, the Mahometans used strap-work—flat bands with intersecting lines, though quite a different kind from the Celtic strap-work. The next development in their art was the employment of letters in a decorative way. They had an alphabet to their hand at once beautiful and sacred. This was the Kufik, a writing invented for the inscribing of the Koran, and in which alone for some centuries the Koran was written. Later again the curious Arabic writing was used as ornamental design. Sometimes one word or sentence was repeated over and over again, which shows how distinctly the lettering was considered in itself decorative; but as a rule the subject of the inscriptions was a text from the Koran on moral precept. Fig. 12 is part of a Kufik, and 13 of a cursive inscription from the Alhambra. With these the walls of Arabian palaces are adorned as well as the mosques.

The spaces between the letters were filled in with Arabesques, the last of the distinctly Arabian motives in decoration. This kind of scroll pattern running over a large space is familiar to every student of art. The word is now rather largely applied, but the true Arabic scroll-work had but only a conventional leaf; that shown in Figs. 2, 5, 6, 7. It was probably not intended for a leaf at all, though vegetable forms were the first to creep into the system which forbade the representation of any living thing. The markings are not midribs and veins, but seem especially designed to contradict the impression of natural foliage. The frequent little curl where the leaf joins the stalk, and the alternating row of dots and lines, seem expressly intended to distinguish it from any portion of a plant. At the same time, the law of growth is carefully followed: every leaf grows from a stalk, every stalk from a stem, which can be traced out to its root, however elaborate its windings and interlacings.

The Arabs were originally dwellers in tents, where the only works of art used as house decoration must have been woven or embroidered hangings. When they came to have an architecture, the old idea of decoration clung to them. Their admiration for hanging things is curiously shown in the stalactite ornamentation of their roofs with ornaments hanging from above: one sees sometimes what is precisely like the canopy over a saint's niche, but no saint, not even a niche, is beneath it. It appears again in the curious valance hangings in wood or plaster, where the edge has an irregular and broken effect, bearing the conventional suggestion of the edge of a hanging drapery. Straight lines and long curved lines without a break were unpleasing to the Arab taste, and they ornamented the edges of their arches to avoid this effect. Fig. 1 is the edge of the valance to a fifteenth-century pulpit. The Mahometan arches—examples of the three principal types of which are given in Figs. 14, 15, 16—were an important feature in their buildings. The borders and spandrels of these arches were chief points for decoration, and the designs were so adapted as exactly to fill them. Diaper patterns covered the walls, and friezes, generally containing inscriptions, ran above them. While the exteriors of the buildings were generally very plain and only beautiful by the grandeur and simplicity of their outlines, the interiors were brilliantly and profusely decorated. The Arabs were great masters of colour, and invented several colour combinations which were a revelation to the Art world.

The first conquests of the Mahometans were in Syria; hence, as has been said, the first workmen were Byzantine, and the stamp of Byzantine influence is seen throughout Arabic Art. No doubt the scroll-work entitled Arabesque originated with the system of design so nearly akin to it, referred to in the paper on Early Christian Art, where a surface was covered with a running plant, the sprays of which curved round in a regular manner, forming a pattern of repeated spirals. The Byzantine decoration was almost entirely surface work, and so was the Arabic. There was no relief carving, properly so called, in the latter, only a system of a mixture of incising, and what is called flat-carving when applied to wood-work.

The Arabian palaces were built rapidly, as the rulers followed each other in rapid succession; and the materials used for their decoration were such as could be most quickly worked. Plaster was a favourite substance; stucco was not disdained; tile-work came to supplement the more elaborate glass mosaics, which still, however, held their own for the noblest purposes, and were very carefully and elaborately executed.

The Mahometans, as has been seen, penetrated to Persia and later to India, but the arts of these countries must be treated separately. They took possession of Egypt, where the solemn character of the inhabitants gave its impress to the development of Arab Art. They appropriated Turkey, and there their art, among an inartistic people, has become debased, and finally effete. In Sicily, on the contrary, where they had an important settlement, it attained a high degree of development in ceramics, in metal-work, and especially in the beautiful silk fabrics mixed with gold and silver, and with Kufik inscriptions interwoven, for which Sicily became famous.

But the most characteristic and the finest blossoming of Arabian Art was in Spain. The Moors held possession of a great tract of that country lying to the south-east, till dispossessed by Ferdinand and Isabella in the fifteenth century. After this they still remained in the country, working at their old arts for more than a hundred years, and immensely influenced Christian Mediæval Art. They were adepts in the minor arts, leather embossing, glass-making, metal-work, etc. The Alhambra, at Granada, built in 1253, and beautiful monuments of their work in Seville and other Spanish towns, remain to show the high degree of perfection attained by the Moors in their artistic productions.

The richness of the decoration strikes the eye at once. Where bold designs are used, which are effective at a distance, the broad outlines are found, on a nearer approach, to be filled in with minute decorations, so that not an inch of surface is left plain.

This paper is entitled Arabic Art; another name for the same style is Saracenic, as the Arabs who followed Mahomet took the name of Saracens. It deals only with the early opening stages of Mahometan work; the later developments will be treated in the papers on Oriental Art.

INDUCTION COILS: HOW TO MAKE AND WORK THEM.

BY G. E. BONNEY.

Shocking Coils—Their Use—Their Abuse—Medical Coils—Construction of a Medical Coil—The Core—The Primary—The Secondary—Various Powers: How Obtained—Switch-board for the Various Powers—Breaks for Medical Coils—Commutator for Coils—Use and Abuse of Medical Coils.

Shocking Coils.—Any of the coils mentioned in previous papers may be regarded as shocking coils, as the smallest spark coil will give a most disagreeable shock to the nerves of persons handling it incautiously. The larger spark coils are really dangerous

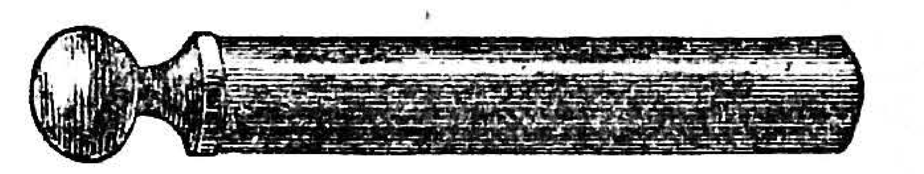


Fig. 26.—Brass Regulating Tube for Medical Coil.

if handled in an improper manner—that is, so as to receive the current from the secondary coil through the body, as from arm to arm. If we span the secondary terminals of a small spark coil with the thumb and little finger, a smart and painful shock will be sent through the hand.

The Use of Shocking Coils.—These are generally in use to provide amusement for

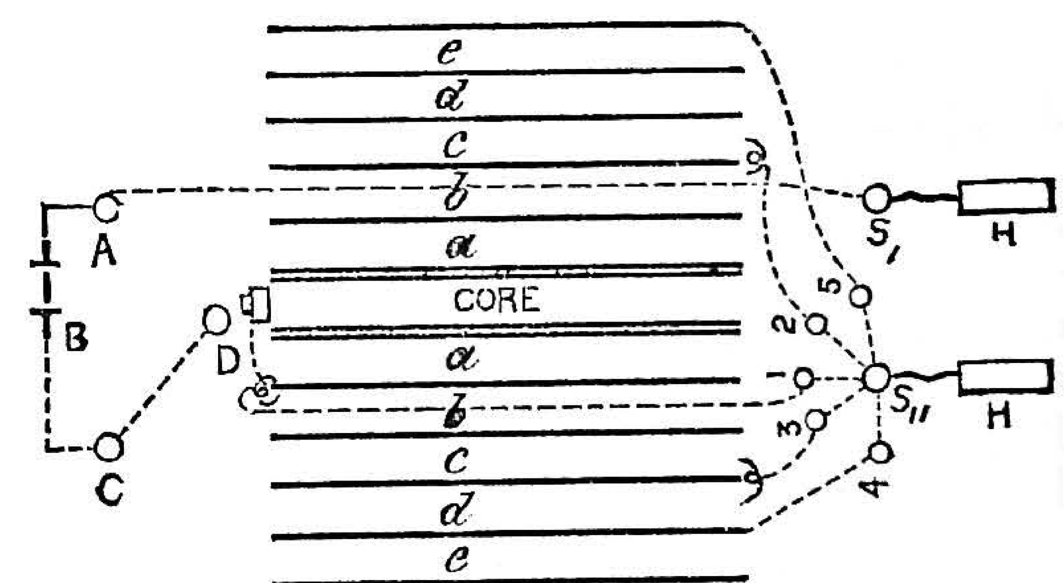


Fig. 27.—Diagram of Medical Coil Connections—A, Primary Terminal Pillar; B, Battery; C, Contact Terminal Pillar; D, Break or Rheotome; H, Handles or Rheophores; S,, Secondary Terminal; S,,, Pivot of Switch; *a*, Primary Coil; *b*, First Secondary Coil; *c*, Second ditto; *d*, Third ditto; *e*, Fourth ditto; 1, 2, 3, 4, 5, Switch-studs.

young folks on long winter evenings. One places one hand on a metal plate connected to a terminal of the secondary coil, and holds another child with the other hand. A string of youngsters then join hands with the first, and the last of this string touches the disengaged terminal of the coil, or a metal plate in connection with it. The result is more or less merry screaming and laughing as each feels the electric shock. From a very small spark coil a smart shock may be obtained, and I should advise such experiments to be restricted to the smallest coils. Much has been said and written about using these coils as traps for meddlesome people, but a deal of this is pure fiction, since very elaborate details would have to be carried out in arranging the trap so as to give a shock to the meddler, who would most likely detect and suspect the arrangements, even if he or she did not hear the merry hum of the instrument.

The Abuse of Shocking Coils.—These

useful little instruments are abused when employed to give surprise shocks to unwary females and persons of a delicate nervous organisation. Heart and nerve troubles may follow as a result of shocks given from coils, hysteria and paralysis not infrequently being the result of a fright or sudden shock to the nerves. It is, therefore, from this cause alone, not safe to play with spark coils in giving shocks to children or delicate

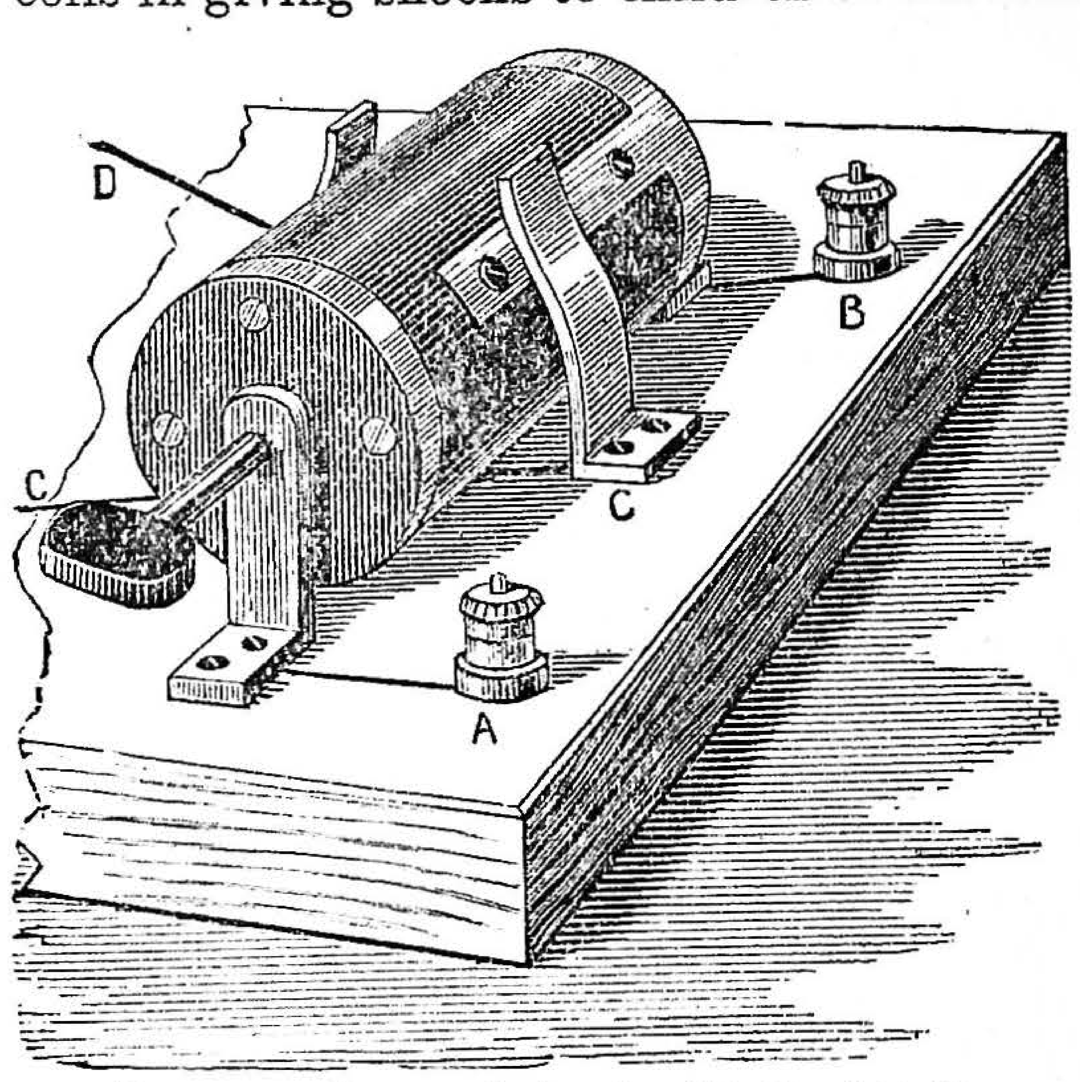


Fig. 28.—Commutator for Medical Coil.

persons; and this warning should be specially observed in dealing with coils giving more than a $\frac{1}{4}$-in. spark. There are other reasons, both physiological and medical, so to speak, which will receive attention further on.

Medical Coils.—This is the name given to induction coils constructed solely for the purpose of producing physiological effects, by induced electrical currents, in human beings. They differ from the spark coils in some very important particulars, although following the principles observed in the construction of spark coils. The same care must be exercised in selecting the materials and in insulating the various parts, and even greater care in proportioning them. This will be seen as we proceed.

Construction of a Medical Coil.—A medical coil is made up of : (1) The core ; (2) the

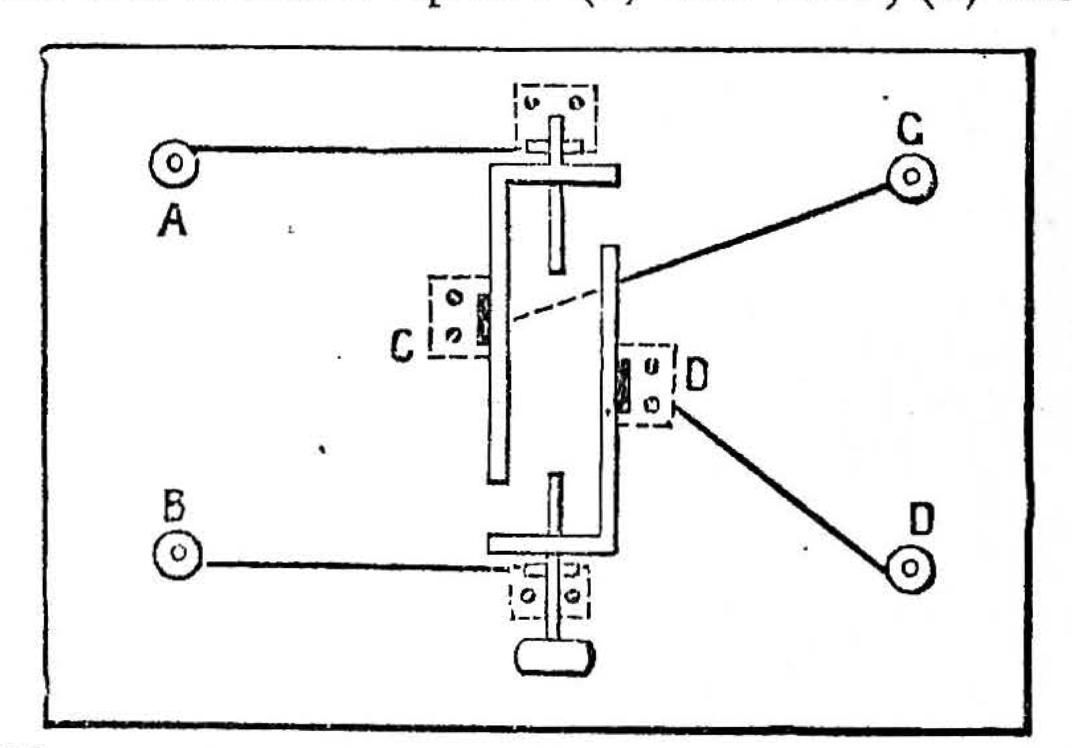


Fig. 29.—Plan of Connections for Commutator of Coil. Reference Letters correspond with Letters on Fig. 28. A, B, Terminal Pillars for Battery Wires ; C, D, Wires from Ends of Primary Coil.

regulating tube over the core ; (3) the primary wire and bobbin ; (4) one or more secondary coils of wire ; (5) the rheotome, interrupter, or current breaker ; (6) the commutator; (7) the rheophores, or instruments for conveying the induced current to the patient; (8) a switch-board for applying the various powers.

The Core.—This may be made of solid soft iron, well annealed, but will be best if made as for the core of a spark coil, with a bundle of fine iron wires soaked in melted paraffin. Before making up a core with a bundle of iron wires, it is advisable to select the regulating brass tube mentioned in the next section, and to fill this with the wires to form the core, packing them in side by side tightly. This done, bring all the ends level with each other, bind a scrap of fine wire around the ends to keep the bundle round, dip the extreme end in a strong solution of copper for a few minutes, then in some chrodide of zinc soldering solution, and finally in some melted solder. This will solder all the wires together in one mass. Then draw out the wires, and bind the bundle as it is being drawn out with some twine or stout cotton. Treat the last end, like the first, to a dip in the melted solder, then fit on it a brass cap, $\frac{1}{2}$ in. deep —a piece of the same brass tube as that used for the regulator will serve the purpose —then sweat it on the soldered wires. This cap will fit tight into the tube of the primary bobbin, to hold the core in it firmly whilst the regulating tube is passing over it. The core, being prepared, must now be soaked in melted paraffin for several minutes, then drained and the twine unwound, leaving a smooth round bundle of wire.

The Regulating Tube.—In a former paper I cautioned the coil-maker against the use of metal tubes as bodies of bobbins for coils, and then stated a reason for so doing. This reason will now become more apparent as we consider the use of a regulating tube for a medical coil. This tube must be of thin brass, and will cover all the iron core of the coil. When the core is thus covered, its inductive effects will be absorbed in the brass tube instead of being transmitted to the primary wire outside. It will also absorb some of the primary induction as well. As the tube is drawn out of the coil, and the core becomes uncovered, the full inductive relation of core and coil is gradually restored, and the full power of the coil is felt. The tube must be selected to suit the coil about to be made—that is, in relation to diameter and length—and should be nicely smoothed and polished inside and outside. A brass knob should then be soldered to one end, when the finished tube will appear as shown at Fig. 26.

The Primary Bobbin.—This may be all in one with the secondary bobbin, as in a small spark coil, or may be made as a separate bobbin. When made in this way, and the secondary bobbin made to slide over it on rails placed outside the coil, the power of the coil may be regulated by sliding the secondary on or off the primary coil. Some coils imported from the Continent are made in this way. The bobbin ends may be made of hard wood or of ebonite, as for a spark coil. The body or tube in which the brass regulator will slide, and on which the primary coil will be wound, should be built up of tough paper, glued together with good thin glue. First cover the regulating brass tube with one fold of paper coated with soap ; this will allow the tube being drawn out when the body is finished. On the soaped paper roll several folds of tough paper, well smeared with thin hot glue, until a tube has been made quite $\frac{1}{16}$ in. thick. Bind this tight with soft cord, and set aside to get hard. The regulating tube can now be slipped out, and the bobbin ends glued on to the paper tube. When this has dried and become quite hard, the whole bobbin should be soaked in hot melted paraffin.

The Primary Coil.—When the bobbin has cooled and again become hard, we may wind on the wire for the primary coil. In choosing the wire for the primary of a spark coil, we had to use as few layers as possible, so as to lessen the evils of self-induction of the turns of wire on each other. But in choosing the primary of a medical coil, we need not be hampered by any such considerations. Indeed, it may be desirable to have several layers of wire on the primary coil, so as to get a self-induced current in this coil. This primary current can then be taken off by suitable wires, and used as a mild current of the lowest power when occasion requires its use. No. 18 silk-covered copper wire will be quite large enough for the primary of a medical coil, and four layers of this may be used. Nos. 20, 22, and 24 may also be used as the primary wires for small medical coils, but it is not advisable to occupy more space than can be taken up by four layers, although six may give good results. The same care respecting insulation and winding must be exercised in medical as in spark coils, and the finished primary coil must be covered with a few layers of paraffined paper before winding on the secondary coils.

The Secondary Coil.—The wire for this should be several sizes smaller than the wire employed for the primary coil, but wire of the same gauge may be used if the bobbin is large, and an induced current of low tension only is desired. If No. 16 is used for the primary, we commence with No. 20 for the secondary, using Nos. 24, 28, and 30 afterwards. If No. 18 is used for the primary, start with No. 22 for the secondary, and follow on with Nos. 26, 28, and 30, if a variety of powers are desired. These are good proportions, but the gauge may be varied to suit the fancy of the maker or the requirements of the coil. If a full current of high tension is required, the secondary may be wholly of No. 30. It is not desirable to have a finer wire than No. 32, although Nos. 36 and 40 have been employed in the construction of medical coils. The current from finer sizes is sharp and irritating to the nerves, and the beneficial use of this is doubtful. All wires employed for the secondary must be of best copper, well annealed, insulated with silk covering, and run through hot melted paraffin, as for spark coils. In fact, the same care must be exercised in winding the secondary of this coil as recommended for winding spark coils.

Various Powers from One Coil.—It is frequently desirable to have at command the means for altering the tension of current from one of these coils. This is partly provided for by the brass regulator, the tension of the induced current rising as the core is uncovered by drawing out the regulating tube of brass. But higher or lower tensions than this will give may be desired, and this wider range of powers may be obtained from one coil by varying the winding of the secondary wire. I will suppose this to be desired in a small coil, and give an account of its construction as an example.

Suppose we wish to construct a small coil, 4 in. in length by $2\frac{1}{2}$ in. in diameter, having a $\frac{3}{8}$ in. core. The primary for this may be four layers of No. 18 silk-covered copper wire. Over this, first wind $\frac{1}{4}$ lb. of No. 22 silk-covered copper wire. When the finish end of this is reached, leave enough free wire to pass out through the bobbin end, and connect to a stud on the baseboard of the coil, then lay 1 in. of the wire, just where it passes out through the bobbin, bare of its insulated covering; twist the bared and cleaned end of the next length of secondary around this bared spot, solder the junction of the two wires, and cover it with a layer of paraffined silk thread to restore the insulation. The next length of secondary will be composed of about 2 oz. of No. 26

silk-covered copper wire. When this has been wound on, bring out the finish end, as in the first length, and join the third length to this second length, as at first, then wind on 2 oz. of No. 28 in like manner; then finish off with 2 oz. of No. 30, bringing out the finish end of this to be connected to a separate stud. As a guide to amateurs, I give herewith a diagram (Fig. 27) of the several coils, just to show how they are connected and the ends carried to the studs. On referring to this diagram, it will be seen that the coil *a* is the primary, connected at the ends to the battery terminals, A and C, through the break-stud at D. S,, shows the position of a switch connecting one of the handles with the studs 1, 2, 3, 4, and 5. S, shows a stud connecting the other handle and one end of the primary coil. The other end of this coil is connected by a short wire to the stud No. 1, and this forms the primary induced circuit, or lowest power. The commencement of the first secondary, *b*, will also be connected to this wire, and terminate in the stud No. 2, forming the second power. To this same wire the commencement of the coil *c* will be soldered, and this coil will terminate in the stud No. 3, forming the third power. All the others may now be easily traced. The switch need only be the ordinary form, made of spring brass, turning on S,, as on a pivot, and sweeping with its other end the semicircle of studs.

Breaks, or Interrupters, for Medical Coils. — In the spark coil, it is desirable to have a slow-acting break, to give the core a chance of being fully magnetised. In a medical coil the opposite condition is most desirable, so as to avoid jerks and twitches in the nerves of the patient when applying the induced current. The break-spring should therefore be short, the adjusting screw made to work easily in a split contact pillar instead of with a lock-nut, and the whole made to work smoothly and regularly. The ordinary form may be employed, using the core as a magnet, and in this case the break must be fixed at the fixed end of the core, which must be left protruding a little for the purpose; or the horizontal form of break may be employed, with a separate horseshoe magnet to work it, as described in the last paper on this subject; but in this case the spring must be short, and all parts made to adjust easily.

A Commutator for Medical Coils.—As it is sometimes most desirable to have the means at command of changing the direction of the current without giving the patient the trouble to change the position of the rheophores, or handles, a commutator for this purpose is a useful adjunct to a medical coil. This little apparatus is shown at Fig. 28, and consists of a cylinder of ebonite, boxwood, ivory, or similar insulating substance, about 1 in. in length and the same in diameter, furnished with two plates of German silver, one on each side, and two short spindles, one at each end, running in two small brass brackets fixed to the baseboard of the coil between the terminal binding-screws and the break. Two springs of brass or of German silver are also fixed to the board on each side of the cylinder, so as to press on both sides and make good contact with the metal strips on the cylinder. The two spindles must be soldered into circular plates, and these fastened by screws to the ends of the cylinder. One of these ends must be connected to one metal strip on the cylinder, and the opposite end to the opposite metal strip. It is also advisable to have one of the spindles longer than the other, and fix to this a milled head or a flat thumb-piece of metal or of ebonite, for convenience in turning the cylinder.

To connect this commutator with the coil, lead a wire from one of the terminals on the baseboard to one of the brass brackets supporting the cylinder; then another wire from the other terminal to the other bracket. Connect one spring to one end of the primary coil, and the unoccupied brass spring to the opposite end of the primary, or to the break-pillar of the coil, as shown at Fig. 29. It will then be seen that a half-turn of the cylinder will change the direction of the current in the primary coil, and a quarter-turn (leaving the springs resting on the cylinder without touching its metal strips) will cut off the current from the coil.

Use and Abuse of Medical Coils.—I could write a whole volume respecting the use and abuse of medical coils, were it in my province to do so. It is, however, no part of my duty to invade the domain of electro-therapeutics by showing how those coils should be used for the relief and cure of disease. Electricity is a curative agent. It is a powerful means, in the hands of a trained man, to cure disease, to injure health, or to kill. Its action is as potent as that of the poisonous drugs aconite, belladonna, and strychnine, and it demands an equal care in its application for the cure of disease. A medical coil in the hands of an experienced medical electrician is a power for good; but the same coil in the hands of an ignorant man may result in irreparable injury being done to the person placed under its influence. Although a person in good health may play with a coil with impunity, it is not a safe plaything for an invalid or one out of health. The sphere in which an induced current of electricity may be beneficially employed as a curative agent is a limited one of small extent. Much harm may be done by using too large a dose of electricity, sending the current in a wrong direction, and applying it to the wrong parts of the body.

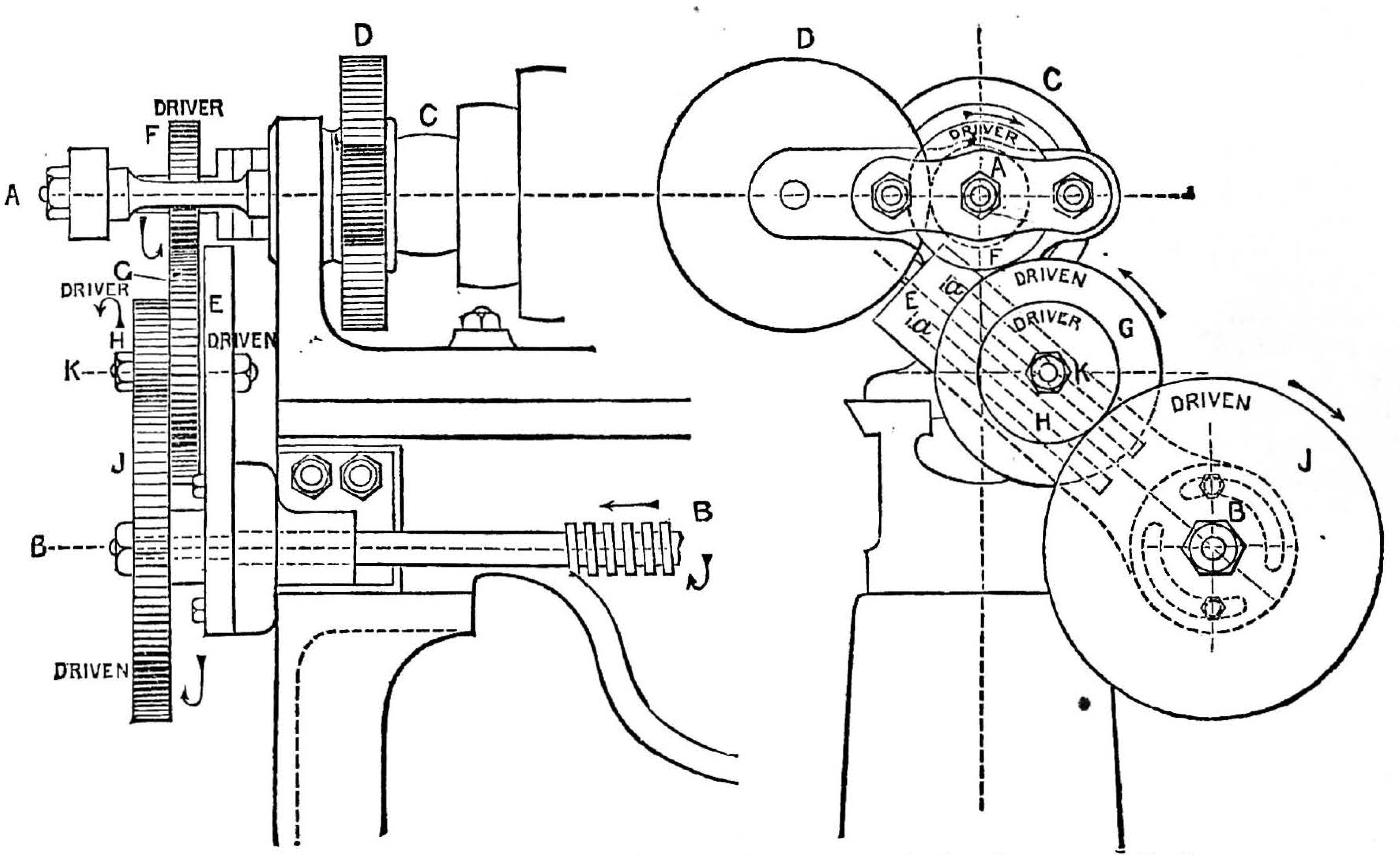
SCREW-CUTTING IN THE LATHE.

BY J. H.

Compound Trains and Examples in Calculation.

Description of a Compound Train—"Stud" Wheels—The Illustration Explained—Recapitulation of Principles—Methods used in Practice.

Description of a Compound Train.—Let us now try to get a clear idea of the use and arrangement of a compound train impressed upon the mind. Suppose we want to cut a screw having twenty-four threads to the inch in a lathe whose leading screw has two threads to the inch. The ratio is $\frac{24}{2} = 12$, and consequently, if a single train were used, the driver wheel—that is, the wheel on the lathe mandrel, as explained in my first paper—would have to make twelve revolutions to each revolution of the driven, or guide-screw wheel. Wheels of 240 and 20 teeth, therefore, would give this ratio, thus: $\frac{240}{20} = 12$, and the 20-toothed wheel would be the driver, and the 240-toothed wheel the driven. But as there is no wheel of 240 teeth in any ordinary set—and even if we had one, it would probably be too large for gearing-up between the centres of the lathe mandrel and the guide screw—we must necessarily break up the supposed 20 and 240-toothed wheels into factors, the ratio of whose *products* will have the ratio $\frac{240}{20}$, and in that case we make use of the intermediate stud on the rocking plate. The numbers are broken up, and the details of the process are as follows: $\frac{20}{240} = \frac{2 \times 10}{20 \times 12} =$ adding cyphers, $\frac{20 \times 10}{200 \times 12}$. As we have neither 10, nor 200, nor 12-toothed wheels, we try again; add cyphers to 10 and 12, and then halve 200 and 100, thus: $\frac{20 \times \overset{50}{\cancel{100}}}{\underset{100}{\cancel{200}} \times 120}$, the same ratio between the numbers above and below the line being preserved, until we come to numbers which are not duplicates of one another, and which are included in the ordinary sets of change wheels. So that if



Screw-Cutting in the Lathe. Fig. 5.—The Arrangement of a Compound Train.

20 and 50 drive, and 100 and 120 are driven, we shall have the ratio $\frac{100 \times 120}{20 \times 50} = 12$, which is the ratio required.

"*Stud*" *Wheels.*—One of the drivers and one of the driven must be placed upon the stud of the rocking plate. But to use the term "stud wheel," except when it happens to be an idle wheel employed for changing the direction of motion, as in cutting left-handed screws, causes confusion; and I shall only employ the terms "driver" and "driven."

The Illustration Explained.—The relative arrangements of these wheels are shown in Fig. 5, together with just so much of the headstock gear as is necessary to illustrate the arrangements of a compound train. In these figures, A is the lathe mandrel; B the guide screw; C the cone pulley through which the lathe mandrel is driven; D the large wheel of the back gear; E the rocking or quadrant plate, pivoted upon the end of the guide screw; F the first driver wheel; G the first driven wheel; H the second driver wheel; J the second driven wheel; G and H are commonly termed the stud wheels; K is the stud. As driver and driven wheels of various diameters are used for cutting screws of various pitches, the quadrant plate is provided with curved slots, to permit of free pivoting around the end of B. The wide range of radius permitted by these curved slots, and the choice of any position in the two straight slots in the rocking plate, permit of such range of location for the stud K, that all the wheels from 20 to 120 teeth, and even higher, can be geared up for compound trains.

It does not matter which of the drivers goes on the lathe mandrel and which on the stud. Neither does it matter which of the driven goes on the stud nor which on the guide screw, because this only amounts to a transposition of the numbers, and does not affect the *products* or the *ratio*. Thus, in the example last given 20 might go on B, and 50 on A, and 100 might go on C, and 120 on B.

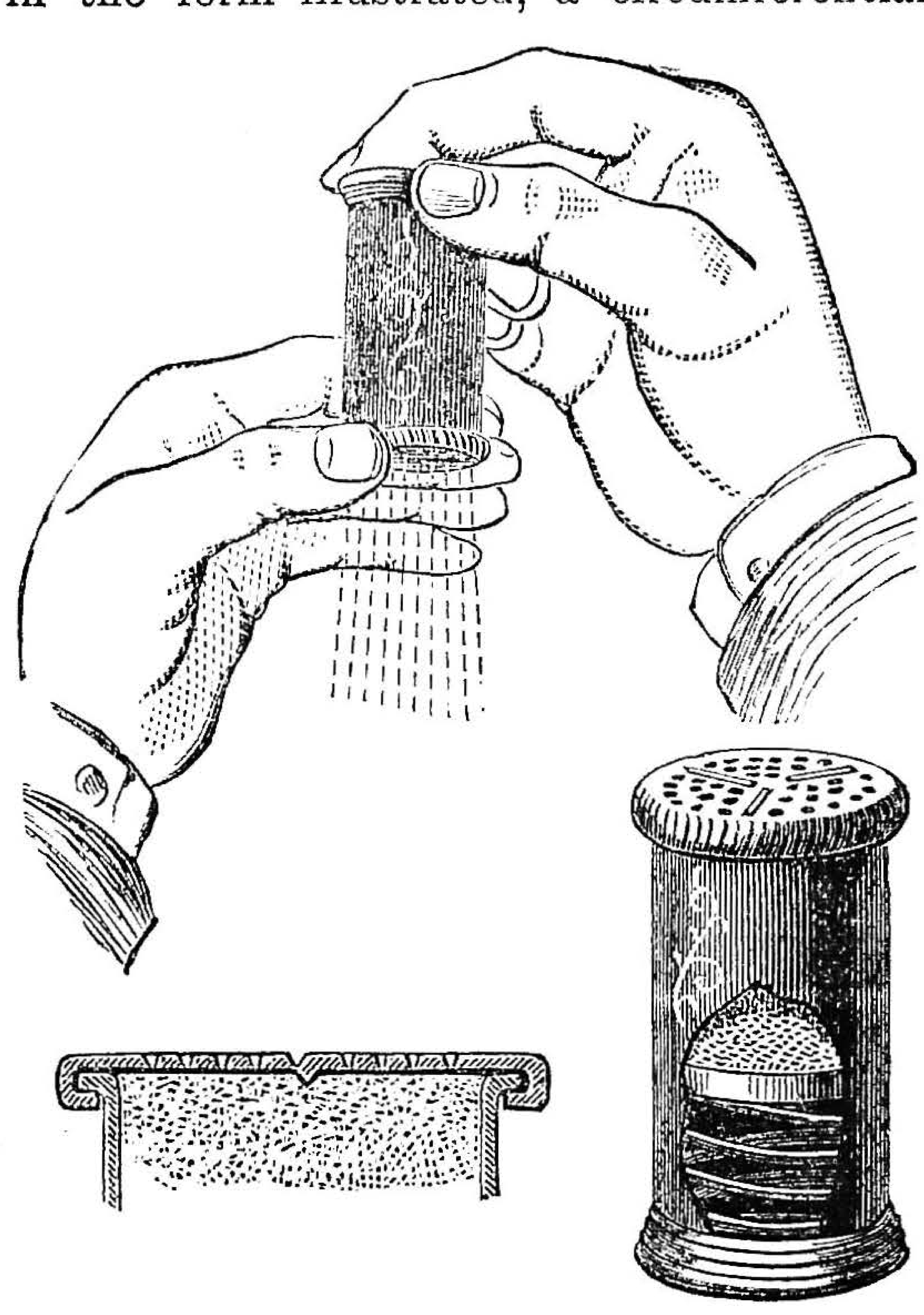
Recapitulation of Principles.—Certain fundamental or axiomatic principles have now been demonstrated in a graphic fashion. Those principles are, in brief, as follows:—The same ratio that exists between the guide screw and the screw to be cut must also exist between the driver and the driven wheel in a simple train; or, in a compound train, between the *products* of the drivers and of the driven wheels. This, therefore, is the fundamental principle of *inverse ratios*. Again, to cut pitches finer than that on the leading screw, the smaller wheel or wheels will drive, and the larger be driven. To cut pitches coarser than that on the leading screw, the larger wheel or wheels will drive, and the smaller be driven. When arranging wheels of a compound train, one driver will be put on lathe mandrel, one driven on the guide screw, and one driver and one driven upon the stud. I will now proceed to apply these principles to some of the rules which are made use of in screw cutting.

Methods used in Practice.—In practice, the common method employed is to write down in the form of a vulgar fraction the number of threads per inch of the guide screw and the number of threads per inch of the screw to be cut, and deduce suitable wheels, having the same ratio as the numerator and denominator of the fraction. The numerator then corresponds with the driver, and the denominator with the driven wheels. This method covers all possible cases that can arise in practice, and is in harmony with the principles just laid down. Thus, with a leading screw of $\frac{1}{4}$ pitch, *i.e.*, with four threads per inch, we want to cut screws, say, having respectively $1\frac{1}{2}$ threads, 2 threads, $6\frac{1}{2}$ threads, and 20 threads per inch. The vulgar fractions expressing these relations will be as follows:—$\frac{4}{1\frac{1}{2}}, \frac{4}{2}, \frac{4}{6\frac{1}{2}}, \frac{4}{20}$. The relations being clearly set down, we now proceed to deduce suitable change wheels from these fractions. In two of these cases we have integers and fractions combined, and we cannot work with these, but must turn them either into whole numbers or into decimals, thus:—Multiply the entire vulgar fraction by the denominator of the fractional number, or turn the latter into a decimal. In this way, $\frac{4}{1\frac{1}{2}}$ becomes $\frac{4}{1\frac{1}{2}} \times 2 = \frac{8}{3}$; or, as a decimal, $\frac{4}{1{\cdot}5}$; and $\frac{4}{6\frac{1}{2}}$ becomes $\frac{4}{6\frac{1}{2}} \times 2 = \frac{8}{13}$; or, as a decimal, $\frac{4}{6{\cdot}5}$. Wheels are deduced from ratio relations of this kind either by the addition of cyphers or by multiplying by 5 (because the numbers of teeth in the change wheels advance by fives), and then by halving, doubling, or otherwise breaking up or increasing the number first obtained, in *equal proportions*—that is, care must be taken to increase or diminish the numbers in numerator and denominator in exactly the same proportions. Now, taking each of these ratio numbers in succession, we can say, Writing:—$\frac{4}{1\frac{1}{2}} = \frac{8}{3} \times 5 = \frac{40}{15}$; or, adding a cypher, $\frac{8}{3} = \frac{80}{30}$; or, further increasing by one-half, $\frac{120}{45} = \frac{\text{driver.}}{\text{driven.}}$ Again, writing:—$\frac{4}{1{\cdot}5} \times 5 = \frac{20}{7{\cdot}5}$, and, multiplying by $2 = \frac{40}{15{\cdot}0}$; or, adding a cypher to $\frac{4}{1{\cdot}5} = \frac{40}{15} = \frac{\text{driver.}}{\text{driven.}}$ Again, writing:—$\frac{4}{2} \times 5 = \frac{20}{10}$, and multiplying by $2 = \frac{40}{20}$; or, adding a cypher to $\frac{4}{2} = \frac{40}{20} = \frac{\text{driver.}}{\text{driven.}}$ Again, $\frac{4}{6\frac{1}{2}} = \frac{8}{13} \times 5 = \frac{40}{65}$, or writing:—$\frac{4}{6{\cdot}5}$, and adding a cypher $= \frac{40}{65} = \frac{\text{driver.}}{\text{driven.}}$ Again, $\frac{4}{20} \times 5 = \frac{20}{100}$; or, adding a cypher to $\frac{4}{20}$, $= \frac{40}{200}$, and halving (because there is no 200-toothed wheel in a set), $= \frac{20}{100} = \frac{\text{driver.}}{\text{driven.}}$

A glance at the numbers shows that we have inverse relations between the guide screw and screw to be cut and the driver and driven wheels. Also, in the case of the first two threads of $1\frac{1}{2}$ and 2 per inch respectively, which are *coarser* than the guide screw, the larger wheels drive and the smaller are driven, thus causing a more rapid revolution of the guide screw than of the lathe mandrel, and consequently a rapid longitudinal traverse of the cutting tool relatively to the work in the lathe. In the case of the second set of threads of $6\frac{1}{2}$ and 20 to the inch, which are finer than the guide screw, the smaller wheels drive, and the larger are driven, and the guide screw revolves slowly, and the tool is retarded in relation to the work. But putting the relation of the guide screw and screw to be cut in the fractional form shown, and remembering that the numerator gives driving and the denominator driven wheels, it is hardly possible to go wrong, because the fraction shows at once which wheels should go on mandrel and which on guide screw.

SALT HOLDER AND SPRINKLER.

A SALT sprinkler, designed to obviate the difficulty so frequently experienced in use from the salt becoming damp and caking, is shown in the accompanying illustration. It is the patent of Mr. F. N. Dixon, Philadelphia. As shown in the sectional view, a follower and a spiral spring are contained within the holder. The spring is secured to the bottom and follower respectively, and operates to force the follower upward, to support the mass of salt, whatever its quantity, against and in contact with the cap. The cap is permanently swivelled upon the body so as to freely rotate upon it, having, in the form illustrated, a circumferential



Salt Holder and Sprinkler.

flange engaging a similar flange on the body. The cap may also be provided with small downwardly turned cutting edges. To operate the device, it is inverted and held with one hand, and the cap rotated backward and forward with the thumb and finger of the other hand. In such rotation or working the cap perforations and edges exert a positive grinding or shearing action upon the surface of the mass pressed against them, so that each movement of the cap compels a given quantity of salt to drop through the perforations. The bottom is secured to the body by a screw thread, and may be removed, together with the connected spring and follower, to fill the sprinkler.

BIRD SEED.—To protect seed from birds, mice, and insects, heap the seed together, pour over it boiling water, then at once stir in pitch-pine tar not too thickly used, then mix wood-ash or slacked lime with the lot: this keeps them from clotting together. A teaspoonful of tar to follow four quarts of water is the right proportion, and birds, mice, or insects avoid it.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

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WANTED—A COLOUR STANDARD.—The task of selecting and naming certain colours with a view to their adoption as a permanent standard has never yet been accomplished to the satisfaction of both artist and physicist, and probably it never will be. Heretofore such efforts have been the work of individual skill and enterprise, and have been somewhat wanting in authority and influence. The results of the present endeavour of the Society of Arts will, therefore, be awaited with much hopeful interest. We are informed that the selecting of representative tints, and the naming of these, has been brought to a satisfactory conclusion. To complete the work, each one will now be scientifically tested and examined by electric light, and a formula for the production of each colour determined. To gather some idea of the scientific impossibilities of this task generally, we have but to remember that fully a thousand hues can be counted in the solar spectrum, and that tints and shades of each distinguishable hue may be produced in hundreds. But between the scientific and the every-day, art and commercial, aspects of colour there is a wide difference; and it is doubtless upon the lines of "art and commerce" that the new standard of colours is being prepared. The advent of the electric light has provided a source of illumination of an exact and measurable nature. Light being the source of colour, it can readily be grasped how great are the advantages of the former illuminant compared to the ever-changing daylight. The possession of an authoritative standard will have an important bearing upon the study of harmonious colouring, and, indeed, upon colour in all phases of art. We trust that when the labours of the special committee have been brought to a conclusion, the project of an international standard will be within the bounds of practicability, and that in the process of time "God's greatest gift to the eyesight of man," as Ruskin has described colour, may be appreciated as such by humanity at large. But let no time be lost. It is the wearying and often unnecessary processes of official delay which clog progressive measures that makes progress in all matters in this country so fearfully slow.

"JACK OF ALL TRADES."—The system which holds in many large workshops of keeping a man employed continually on one class of work has some advantages which must be admitted. By daily practice in the same set of operations the workman acquires a dexterity and knowledge of his particular branch of work which enables him to turn out his results with the utmost perfection and speed. The man, for example, who has been brought up from his youth to the making of dolls' eyes of a particular size and colour benefits his fellow-men by the production of very excellent dolls' eyes, and himself by the receipt of the good wages he is enabled to earn. But at what a cost it is to the man's development as a human being! All his thoughts and efforts bestowed on the one narrow object of turning out weekly so many gross of dolls' eyes! It cannot be too strongly impressed on the artisans of to-day, especially the younger ones, that a well-developed and organised brain—what is known as a "level head"—can only be obtained by breadth of culture; that is to say, by knowing something, if only a little, of a great many things. The old millwrights of the beginning of the century, the men who invented nearly all the machine tools and labour-saving appliances that we use to-day, were not accustomed to working in one groove of routine week in and week out. Maudslay, Nasmyth, and Whitworth were not afraid to tackle undertakings of the most diverse character; Richard Roberts invented and improved appliances of every description from cigar-making machinery to locomotive engines; and the inventive and speculative character of the modern American workman is largely due to the fact that every American, from Gilead P. Beck to President Harrison, has generally made a living at half a dozen trades before he is thirty years of age. There is no harm in being called a "jack of all trades." The workman who does nothing year after year but turn pearl buttons may become very expert and turn out first-class buttons, but he becomes little more than a machine that walks about and requires feeding and clothing, while the workman with brains will think the matter over and produce a machine of iron and brass that will do the work of fifty men with absolute accuracy. Machinery does not work by rule of thumb, and does not make mistakes, and so the world is happily supplied with its pearl buttons at a very much lower price, while so much human intelligence and labour are free to be directed to more worthy channels. Every workman, and, for the matter of that, every civilised man, should endeavour to use all his faculties as much as possible by making himself familiar with things and ideas that lie out of the track of his daily life, and by this means save himself from becoming narrowed and bigoted in his views. What a healthy sign it would be if 500,000 British workmen took up WORK and familiarised themselves with some of the subjects which we endeavour to have so plainly treated therein, that with pluck and perseverance any ordinary man might make himself independent of his own trade—if it suited him to do so.

USEFUL FOLDING TABLE.

BY C. S. V.

INTRODUCTION—WOOD—CONSTRUCTION OF PARTS AND PUTTING TOGETHER — CONCLUDING HINTS.

Introduction.—Furniture that can, after use, be folded into a smaller space than which it originally occupied, is found to be very useful in most houses—especially in small ones, where space is limited.

It is with this intention that the following paper is put before the readers of WORK—to enable them to make an article which, I have no doubt, they will find of service to them in their homes. Furniture generally, I am inclined to think, rather influences the members of a household in a certain degree, inasmuch as one becomes attached to an article after years of use, etc., and if smashed or "departed," one is apt to mourn its loss. This is more so the case with chairs—arm-chairs in particular—as one gets well acquainted with their various ways, etc., and habits, and feels "not at home" in any other. I've no doubt most of us remember a piece of poetry commencing—

> "I love it—I love it, and who shall dare
> To chide me for loving that old arm-chair?"

But I have every right to believe that many become as much attached to other pieces of furniture; and there is no reason why a table such as is put before our readers may not be spoken of in such "loving" terms, especially if made by one's own hands; for, as I myself have proved, it will be found a very useful article for placing books, etc., or for an afternoon cup of tea. With the help of a few simple instructions I think I may say that anyone commencing it will find it an easy task to complete, and that, I trust, satisfactorily.

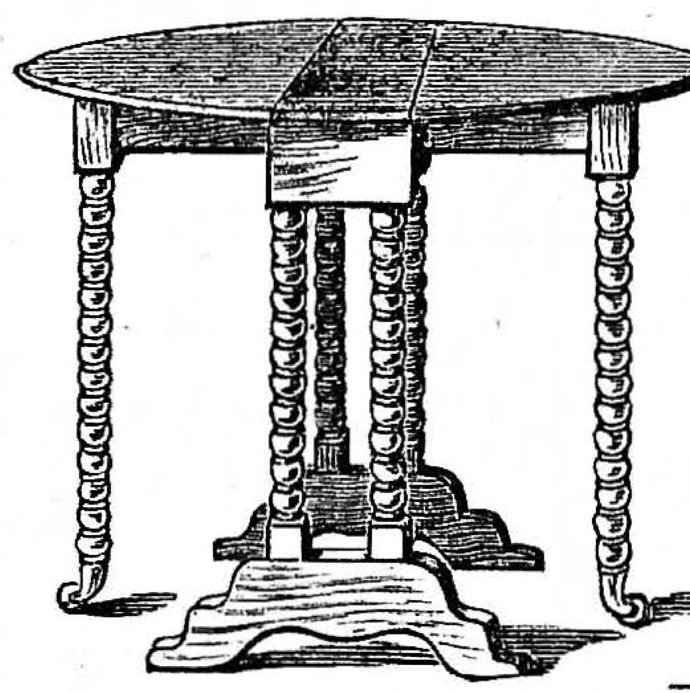


Fig. 1

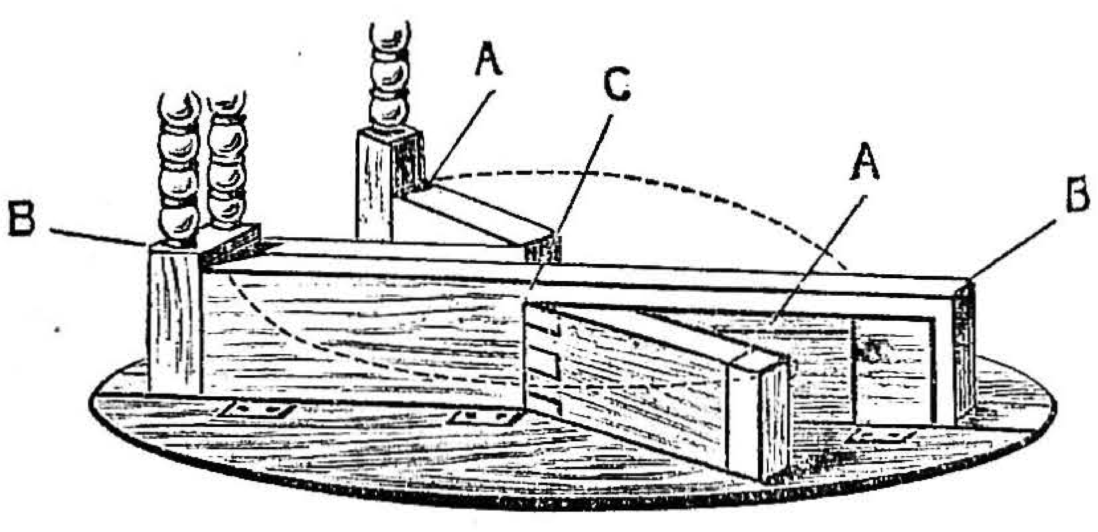


Fig. 4

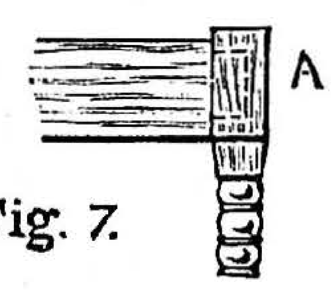
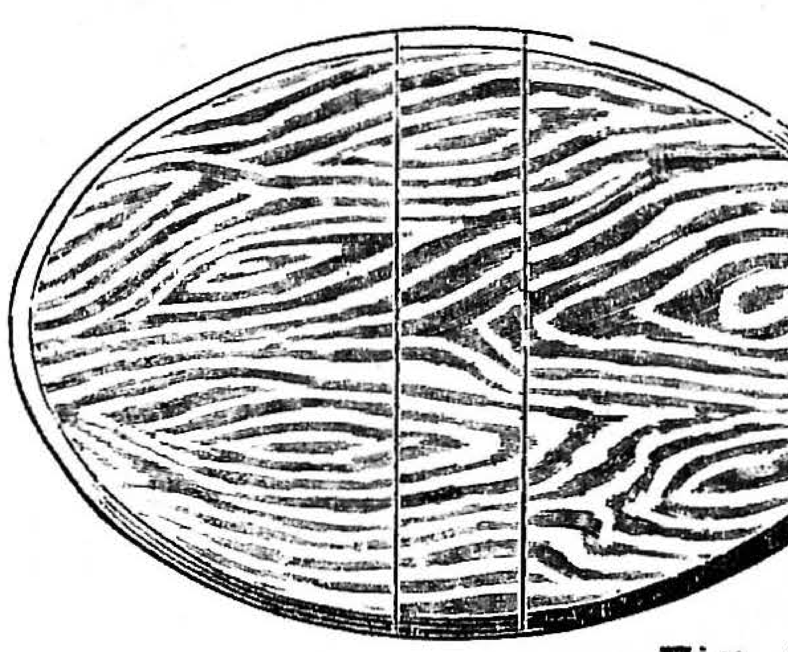


Fig. 7



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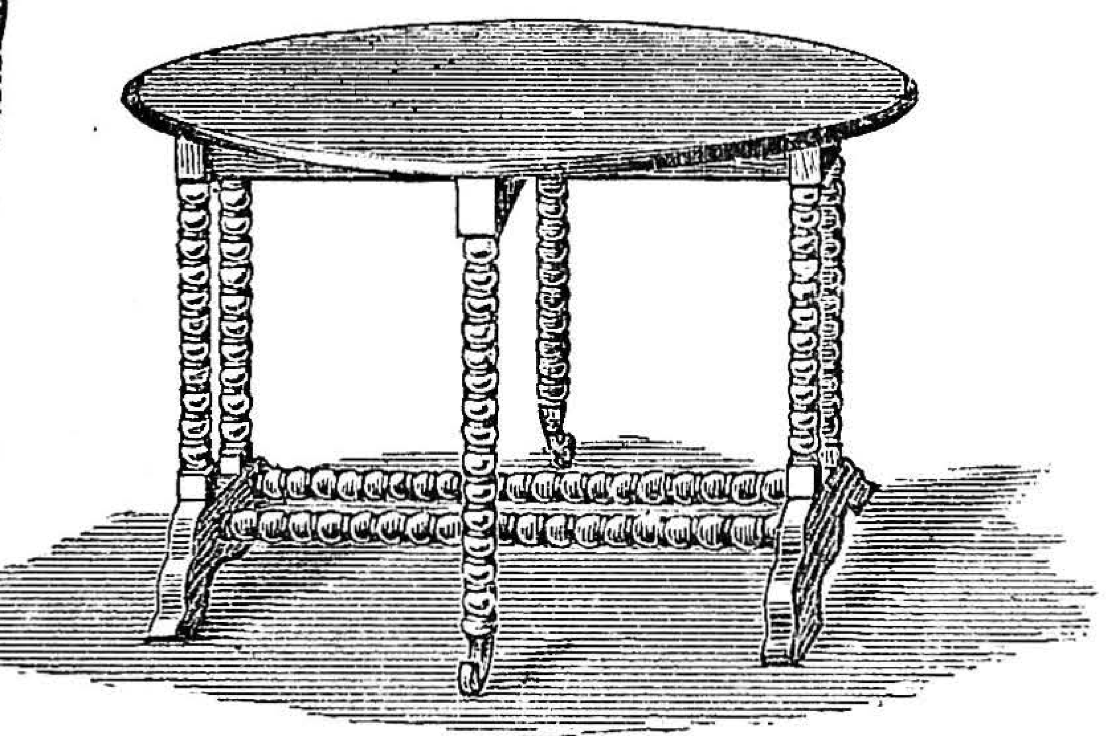
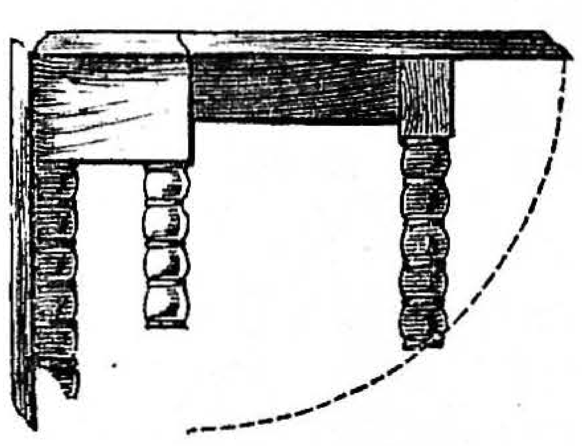


Fig. 2



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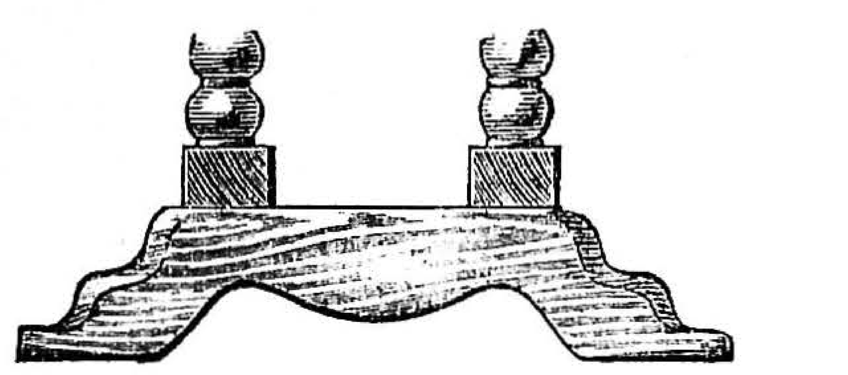

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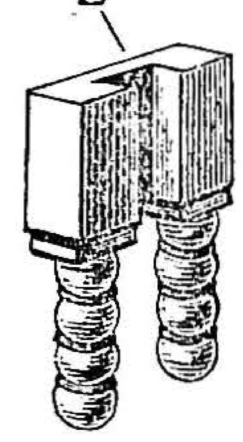


Fig. 8

Folding Table. Fig. 1.—Front View of Table. Fig. 2.—Side View. Fig. 3.—Top of Table, with Lines for showing Folding. Fig. 4.—Showing Construction underneath the Table. Fig. 5.—Plan of Folding. Fig. 6.—Plan of Foot of Table. Fig. 7.—Method of joining Leg. Fig. 8.—Joint for Front Legs.

Wood.—I had first better state what wood it had best be made of. The original is made of American walnut, but I think that mahogany would do as well. A nice clean piece had better be obtained, as it would tend to make the whole a handsomer piece of furniture and more valuable. It can afterwards be French polished, or finished as may be thought desirable.

Construction of Parts and Putting Together.—In Fig. 1 we have a front view of the table complete. Fig. 2 shows a side view of the same, and shows the bars between the two legs. This table will afford a good opportunity for those possessing lathes to turn the legs themselves. Fig. 3 is a view of the top. The lines marked have to be sawn through for the folding, and they had better be sawn through in a sort of half an S form, to enable it to fold better. The edges of the wood may be rounded off, to give it a better appearance. A convenient size for top of the table would be about 25 in. long by 18 in. broad. The height of the table had better be about 20 in. Fig. 4 is a view of the underneath of the table, the construction of which is as follows:—Turn Fig. 3 over, and parallel with the lines of the folding; glue or screw to the wood a piece about 4 in. or 5 in. wide by ½ in. or 1 in. less each way than the length of the top of the table. From one end of the wood screw to it another piece running about half-way; and from the other end of the other side screw another piece as before. These two bits had better be about ½ in. less wide than the piece to which they are screwed. The mode of fastening the wood marked A is shown in the illustration, and a small pin run through the joint at C will enable it to move easily.

I think a study of Fig. 4 will show the construction of the underneath, and will make everything clear. The piece of wood running right across must be exactly in the centre, and care must be taken that the pieces on both sides do not pass the lines cut for folding, or else we shall have a rather hard "job" to make it fold nicely. The wood for the top (see Fig. 3) must be rather thick, on account of the pieces that have to be fastened underneath it. The piece of wood, as shown at B B (Fig. 4), can be screwed to the top, and the hole filled in with putty; but I advise the reader to glue it down, and to run a screw sideways at the top and bottom of the length of the wood. This will, if carefully done, hold it firm enough to be able to bear a good strain, and, besides, have a better appearance. Fig. 5 shows a view of the manner in which the table folds; the leg moves on the joint shown at C (Fig. 4), in the position as shown by the dotted lines in Fig. 4; the flap falls down parallel with the legs of the table. Fig. 6 is a plan of the bottom of the two legs, as shown in Fig. 1. At the back of this (Fig. 6) two bars run across, and join a similar piece on the other side. The bar is shown running across in Fig. 2. In. Fig. 7 we have a drawing showing the mode of securing the legs in A (Fig. 4); a mortise and tenon joint will do. The end of the wood (A in Fig. 4) must be finished off so as to hold the leg. Fig. 8 shows the joint for the two legs, as shown in Fig. 1, and is fastened on to B in Fig. 4. The end of B must be cut to receive it. A small screw run through the back of it will make it all the firmer.

Concluding Remarks.—In conclusion, I think the fitting together of the parts will be easy enough if the diagrams are well studied. Care must be taken in cutting the top to have a nice joint for folding. The sizes need not be strictly followed, but are given as the measurements of the original. Castors will be wanted for the legs that are moved for the folding, to enable them to run easily and smoothly. Hinges under the table, where it closes, will, of course, be wanted—six in all; and they had better be nailed; and for the position of them the reader will see on one side of the table, in Fig. 4. The whole had better be French polished as desired. Any inquiries I shall be happy to answer in "Shop."

WRINKLES.

LUBRICATING OIL.—A good lubricating oil for machinery, that will not clog, can be made as follows:—Place a bottle containing half a pint of fresh neatsfoot oil in the sun, put therein a few scraps or thin pieces of lead, and shake it well, and let it remain a few days; then pour off carefully into another bottle the clear oil *only*. Repeat as before, using fresh scraps of lead. Only use the transparent oil.

BLOWPIPE SPIRIT.—A good spirit for blowpipe lamp can be made by mixing six parts of alcohol, a little oil of turpentine, and a few drops of ether, mixed up in a stoppered bottle.

CARBOLIC ACID will remove paint stains from clothing.

CEMENT.—A useful cement to fix the glasses on paraffin lamps, and also resist the action of the paraffin, can be made by mixing plaster-of-Paris with a solution of alum and water, and it has the advantage of drying hard.

AGE ON WOOD.—To impart to wood carving the appearance of age, boil five ounces of walnut shucks in one quart of water, filter, and apply in a cold state.

BOOT AND SHOE MAKING.

BY WILLIAM GREENFIELD.

THE WAY TO FIT THE SOLE—METHOD OF ROUNDING (OR KNIFING-UP) THE SOLE—THE WAY THE SOLE IS CHANNELLED—THE STITCHING-THREAD.

The Way to Fit the Sole.—The sole has to be wetted, and dried until it is just mellow, then hammered from the centre outwards. In this condition it is pasted well over on the flesh side. The bottom of the boot must have a coat of paste, and French chalk should be sprinkled over the felt, etc., to prevent the boot from creaking. A sole-tack is put in the centre of the toe, as at A (Fig. 1), one at B, and another one at C and C. Here the sole is tapped down all over with the hammer, and the boot held firm on the knees, by letting the strap pass across the centre of the waist, a little below B, and under the left toe. The waist at either side should be manipulated with a round-headed hammer, called a waist- or cramp-hammer.

In very strong work the waist of the sole is left to the full substance; but this depends greatly upon the wear such boots are to be subjected to, and also the special desire of those who will have to wear them.

When the waist is left in this way, and stitched through close to the edge, it is called a square waist, and is only suitable for riding and other strong boots. The thickness is taken down—not the whole way across, but only at either side—and then off the flesh side. This is the general rule. The sole is placed flat upon a board, grain side down, and a skiver taken off, as from D to D, and then another (by turning the sole the reverse way round) from E to E, leaving the skivers a little thicker at F and F. The dotted line in Fig. 1 shows the shape of the soles when bought in pairs, and also how the sole can be fitted to the boot so that, if it be a narrow toe, the piece G is not wasted. Two of these odd pieces will half heel a pair of boots, or, spliced together, will make one top-piece. Therefore, it is well to mark the sole round to the boot, and cut this piece off before putting the sole on. The dark-shaded pieces, F and F, will not, when placed upon the boot, be on top, as here shown, but underneath, next to the welt.

When this is done, and the work has been hammered, so as to make the bottom quite smooth and level, it can be taken off the knees, and a piece of blunt bone or hard wood run right round between the upper and the welt. This will make the welt level, and cause it to set flat against the sole. If rounded up well before the sole is put on, the boot will be a good guide of what the sole should be, which also, in its turn, has now to be rounded up.

Method of Rounding (or Knifing-up) the Sole.—To this part of the work great care and attention must be paid, since it is this "shaping-up" which makes the difference between a well-finished and badly-finished boot.

The boot should be held upon its side on the knees firmly with the left hand. The knife must be very sharp, and held in the right hand. The point should lay on the first finger, with the thumb on the top of the blade, with the rest and the handle held firmly in the hand. The point should only overhang the side of the finger to just the substance of the sole, and not as A in Fig. 2; otherwise, the upper of the boot will be cut as shown. The finger is kept next to the sole, as at point B, and forms a guard to the knife. The piece (C) taken off need not be one cut; it can be pared in very small pieces, so as not to go in too far, and spoil the shape the boot is to be.

This is continued all round, only at C and D the cut must not be close, as the leather here will be wanted to make the seat with and to cover the stitches.

When towards the toe, you will not need to keep the knife cramped up in the hand, as the upper here does not overhang the sole so much, and more liberty may be given to the knife, using the centre more.

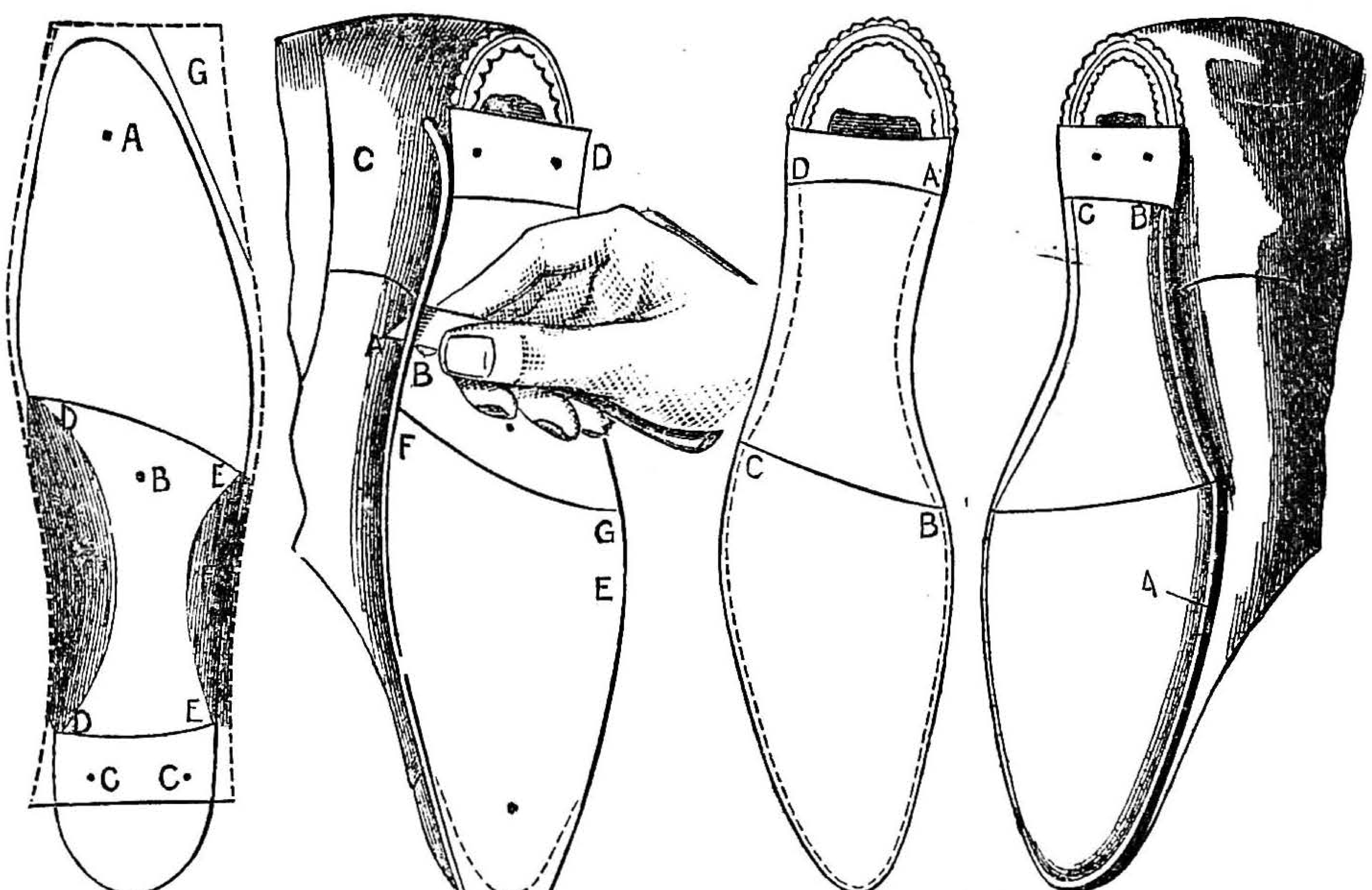


Fig. 1. Fig. 2. Fig. 3 Fig. 4.

Boot and Shoe Making. Fig. 1.—Showing by Line the Shape of a Long Sole, and by the Dark Portions the Skiving for the Waist; also its position on the Boot. Fig. 2.—Showing how the Knife is held in rounding up, and the danger of having the Blade too far out of the Hand; also how the Upper is cut. Fig. 3.—Showing where to cut the Channel. Fig. 4.—Showing how to cut and how to open the Channel.

The welt and sole should be pared closer at E than at F; but starting very close at G, it must become gradually wider until reaching F, and similarly narrower until reaching B. Then the ends of the waist, C and D, should match, but there must be no stint.

In rounding-up, great care is necessary to make and keep the edge quite even and square. This is the only chance now left to give the fore part of the boot shape and form, and this should be done consistently with the shape the heel is to be.

The Way the Sole is Channelled.—This is by holding the boot firm between the knees with the left hand. The knife (which must be very sharp at the point) should not be wide, and should be held in the right hand, as we hold a pen, only a little more upright. The third and little finger should be left loose. The tip of the second finger is placed on top of the sole on the extreme edge. The knife is then dug into the leather at A (Fig. 3), and the third and little fingers that were left loose are now used against the edge of the sole and welt to form a guard, and to steady the movement of the hand while the knife is being passed round the sole.

It will be seen by the dotted line in this figure that the channel has to be cut very near the edge quite round the fore part, as from B to C, whereas it is wider from A to B and C to D in the waist. This line can be marked off first with a pair of compasses, allowing it to be $\frac{1}{16}$ in. from the edge in the fore part and about $\frac{1}{4}$ in. in the waist; or another very good way of doing the fore part is by filing off the sharp edge (where we found the finger should rest), so that the edge of the grain may form a line.

We have seen how to hold the knife, and now its exact position should form an angle of 50° with the flat of the welt. The point of the knife should pass through the grain of the leather and into the fibrous portions sufficiently that the thread may be well embedded into it. This will be nearly half-way through the leather. It is the substance of the sole that decides the thickness of thread which lies in this channel. The thread, lying in the firm part of the leather in this way, leaves the grain free to form a covering for the stitch when the channel is laid down.

Care must be taken with the waist, as the leather has been thinned down; and if the knife should go more than half-way through, it would not hold the stitch, and so the entire sole would be spoiled.

The channel can be opened with any blunt instrument, but the prick-stitch is best. Put the point in at B (Fig. 4), and open it up the whole way round, as shown at A, until reaching C. In doing so, don't disturb the edge, but only the grain on top, throwing it quite back. This will allow the stitching-awl to pass through without cutting. If cut, it would not only make the channel harder to lay down, but also cause an unsightly appearance in the finishing.

The bone can now be rubbed round the welt, and it is ready for stitching.

The stitching-thread is our next consideration. This is made in a similar way to the sewing-thread, only it is not made so stout. From five to nine strands are about what are necessary for ordinary work; but whatever be the work, the thread need not be thick, as the stitches are put very close together, and so tend to make a solid result without substance of thread. The bristles will need to be a very nice pair—thin, with the transparent part long and round. They are not bent at the end, as the sewing-thread bristles are, but kept quite straight. They can be plaited on, as already shown and described. These threads can be wetted and twisted, and when dry, slightly waxed.

In a great many boots and shoes the stitches on the welt side are shown up yellow. If this result is desired, yellow flax is used to make the thread, and white wax or beeswax employed to wax it. If the ordinary brown wax is used, it must be waxed very sparingly indeed.

A very good flax for stitching is slate, if the stitch is required to be black; but whatever material is used, the thread will need to be twisted lighter than the sewing-thread, and should be a firm wiry thread.

The student and worker can thoroughly master this chapter, and if anything is not clear I will answer him in "Shop."

NOTES FOR WORKERS.

THE population of New York City is 1,800,000, according to the census just completed.

NEAR the railway village of Galera, Peru, is a peak which affords the highest inhabited place in the world, it being 15,635 ft. above sea level. A tunnel 3,847 ft. long is being bored through the peak, and this tunnel will be some 600 ft. above the perpetual snow line.

AT the New York Eagle Saw Mills, the cutting machine consists not of a saw, but of a blade weighing 450 lb. and moved by a 6-ton fly-wheel. By this, logs are sliced into ½ in. planks at the rate of 1,500 per hour.

STEAM should never be led into a brick chimney or sewer, as it causes disintegration and collapse.

WHEREAS in Germany, Switzerland, Norway, and Sweden from 100 to 400 persons in every 100,000 of the population use the telephone, in Great Britain only 58 do so.

FOUR wooden "turn-about" torpedo boats, fitted as lifeboats, are being built at Cowes for the Spanish Government. Each will be 60 ft. long by 9 ft. 4 in. broad, and provided with compound surface-condensing engines and locomotive boilers. With a load of 2 tons on board, each will have an extreme speed of 17¾ knots, and when going ahead will be able to describe a circle of 40 yds. in 35 secs.

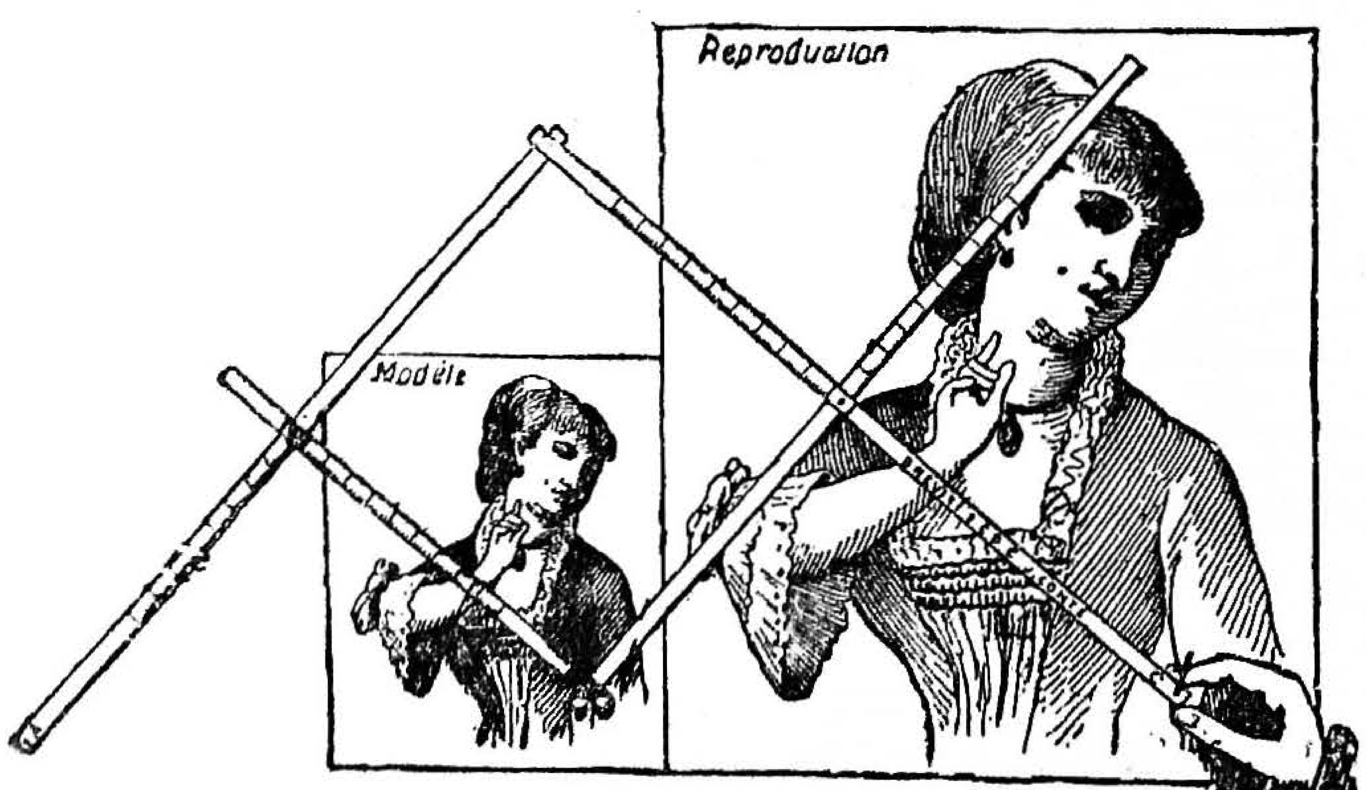
A NEW building material, called "fossil coral," is being worked on an island in the Bay of Suva, Fiji. It is so soft that it can be easily cut into any form, but soon hardens on exposure to the air, becoming similar to fire-brick.

GOMMELINE, used by dyers and finishers for finishing their goods, is made by boiling starch with water, and then adding diastase, which converts part of it into dextrin. The solution is boiled down to 30° Baumé, run into casks, and sold as liquid gommeline, or boiled further until it solidifies, and sold as solid gommeline.

SCIENCE TO DATE.

Anhydrous Crystallised Fluorides.—Anhydrous crystallised metallic fluorides have been lately prepared by the following process: A double fluoride of ammonium and the metal in question is first obtained by the action of ammonium fluoride on the metallic chloride. This, on being heated in a current of carbonic acid gas, leaves the anhydrous metallic fluoride, but in an amorphous state. If this is now heated in a current of hydrofluoric acid gas, it becomes crystalline.

Ohm's Law.—An American electrician suggests the following mnemonic for remembering Ohm's law: Writing E for electro-motive force, C for



Pantograph.

current, and R for resistance, as usual, arrange the letters as follows—

$$\begin{array}{cc} & E \\ C & R \end{array}$$

Now covering C with the finger, we get $\frac{E}{R}$ $\left(C = \frac{E}{R}\right)$, and, similarly, $R = \frac{E}{C}$ and $E = CR$.

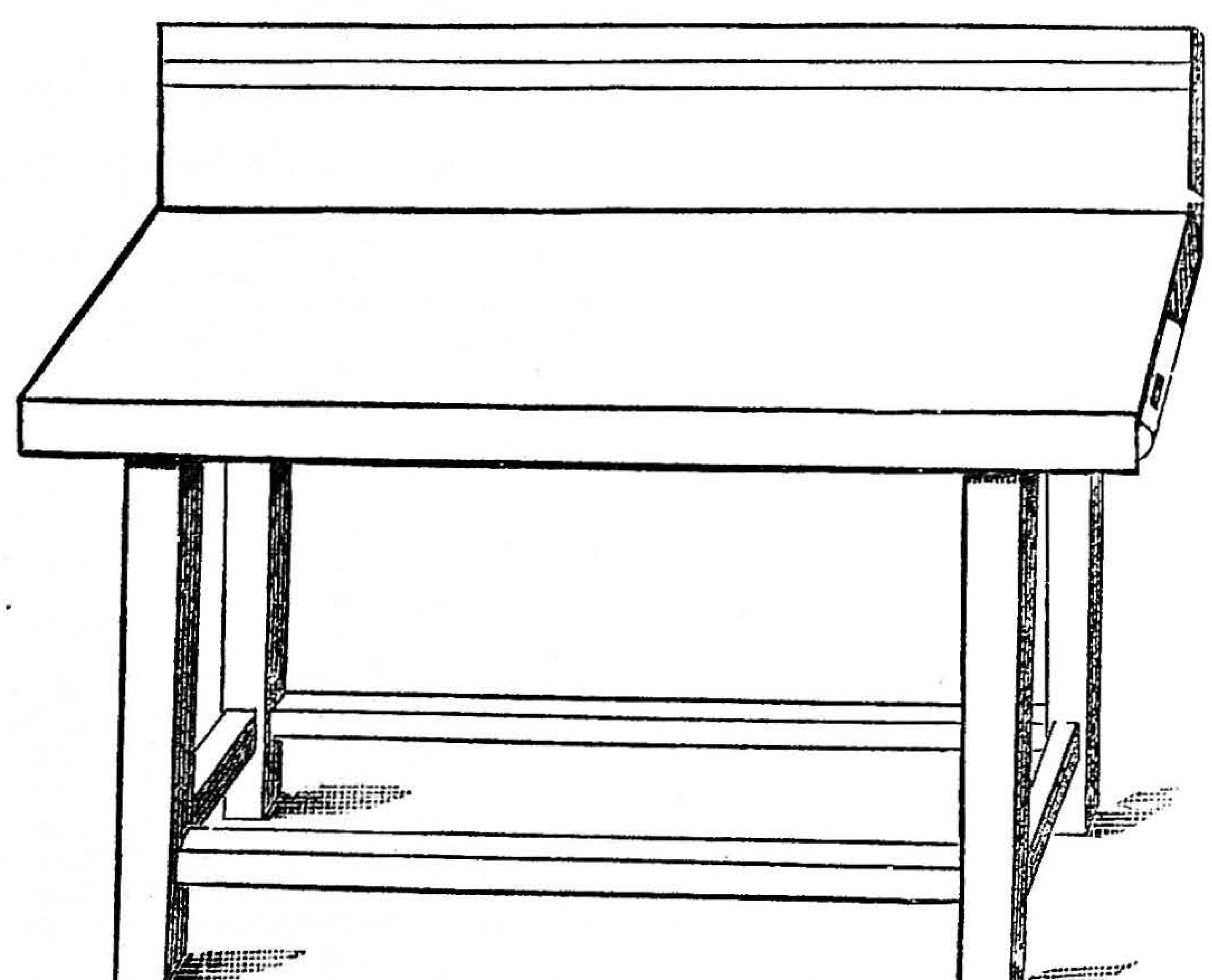
Electric Resistance of the Human Body.—Von Frey finds that the electrical resistance of the human body varies from 300 to 400 ohms.

SOME GOOD THINGS.

Tools.—With the long winter evenings rapidly approaching, the industrious craftsman and apprentice, hobbyists—professional and amateur—and all who take the sensible view of employing the spare time in some profitable pursuit—these will be looking round and spacing out their winter work. It is safe to predict that no hobby will find a larger number of adherents than carpentry. Little wonder, then, that tool-makers, both in London and the country, are to the fore with lists of tools at prices which should make

Punches for Ground Work.

this hobby a favourite one in any home where there are boys and youths. We have already commenced series of papers on "Carpentry for Boys," to be followed by "School Carpentry," and with the plain and easy instructions therein given, every lad who can purchase a few tools


Carver's Bench.

from one or other of the advertisers in WORK ought, with practice, to be in a fair way towards attaining not a little proficiency in, perhaps, the best of all hobbies—that of wood-working. A sign of the coming busy times is the list after list of tools which pour in upon us. One of the latest is that of Mr. Henry Osborn, whose advertisement appears in this issue. The copy before us is the 17th edition of a really useful and well got-up price-list of tools and cutlery of some one hundred odd pages for the cost of 6d., which amount is returned to all purchasers of first orders for 10s. or upwards. Illustrations to the number of about 500 embellish the catalogue, which is divided into six sections, thereby materially simplifying the process of finding tools for particular crafts and processes. Mr. Osborn's system of enclosing order lists upon which selections from his catalogue may be written is a good idea. With the price-list a box of goods, taken haphazard from stock, has been sent for our inspection, and, after making this, we have no hesitation in pronouncing Mr. Osborn's tools entirely satisfactory on the score of quality, finish, and price—points which amateurs and professionals alike will admit to be the chief desiderata. The punches for grooved-work, lamps, bench, and pantograph, illustrating this page, and all articles often inquired after by WORK readers, are from Mr. Osborn's list. We shall hope to bring under notice selections from other manufacturers' lists as they commend themselves for remark.

TRADE: PRESENT AND FUTURE.

*** *Correspondence from Trade and Industrial Centres, and News from Factories, must reach the Editor not later than Tuesday morning.*

PLASTERERS' TRADE.—The plasterers' labourers in Aberdeen are out on strike for an increase of wages from 4½d. to 5d. per hour.

PLUMBING TRADE.—In Aberdeen this is brisk.

EDGE TOOL AND SKATE TRADES.—The edge tool and skate makers of Sheffield are having a busy time.

CUTLERY TRADE.—There is a little more work, chiefly of the better classes of table and pocket cutlery and fine scissors.

FLANNEL TRADE.—The contract to supply the War Office with no less than 1,787,000 yards of flannel has again come to Rochdale.

WOOL TRADE.—Prices are nominal, and buyers very careful: East Indian, white, 5d. to 9¾d., yellow, 3½d. to 8½d.; washed Peruvian, 7d. to 11½d.; washed River Plate, 11d. to 13d.; unwashed River Plate, 5d. to 8d.; washed Morocco, 8d. to 9½d.; unwashed Morocco, 4½d. to 6¼d.; Egyptian, white, 7½d. to 10½d.; Oporto fleece, 7½d. to 8d.; mohair, 11½d. to 12½d.; alpaca, 10d. to 12½d.

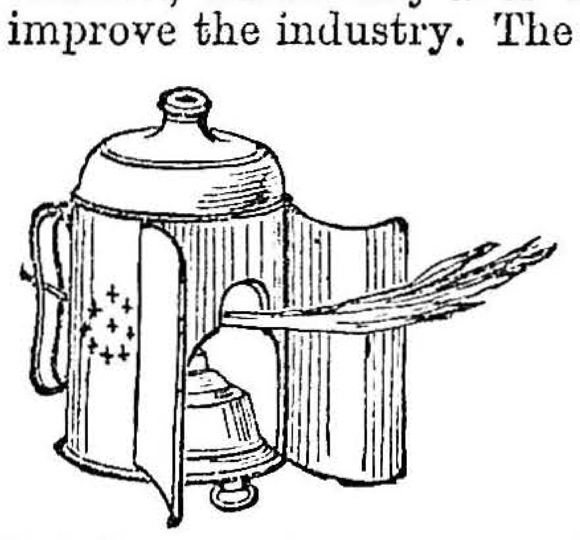
SILVER TRADE.—Sheffield silver trade is looking up. Firms that have been running short time for the last six months are now giving full employment to their men.

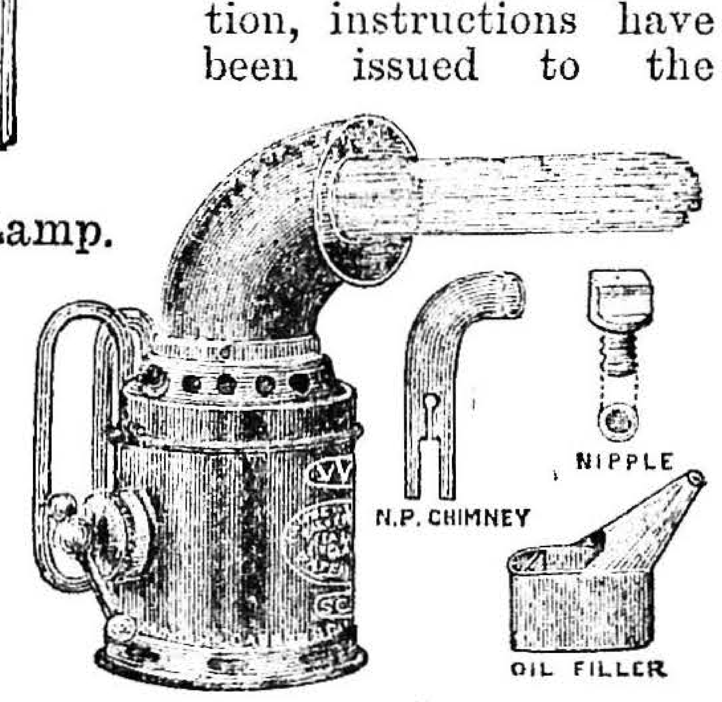
ENGINEERING TRADE.—In the Lancashire district the stationary engine trade is very depressed, as is also the machine tool making branch. Boiler makers are exceedingly slack, and in the locomotive business there is practically no work coming forward. At Barrow the strike continues, and 1,250 men are unemployed in consequence.

STEEL TRADE.—The Lancashire steel trade continues very unsatisfactory, and prices continue to fall. Exceedingly low rates are being quoted for both raw and manufactured material.

IRON TRADE.—Rolling mills are slack. Heavy iron shows an improved tone. Hematites are quoted at from 58s. to 60s. Some forges are well employed on sheets, bars, and angles. In the Lancashire district prices are somewhat firmer. In the Midland district a better tone prevails, and, in Staffordshire especially, increased activity exists. Several of the Midland furnace owners are behind in their deliveries, while in one or two cases extra furnaces have been blown in. New iron works are to be commenced at Middlesborough. A new wire works is about to be opened out also.

COTTON TRADE.—The operatives having unanimously decided to oppose the proposed reduction of 5 per cent., submitted a scheme for curtailing production, which they aver is all that is required to improve the industry. The employers have declined to accept the alternative suggestion, and although only 77½ per cent. of the members of the Federation are in favour of enforcing the reduction, instructions have been issued to the members to give the necessary month's notice for the reduction. There is thus every prospect of a severe struggle taking place in the industry shortly. As against all this our Rochdale correspondent writes:—One local limited company took stock last week, and again declared a dividend of 12½ per cent., which does not look like bad times!


Paint-removing Lamp.



"Paquelin" Plumber's Lamp.

TINPLATE TRADE.—The proprietors of the Alyn Tinplate Works have given notice of a ten per cent. reduction in wages or the closing of the works.

SHOP:

A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given.*

I.—Letters from Correspondents.

Technical Education in the Army and Navy.—C. B. (*Battersea Park*) writes:—"I have read your leader 'Handicraft Education for the Army and Navy,' in Work, No. 178. I have tried very hard to get this subject taken up by the military authorities, and in March, 1888, prepared a paper on the subject; but I was a humble *private* soldier, and what I tried hard for ended in nothing save one thing—viz., the Royal Military Exhibition. Very few people know that this was proposed, also the site, etc., by Musician C. Brock, Scots Guards Band. I cannot enter into all the details in a letter, but I can say that I hoped we might clear a good amount of money by which we would have been enabled to start workshops, etc., in every barracks on the Polytechnic lines. The surplus was, I believe, devoted to soldiers' homes, and nothing whatever was done towards what I proposed. I can give every proof of what I say, and, more, I served on the committee for a short time, but was very quietly ousted, owing, so I was informed, to an objection to anyone serving on the committee under the rank of a commissioned officer. Anyone, therefore, who feels inclined to take up your subject with the hope of seeing it carried out must be prepared to meet with the strongest opposition from the high military authorities that be, unless he himself is one of that very highly distinguished assembly. P. S.—I left the army in disgust after serving no less than eighteen years." [The following extract is from the paper referred to.—Ed.]:—"After long experience, and much questioning with my comrades, I find the great thing needful is education, especially in technical subjects. Therefore, I advocate evening classes on such lines as are laid down in the Polytechnic and similar institutions. This will seem next to impossible, but I have great confidence in the proposition, and if tried on well-founded plans they will take far better than we imagine. The expenses need not be heavy, for I think we would get much help from our civilian professors without having to pay for it. There would have to be a small company subscription, or individual payments, and I suppose the Government would give the army a grant of money on the same lines as they do the civil institutions. Of course, prizes would be offered, and the day when they are to be awarded should be kept as a general holiday for the regiment, and a good entertainment given in the evening. Do not engage any renowned music-hall star, at a good salary, to attend simply for sake of howling 'Two Lovely Black Eyes,' or some such foolish stuff. Give our soldiers an entertainment that will not only open their eyes, but their ears and also their mind. A series of lectures on chemistry, geology, etc., should be given throughout the year. Recollect, to counteract the many temptations by which we know the soldier is surrounded, we want something very powerful indeed to win him from them. Nay, more; we want something that will make him appear a foolish man when he is in bad company, and a wise and elevated man when he is in good company. Another thing I will advocate is regimental exhibitions. Indeed, the opening of one about the time when the prizes spoken of above are awarded would be a great thing accomplished at one and the same time."

People's Homes.—J. C. K. (*London, N.W.*) writes:—"The able leaders in Work, though so brief, yet so succinctly ask How, why, and when the people are to be housed in a way their worth as workers demands, and the progressive civilisation of this age warrants, in one of the richest nations in the world? For 800,000 able-bodied men and women to be workless in these islands means that they are homeless, or on the verge of that sad state; while those who are in work, your able articles show, have to pay exorbitantly out of their uncertain wages for a home which, in nine cases out of ten, is unfit for health, comfort, or misplaced for their work arrangements. The purpose of Work, I assume, is to obtain cogent and logical answers to such questions as are submitted to its readers. As in physics, a definition should be clearer than the thing defined, or a definition would not be needed; so in ethics, the answer should be more demonstrative than the question, or it fails to be an adequate answer. The space at the disposal of those who attempt replies is very limited, and well it is so. It enforces condensation of ideas, which are of more value if focussed to brevity, being at once comprehensive and conclusive. To epitomise the matter, our modern existence may be summed up in two words 'peck' and 'perch.' The 'peck' for food has been settled by Free Trade. The 'perch' for a home must be settled by free land—that is, enough of it for making a home on State-owned domains. Luckily, notwithstanding the vast enclosures of common and open land within the past fifty years, there are many millions of acres still available for people's homes. Of 20,000,000 acres of waste land, 8,000,000 are well suited for productive cultivation, which, under State ownership, would provide as many millions of pounds revenue at once, and produce food for which we now pay £130,000,000 yearly for these imported food products. Average this acreage at ten for each State-renter; it would absorb thousands of able-bodied men and women at healthy productive work without doing injury to a single person in the community. Practically, but a moiety of the army of waiting workers would be fit for land cultivation, and only those proved fit should be allowed to have just as much as their labour could make productive; the remainder would fulfil their duties in other equally useful and productive works, according to their capacities. So much for the *bare land* now waiting for the spade, pick, or plough, where every worker produces twenty-five times more than he consumes. Now for the home for everyone who worked and wanted one. The monster iniquity of home-mongering should be gradually suppressed by a graduated penal tax on this class of property, so that it would cease to be profitable to hold many homes, and at the death of every homeholder of more than one, a tenth should revert to the State as a home death duty, and by the State be handed to County or Borough Councils to let at the lowest possible rate to all who wanted homes, and never to be made a source of profit taxation. In a roundabout, costly way County Councils are becoming dealers and homemongers, resolving into a source of official gain which will soon rival City proceedings in the same line, and make municipal home-mongering an almost irresponsible tax-levy and a curse to the people who have to endure the extortion. This would be avoided if cost were to be the limit of rent-charge."

Jewellers' Trade Annuities.—One of the Trade writes:—"Will more members of the trade make it convenient to attend the next half-yearly meeting of the Annuity and Asylum Institution? A proposition to make the annuity bear some proportion to the amount subscribed was worth discussing at the last meeting, but was withdrawn, partly on account of a rather noisy faction then present. It will probably be brought forward again, when some of the more thoughtful members of the trade should attend and give their opinions and votes."

II.—Questions Answered by Editor and Staff.

Boiler.—R. A. (*Leeds*).—You do not say what type of boiler, nor the nature of the draught, so that it is impossible to frame a reply that would be of any service.—J.

Mill.—G. V. (*Stepney*).—It is impossible to give any useful advice without seeing the mill in question. There are a number of mechanical movements capable of imparting a backward and forward movement from which choice might be made.—J.

Screw Cutting.—P. B. H. (*Southport*).—Of course, anyone "with a moderate intellect would soon find out" that J. H. was not talking at all about the "handing" of screws in the paper referred to, but simply illustrating the elementary relations between the *pitch* of the leading screw and that of the screw to be cut. I think all readers of Work, even though "not blessed with the same brain power," would understand this, and allow the author to finish his work before offering premature and childish criticism.—J.

Locomotive.—G. S. (*Windsor*).—The best book on the subject, though deficient in recent practice, is "Locomotive Engineering and the Mechanism of Railways," by Zerah Colburn, published by William Collins at £2 2s. The only other good book relates to American practice. It is the "Catechism of the Locomotive," by M. N. Forney, published at 10s. 6d. You can get it of Spon, in the Strand. A useful little book is "Locomotive Engine Driving," by Michael Reynolds, published by Crosby Lockwood at 4s. 6d.—J.

Casting.—H. G. (*Coventry*).—The only work which I can recommend is "Casting and Founding," by Spretson, published by Spon at 18s. Chapter XXIV. is devoted to the brass foundry, but is very brief. There is quite a dearth of really good works on this subject. I think the matter will be treated in Work eventually, and, if so, the articles will be exhaustive and reliable.—J.

Etching Ink for Zinc.—Zinc.—To 1 gallon of dissolved gum arabic (genuine and of best quality) add 1 pint gallic acid and ½ pint phosphoric acid; thoroughly mix. To obtain gallic acid, boil 1 oz. gall nuts in 3 pints water. This is the recipe, but it pays no one to make his own zincographic materials. Get them from Stroeger & Co., 68, Barton Street Arcade, Manchester. It is probable that Zinc fails in his lines from want of practice; but if he gets his materials as above, and still thinks that the fault lies in them and not in himself, he should write to Messrs. Stroeger for explanation.—S. W.

Making a Print Imitate an Oil Painting.—Oil Painting.—I am not acquainted with the print in question, and you do not say what kind of print it is. Possibly the same system by which mezzotintos are made to look like paintings will serve your turn. Render the picture fairly transparent by coats of mastic varnish (in which just a trifle of oil is mixed) on back and front; then paint on the back, either with oil or varnish colours, laying them on flat merely, as the shading of the print will give the modelling. But should the paper be too thick to be rendered transparent, I know no other plan than that of retouching on the surface with oil or varnish colour for oleographs, and with body colour for chromos. When this plan is adopted, the strokes of the brush are not "sweetened" out, as they aid in furthering the deception.—S. W.

Thread.—Reader of "Work."—The "pitch of the thread" means the distance from centre to centre, or, what is the same thing, the distance from edge to edge, of a continuous thread. But that is not the same as saying "a ½ in. Whitworth thread;" the latter term relating to diameter at the points. There is no other way of finding change wheels for square threads. Whether the threads are square or V'd is quite irrespective of the pitch; the same change wheels are used for threads of the same pitch, and different thread sections are imparted by different tools.—J.

Wringer Rollers.—Warsaw.—These rollers are made from sycamore or American maple, and can be bought in any large town. The cheapest firm we know of is Messrs. Baker, New Cut, Westminster, London, S.E. The prices range from about 6s. up, according to size.—A. J. H.

Monograms.—F. K. (*Bradford*).—Much obliged, but your designs are not quite good enough for Work. Study more.—Ed.

Making Model Gas Engine.—C. W. L. (*No Address*).—I made one, vertical, about the size you name—1½ in. diameter—but 4 in. stroke. You will find an account of my difficulties with it in two articles, entitled, "Why my Gas Engine won't go," Vol. I., pp. 742 and 759. This was of the simplest description, and I think you will find the information you require in those articles as to how the engine works, etc., and how the valve gear is managed. Several books are named on p. 364, Vol. IV., middle column.—F. A. M.

Medical Coil Battery.—R. P. W. (*Worcester*).—Battery solutions get hot in working when a large volume of current is being taken from them in a short time, and when the carbon plates are of inferior quality. In your case, I suspect the primary of the coil to be of large wire, and the contact spots on the break also large, thus allowing a full volume of current to be taken from the battery. Under such conditions, the solution will soon be exhausted. Respecting the dry battery described by my colleague, Mr. J. Brox, in p. 100, No. 163, Vol. IV., I think you may safely follow his directions, which are most explicit. Dissolve scrap zinc in a teacupful of hydrochloric acid until the acid ceases to act on the zinc, then warm the killed spirits thus prepared, and add sal-ammoniac, a few grains at a time, until the liquid ceases to dissolve any more. As the capacity of cells varies with the size of the carbon block used as the negative element, I advise you to first fill the cell with dry plaster, then turn it out and make the paste. As the holes at the sides of the carbon are for ventilators, you may leave short lengths of glass tube in the holes.—G. E. B.

Steam Economiser.—Interested, D.B., J.W.S., and others, who have asked for the address of the inventor of the engine fitting for economising steam at Glasgow.—Inquiries have been made from engineers in Glasgow and other places, but, so far, none of them have been able to give any information on the subject. As soon as the address is obtained it will be published.—M.

Lens.—Amateur Photographer does not say which kind of distortion is produced. Almost any wide angle lens, if used without a small top, will distort, or the lens may be faulty of itself. Any rectilinear lens of good quality will produce pictures without distortion, but very much depends on the manner a lens is used whether it distorts or not. The best lenses made will do so if used improperly. If your camera will not extend more than 6 in., a lens of about 4 in. or 4½ in. focus would be suitable. Lancaster, of Colmore Row, Birmingham, could supply you with a suitable instrument at a low price, but any photographic apparatus dealers could do the same. We can scarcely recommend one before another. If very low prices are paid for instruments of this kind, the buyer must take the risk as to the quality. High-class optical work is always expensive.—D.

Tuning-Forks.—Bottom.—Our correspondent can obtain the set of chromatic tuning-forks—thirteen in number, from C to C, price about 18s. 6d.—from S. Walmsley, St. Thomas Road, Finsbury Park, London.—G.

Polishing Organ Case.—Amateur.—The plan you suggest of putting a fair body of polish on the organ case, and finishing by giving a coat of oil varnish, would give a good result: it would look and wear well if you are careful to be sparing in the use of oil with the polish rubber. The oil varnish should be of good quality; for the pews the price must be a good one to allow you to adopt such a method. It is usual to size and give two coats of oil varnish. You need not feel afraid of the varnish cracking; I have some before me that was done four years ago on the lines you suggest that still looks well.—Lifeboat.

Hanging Sashes.—J. G. (*South Africa*).—The hanging sash referred to in No. 167, p. 168, is Hough's Patent Reversible Sash Frame with Sliding Sashes—135, Great Suffolk Street, Southwark, London, S.E. Kindly mention Work, wherein they should advertise.—E. D.

Engravers' Copper Plates.—H. Y. W. (*Bromley-by-Bow*). — Your second letter contains no details, but I must endeavour to guess your requirements. You can buy of Messrs. Sellers, Arundel Street, Sheffield, engravers' copper plates of any size and thickness at from 2s. 2d. to 9s. per lb. Their steel and copper plates—indeed, all their manufactures — are of first-class quality, which makes their prices a trifle higher than others in the same line of business. I cannot advise you to attempt the making and polishing of copper plates unless you have a full plant of tools and skilled workmen, as a copper plate is of no use unless it be flat and free from scratches. You may, however, get a fairly flat surface on a small plate by proceeding as follows :—Procure a sheet of best copper, and with a boxwood mallet on a plane surface take out the inequalities of the surface ; this may easily be done with a few smart taps in the proper places. Ordinarily, the sheet copper is very smooth as from the rolls, and the scratches are mostly superficial, which therefore will not take up much time to remove them. You may now take a "Tam O'Shanter" stone and water, and go over both surfaces till scratches are removed. Next tack down the plate on a board, to keep it flat and also from bending. Now rig up in your lathe a buffing wheel of any convenient diameter—say 3 in. or 4 in. by about 1 in. in width. You will require to get up a speed of about 1,500 revolutions, using lime, previously pulverised, as a dressing for the buff wheel. If you have got an old lathe which you can utilise for the buffing process, you might place it in a room where dust is of no account, as if the lime gets into a good lathe it will certainly spoil it by clogging the oil, although beyond that it will do no further damage.—N. M.

Cabinet Varnish and Reviver.—ONE THAT WANTS TO LEARN.—(1) A varnish good enough for all practical purposes can be made as follows:—1 gal. rectified naphtha, 2 lb. shellac, 1 lb. gum sandarach, $\frac{1}{2}$ lb. benzoin, $\frac{1}{4}$ lb. gum thus, $\frac{1}{4}$ lb. pale resin. Crush the gums, and dissolve by gentle heat and frequent stirring; carefully strain before using. This brings the cost to about 8s. per gallon, or the price of the commercial brown hard spirit varnish, which, by the way, makes a capital varnish either used alone or by mixing with French polish in the proportion of 3 parts polish to 1 part varnish. There are scores of recipes for varnish-making; the one frequently recommended in "Shop" by F. P. of 3 lb. shellac, $1\frac{1}{2}$ lb. benzoin to the gallon, makes a really first-class varnish, though for common work, such as Windsor chairs, resin only is often added to the polish. But the one I give is what I use daily, only that I dissolve the gums apart from the polish ; I then mix the polish—white or brown, as advised—with the brown hard, varying the proportions according to the job I have in hand. For the carved work it should be slightly warmed. (2) There must have been some mistake in the reviver you mention, as *boiled* oil is never used in polishing, though there is a reviver made of equal parts of turpentine, vinegar, methylated spirits, and linseed oil, the secret of making which appears to lie in mixing in the order given to prevent curdling. A reviver in general use in the trade is (*a*) Vinegar 1 quart, naphtha 1 quart, linseed oil 1 quart, butter of antimony $\frac{1}{4}$ lb. ; shake well before using; apply with flannel; wipe off with clean rag; (*b*) linseed oil 1 quart, 4 oz. spirits of camphor, $\frac{1}{2}$ pint vinegar, 1 oz. butter of antimony, 1 oz. spirits of hartshorn. These revivers containing vinegar soon become to some persons disagreeable by reason of the vinegar turning sour; for this reason I have long discarded their use, using instead one made of lime water 1 quart, linseed oil 1 quart, sweet oil 1 pint, turpentine 1 quart; mix carefully in the order given, apply with wadding, wipe off with soft rag, and finish with a clean piece damp (not wet) with methylated spirits. Many thanks for your good wishes and appreciation of services rendered. —LIFEBOAT.

Metal Repairs.—MENDALL should experience no special difficulty in turning down the edge upon the stake. Perhaps he tries too great a length at once. It needs to be done little by little, going round again and again, till all puckers are obliterated. One-sixteenth of an inch will be wide enough for the turn down. For the other job open the chaps of your leg vice, lay the strip upon it, and with the pane of a hammer strike it down into the interval between the jaws. This will start it. Then lay in it a round bar of wood, and repeat the hammering.—J. L.

Electric Regulator.—W. W. C. (*New Kent Road*).—The value of any invention is governed by the usefulness of its application. To what purpose do you intend applying your special arrangement for regulating the strength of the current by a movable resistance controlled by a solenoid? As an automatic regulator it might serve some useful purpose. The idea of regulating current by means of a solenoid and an adjustable resistance is not new, but your application of it presents a few novel features. Your next course should be to find a use for it, then make a model, and practically test its usefulness.—G. E. B.

Demagnetising Watches.—J. A. (*Thirsk*).—To take the magnetism out of a watch, either revolve it rapidly for a few minutes in a strong magnetic field—such as that of a dynamo—or revolve a powerful magnet or set of magnets over the watch close to its face. Hanging it for some time close to a mass of iron will sometimes cause it to give up its magnetism. Watches kept in iron cases are shielded from magnetic influences. An ordinary block-tin case will serve the purpose.—G. E. B.

Ceilings.—J. H. C. (*East Ham*).—The advice given by your friend is the best you can adopt under the circumstances, but you need not go to the expense of painting or whitewashing at once. I should advise you to wash off the ceiling, fill up the cracks with plaster-of-Paris, rub down smooth and level, and then paper, which should wear two or three years, after which you may paint or whitewash. In the living rooms you might lay on a border round the ceiling, which would improve the appearance. After filling in the cracks and rubbing down, if any of the ceilings are fairly hard, you might try whitewashing alone, and save the expense of papering ; but if soft and loose, they should be papered.—M.

Child's Swing Cot.—T. J. H. (*Nuneaton*).—You can make the cot to swing either from the ceiling, hung by two hooks in the joist over, or else make a frame for it, as in Fig. 2. As the latter has many disadvantages—such as a tendency to tip over—and

Fig. 2

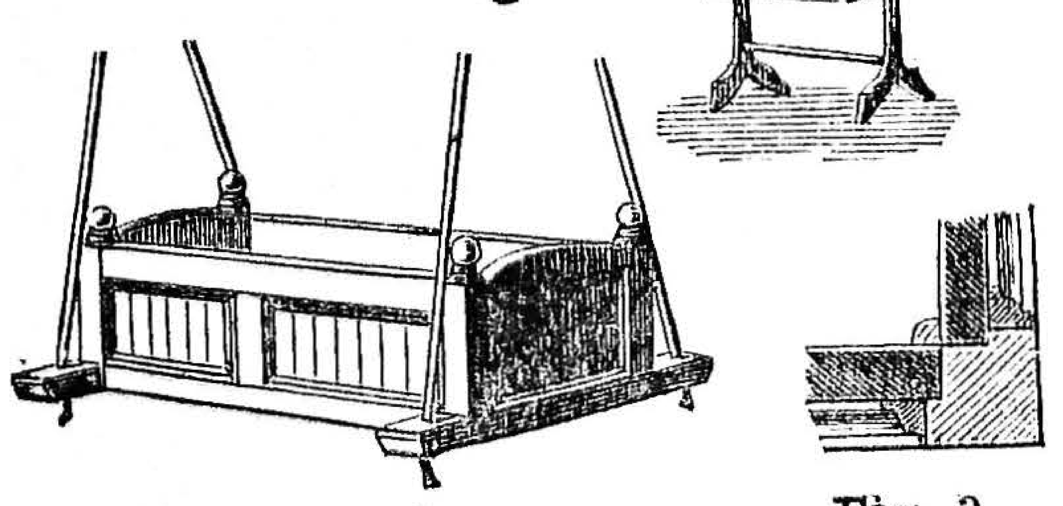


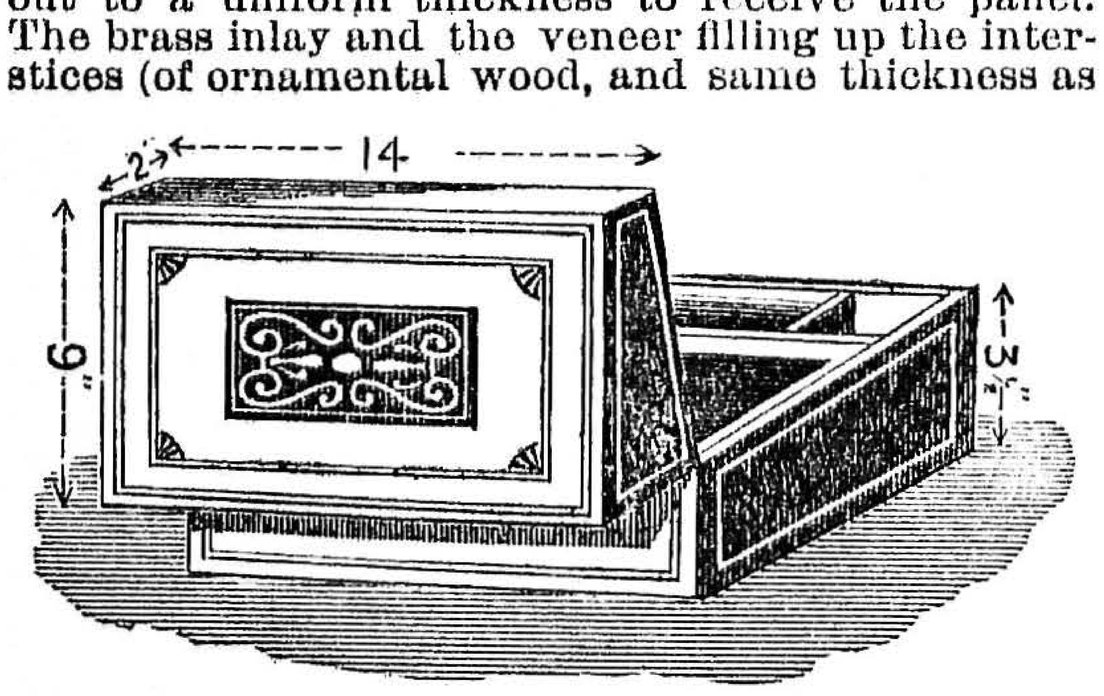
Fig. 1 Fig. 3.

Child's Swing Cot. Figs. 1 and 2.—Different Methods of hanging. Fig. 3.—Section of Corner-pieces.

takes up a good deal of room with its strutted legs, I shall briefly describe the construction of the one shown in Fig. 1. All the wood is framed together in the usual way, of $1\frac{1}{4}$ in. rebated stuff, the corner-posts having turned knobs. The two bottom end rails project a little, and a hole is bored in the projection for the cord to go through and a knot tied on its under side. The cord also passes through an iron eye screwed in the corner-pieces just below the knobs. The end rails had better be 2 in. square, as all the strain is thrown upon them. The panels are filled in with $\frac{3}{8}$ in. or $\frac{1}{4}$ in. boards, moulds run outside, and beads in all corners inside. I will not give any general sizes, as you may please yourself in that matter.—F. J.

Induction Coils.—G. F. D. (*York*).—Articles appeared in WORK, Nos. 157, 159, 164, 166, 170, and 178.

Writing Desk.—JOINER.—Convenient sizes for a writing desk are marked on the sketch. Brass for inlay can be purchased in various thicknesses from any of the fretwork material dealers (see WORK advertisement pages); from $\frac{1}{64}$ in. to $\frac{1}{16}$ in. thicknesses are the most useful. From the same source you can get the saws necessary ; Nos. 1, 0, and 00 are generally used for this work. To saw the sheets of thin brass, they should be placed on a piece of wood, and then saw through both, the wood giving the support necessary to the thin metal. Supposing you to proceed with the panel shown in this design, the ground would be taken out to a uniform thickness to receive the panel. The brass inlay and the veneer filling up the interstices (of ornamental wood, and same thickness as



Writing Desk.

the brass) are glued on a newspaper face downwards, and when quite dry, the back of the panel must be roughed with a "rasp," and coated with thin glue. Then lay in the design, press out all superfluous glue, screw up in a "caul" or press, and leave to dry for a few hours. When firm, it is cleaned off with a cabinet-maker's "scraper;" this will bring off the newspaper and any glue that may have been squeezed up. Then carefully go over the surface with fine glass-paper. All the other brass lines and the escutcheons may be treated in the same manner.—F. J.

Dentistry Appliances.—AMATEUR DENTIST. —Sample of spring sent is brass (plated), and very dangerous to wear in the mouth, and would only be used by cheap advertising dentists. Occasionally silver gilt springs are used, but very seldom ; by good dentists none other than gold is used, which lasts for years. If AMATEUR DENTIST would send a list of his requirements to Editor, DENTA will obtain them, and forward upon receipt of name and address.—DENTA.

Dental Plates. — AMATEUR DENTIST. — The metals principally used for dental plates are 18 and 16 carat gold, platinum, and dental alloy ; silver is seldom, if ever, used, owing to its becoming dark, due to the action of the acids in the mouth. When used it must be alloyed with copper, same as coin ; but dental alloy can be obtained at from 15s. to 25s. per oz.—DENTA.

Boring Holes in Wood.—S. S. (*Grantham*).— I understand the pieces are 4 in. square, and the holes are to go through lengthways of the grain, and that your difficulty is to hold the pieces so that they will not turn round by the action of the auger. I never had such a job to do, so I can only suggest what I think would do. First, are you using the full size, $1\frac{1}{4}$ in. auger at first? If so, I think you would do better to begin with a small size and then enlarge it, so that each size would do part of the work—the number of sizes to depend on the hardness of the wood. Second, I think I would fix up on the lathe-bed a kind of wooden trough, in which the pieces could lie while being bored. This would enable you to hold them firmly and present each piece at the right height. Thus you could put in one piece after another, and bore from both ends. Patterns for table legs have been advertised in WORK, and articles on tinwork, giving recipes for making solder.—F. A. M.

About Work and Power.—VELO.—Articles appeared in WORK, Nos. 158, 164, 169, and 173.

Watch and Clock Cleaning, etc.—E. W. C. (*Leicester*).—Glad to hear you appreciate the articles now running on this subject. The writer will treat the trade in as full a manner as possible, at the same time making everything plain to beginners. Repairing will be fully gone into, and it is hoped the articles will be of service to all, whether amateurs or practical watchmakers.—F. J. G.

Brass Lacquer.—W. H. B. (*Barrow*).—You will be able to get what you require from the Frederick Crane Chemical Co., Newhall Hill, Birmingham.— R. A.

Hand-working of Specula.—W. H. (*Nantwich*). —No ; the passage which you quote does not refer to a Trunnion vision telescope. "Trunnion vision" describes a method of mounting at one time much in vogue in this country and in America. The oval reflector (which would have to be used) would not, of course, screen off any more light in that than in any other form of mounting. What was written on p. 132 was based on the simple fact that it is much more difficult to perfectly parabolise a mirror of short than one of long focus. Thus, a speculum of 6 in. diameter and 6 ft. focal length is easier to work than one of the same diameter but 3 ft. only in focal length. On the other hand, a mirror of short focus can be more conveniently mounted. There was at one time a rage for metal mirrors of short focus, and the great makers rivalled each other in producing such instruments, which were aptly named "dumpies." "Powder emery, like that made up in tins for knife cleaning," is not "good enough for the fine grinding of the speculum." It would be quite useless for the purpose. The mere process of washing would speedily show the stuff to be more slate and mud than emery. Good grain or washed flour emery should be obtainable from any stone polisher or dealer in jewellers' sundries ; or a polite note to a wholesale firm of reputation (with a stamped envelope enclosed) will probably procure for you the address of a reliable dealer in your neighbourhood. Years ago Messrs. Oakey & Son informed me that washed flour emery, manufactured by them, could be obtained in any town in the United Kingdom at about 1s. per lb.—E. A. F.

Refracting Telescope.—AMATEUR.—If you will refer to WORK, No. 145, you will find instructions for the making of a simple refracting telescope, and you had better see this before you proceed further in the matter. For prices, write to some established firm (say Lancaster & Son, of Birmingham) and to some dealer in second-hand optical materials (say Caplatzi, of Chenies Street, Tottenham Court Road), and compare their charges for achromatic object lenses. You will then, most probably, find that a 5 in. lens is beyond your means, apart from the cost of mounting. There is, of course, some element of risk in the purchase of a second-hand lens, unless you protect yourself by making an arrangement with the dealer. Make your experiment with a $2\frac{1}{2}$ in. or 3 in. glass, and try to mount it so that it can be used with success. You will do better work with a small lens carefully mounted (by carefully I do not mean expensively) than with a larger one badly mounted. If properly mounted, the telescope should be quite rigid when fixed for observation, and there should be no shake when the instrument is moved on its bearings. When you have further considered the matter, if difficulty occurs, you must ask for advice again. But in that case, detail your difficulty. For eyepiece making, see No. 148, p. 701, and read the recent account of the making of telescope eyepieces in Mr. Parker's paper on the Spectroscope (see No. 177, p. 323).—E. A. F.

How to Make a Galvanic Battery.—H. J. (*Burnley*).—Given : Two carbon rods 1 ft. by 2 in. by 1 in., and two zinc cylinders 10 in. long by 4 in. in diameter—how shall these be made into a galvanic battery? This is the purport of your letter. The task is not a difficult one. You may get glass, stoneware, or porcelain pots, $9\frac{1}{2}$ in. in height and $4\frac{1}{2}$ in. inside diameter, for the outer cells, and porous pots $10\frac{1}{2}$ in. in height and 3 in. in diameter for the inner cells. The zinc cylinders must be well washed in soda-water, rinsed in clean water, then rolled in a flat dish containing mercury and dilute sulphuric acid until well coated inside and out with mercury. When thus amalgamated, fit to each a binding-screw of brass. The carbon blocks must have brass connecting clamps fitted to one end. They will go in the porous cells in a mixture of 3 oz. chromic acid and 1 oz. sulphuric acid in one pint of water. The porous cells go inside the zinc cylinders, and these in the outer cells, which are then filled with a mixture of one part sulphuric acid in twelve parts of water. By cutting the zinc cylinders and carbon blocks in equal parts, you can form a battery of four cells, each 4½ in. by 4½ in., with porous cells 5¼ in. by 3 in. This will make a strong galvanic battery.—G. E. B.

Testing Electric Belt.—Mrs. M. (*London, W.*).—The most simple method of testing an electric belt for an evidence of electric current is as follows :—Attach a thin copper wire, 1¼ yds. in length, to a copper disc at one end of the belt, and a similar wire to a zinc disc at the opposite end. Put on the belt, take the two free ends of the wires, and bring the two ends to touch on tip of your tongue. If the belt generates any electric current at all, a sharp acid taste should be experienced at the moment when the wires touch.—G. E. B.

Improver.—Jack Plane, in rather a vague letter, wants to know if he can go as an improver after he is twenty-one. An apprentice's indentures are not *legally* binding when he comes of age, and he can then become an improver, if he wishes, for a year or two. If Jack Plane has made the most of his opportunities and time during his apprenticeship, he could go as a journeyman at once, instead of an improver. Whatever he does, he shouldn't devote his evenings and spare time to loafing. After he has "knocked off" work, he should take up some profitable study and home work, and thus really "improve" himself.—F. J.

Fret-Cutting Machine.—S. P. (*Whitechapel*).—Articles appeared in Work, Nos. 58, 60, 114, and 139.

Boiler.—Anxious Engineer.—Do not attempt to rivet so small a boiler, nor bother with return tubes. Unless very skilful, you will never make it water-tight nor safe. Get solid tube and, preferably, make the simpler vertical boiler. You cannot do better than copy the boiler illustrated in Vol. III. of Work, p. 812.—J.

Recommending Work.—C. H. C. (*Grosvenor Road, S.W.*).—Thanks for acquainting "many young fellows of Work." If every subscriber did the same, or induced one new subscriber for the fifty-two weekly numbers, there would be no need to advertise Work above ground or below it. Readers all, see what you can do.—Ed.

Blades for Thread Bobbins.—Steel Wire.—After exhaustive inquiries, I am sorry to have to inform you that no Sheffield firm will take up the manufacture of these blades, on account of their small size, which is, approximately, as follows: Thickness on back, $\frac{1}{32}$ in. ; width, $\frac{3}{64}$ in. ; and length, ¼ in. The manufacture of such small blades clearly belongs to women. Such being the facts, I can only direct your attention to what I consider the cheapest method of making them. A small plant will be required, but which need not be very expensive. In the first place, send an exact sample of the wire, which, practically, will be a length of flat wire of the width and thickness as above, bevelled on one side to nothing. This wire should be supplied in convenient lengths, which, I think, you had better decide—perhaps 3½ in. would be best, as a longer length would generate a most inconvenient spring while being worked. The work should be divided into four processes—namely, grinding, pointing, cutting-off, and driving into the bobbin. For each of these processes an intelligent girl of fourteen years could, in a very short time, be trained to do the work better than any boy. Of course, you would want a foreman to look after them and to adjust and keep their tools in order. The "grinder" and the "pointer" would both work on wet grindstones—known as "blue stones"—such as are used by the razor grinders; and, indeed, their stones which have worn down too small in diameter for razor grinding would be the very thing for your job, and could, no doubt, be bought cheaply. The size of these discarded stones is about 3 in. to 4 in. in diameter and 1 in. across the face. Two of these stones could be rigged up on a long shaft between the centres of an old lathe, and each fitted with a trough and backboard, taking particular care that the stones are fitted at such a height from the floor of the workshop as will ensure the comfortable sitting of the girls while at work. Thus, one girl would grind the long length of side to form a sharp cutting edge, which, by reason of the bevel formed in the drawing of the wire, would be easily done, afterwards taking off the "burr" at the other side. The length of wire, being sharpened, would be passed on to the second girl, who would point both ends of the wire. This being done, another pair of hands, at a self acting cutting press furnished with a gauge for cutting off the exact length, would cut off the ends of the sharpened and pointed wire and pass back the wire to be re-pointed, repeating the process until the whole length of wire is used up. In all wet-grinding processes it is necessary to have a box of dry lime in which to drop the wet articles, to prevent their rusting. The process of driving the blades needs no instructions, but, probably, a magnetic hammer might be used with good effect.—N. M

Model Electro Motor.—Youthful Gunman.—Your question shall be sent to J. Brox to answer for you. As you have made the model electro motor and the battery so successfully from Work, it is to be hoped you will make the fact known among all your friends. The success of a journal like Work depends largely upon the exertions of those who already know it. You and every reader should induce one new subscriber for the year. The recommendation of readers is better than much bold advertisement.—Ed.

Luminous Bell-push.—Tavy.—If I understand your letter aright, you think there should be some means for rendering a front-door bell-push luminous at night, because you have found some difficulty in locating those on the fronts of strange houses. Some town dwellers who are pestered with runaway rings and knocks will think otherwise. A friend of mine was so pestered that he invented a secret bell-push, known only to his intimate friends. Another friend had his bell-push wrenched off from the door-post at night on several occasions. Luminous paint around the push would not be very desirable. But Tavistock youth may be less mischievous than London gamins; nevertheless, I think you would have some difficulty in getting a patent for your invention, and the money spent on it would be thrown away. Your good opinion of Work is gratifying, and you are quite right in spending your pennies in scientific papers instead of trashy literature.—G. E. B.

III.—Questions Submitted to Readers.

*** *The attention and co-operation of readers of* Work *are invited for this section of "Shop."*

Model House.—T. B. (*Kirkbythore*) writes:—"Will some kind reader give me an address, or inform me where to get model fittings, such as chimney-pots, door-handles, and small spouting?"

Easel with Tray.—J. O. S. (*Glasgow*) will thank any reader for directions for making a light folding sketching easel with tray.

Meerschaum Pipe.—G. E. (*Falcon Square*) writes :—"Will some kind reader tell me how to treat and to preserve a meerschaum pipe, and the best method for re-waxing?"

Charcoal.—R. A. (*Leeds*) writes :—"Will anyone inform me how to make charcoal, etc., from English ash, elm, and oak? Is it profitable or otherwise? Also, could anyone tell me how to dispose of about 3 tons per week?"

Bottle-filling Machine.—T. S. C. (*No Address*) writes :—"Will any reader kindly explain the working of the bottle-filling machine used by beer bottlers, filling three or more bottles at once, and stopping automatically when bottles are full? I want to try and make one."

Corn Bushels.—Ironwork writes :—"Can any reader of Work kindly tell me where I can obtain the ironwork necessary for making bushels—such as handles, etc.?"

IV.—Questions Answered by Correspondents.

Refuse Destroyer.—Manlove, Alliott & Co., Ld. (*Nottingham*) write :—"In reply to Colonist (see No. 178, page 350), our destructor for dealing with town and city refuse is used in most of the principal towns in this country, and we have already supplied destructors capable of dealing with upwards of one million tons of refuse per annum. The destructor is working in Australia and New Zealand. In England the refuse is reduced to about one-seventh in bulk and about one-fourth in weight; in the colonies we should expect that the amount of residue would be somewhat less. This résidue, being perfectly innocuous, may be tipped anywhere without fear of nuisance or contagion; or may be used for road-making, for grinding with lime into mortar, for making artificial stone, and for other purposes. The waste heat from the furnaces may also be utilised for raising steam, for electric lighting, pumping, sawing, grinding, or other purposes for which steam power is required.

Piano Panels.—M. (*Bishop Auckland*) writes to J. D. (*Ipswich*) (see No. 178, page 350) :—"You might use Lincrusta Walton, which could be painted or gilded."

Bamboo.—M. (*Bishop Auckland*) writes to Rufus (see No. 178, page 350) :—"Heat them over a spirit lamp or Bunsen burner, moving them about continually, to prevent burning them. Then have a piece of U-shaped iron rod turned down at the ends fixed in the bench, and projecting over one side. Insert in this, and bend when sufficiently hot."

V.—Letters Received.

Questions have been received from the following correspondents, and answers only await space in Shop, upon which there is great pressure :—J. H. H. (*Catford Bridge*); J. G. (*Kilmarnock*); P. R. (*Alloa*); W. N. (*Shrewsbury*); R. S. (*West Croydon*); S. S. (*Blackburn*); F. P. (*Campden Hill*); W. H. (*Leicester*); C. R. (*West Kensington*); Novice; H. H. (*Stony Stratford*); W. P. C. (*No Address*); J. B. (*Dalton-in-Furness*); W. S. (*Bedford*); Constant Reader; A. N. (*London, N.E.*); T. L. F. (*Portsmouth*); J. H. (*Gateshead*); Opifex; W. T. B. (*Kenton*); H. C. (*Clapham Junction*); C. G. W. (*Knutsford*); T. W. (*Wigan*); J. H. (*Newton*); Boxer; A Young Clockmaker; Pat; J. O. (*Aston*); X. (*Rotherham*); G. L. (*Salop*); J. B. (*London, E.*); F. J. (*No Address*); Little Jim; T. S. (*Kokstad, Griqualand, Cape Colony*); Gulielmus; W. J. G. H. (*Errington, W. Nanaima, British Columbia*); J. H. (*Birmingham*); Whitesmith; W. H. (*Arbroath*); H. K. K. (*Chiswick*); E. P. (*Islington*); E. J. C. (*Charlton, S.E.*); Newel; F. C. (*Stockton-on-Tees*); Joiner; J. O. H. (*Balham*); F. H. R. (*Queen's Park*); R. E. M. (*Sunderland*); W. P. B. (*Birmingham*); W. E. (*Haverhill*); F. T. R. (*Lybster*); Pipes; E. C. (*Uxbridge*); P. J. M. (*Bristol*); A Worker in Iron; W. J. W. (*Wolverhampton*); E. W. B. (*Herne Hill*); H. R. (*Openshaw*); W. M. (*London*); Mackintosh; W. J. C. (*Islington*); E. B. (*Darlaston*); F. D. (*Dunstable*); Ribs; Felt; E. C. N. (*Islington*).

"WORK" PRIZE SCHEME.

FOURTH COMPETITION.

"Tourists' Road, Water, or Rail, Travelling Requisite" Competition.

To give zest to, and widen the field of original research, such an outfit might, for instance, combine with it some useful appliance to be used in case of emergency—such as life-saving, or in pleasure hunting while holiday bent. This we must leave to our readers' judgment, and feel sure that anything to make travel more enjoyable will be welcomed by the public and the readers of Work who have to travel. By the time this announcement is made most of us will have had some experience of holidays and the pleasures (?) of luggage. For the three best suggestions for an "Improved Tourists' Travelling Requisite," the following prizes will be awarded—

First Prize, £3;

Second Prize, £2;

Third Prize, £1.

Conditions and Rules of the "Tourists' Travelling Requisite" Competition

will be found in No. 181 and subsequent issues.

All manuscripts intended for the "Tourists' Travelling Requisite" Competition must be addressed to the Editor of Work, c/o Cassell and Company, Ltd., Ludgate Hill, London, E.C. They must reach him on or before Saturday, October 29, endorsed, "Tourists' Travelling Requisite" Competition.