Technical and Bibliographic Notes / Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for scanning. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of scanning are checked below.

L'Institut a numérisé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de numérisation sont indiqués ci-dessous.

- [ ] Coloured covers / Couverture de couleur
- [ ] Covers damaged / Couverture endommagée
- [ ] Covers restored and/or laminated / Couverture restaurée et/ou pelliculée
- [ ] Cover title missing / Le titre de couverture manque
- [ ] Coloured maps / Cartes géographiques en couleur
- [ ] Coloured ink (i.e. other than blue or black) / Encre de couleur (i.e. autre que bleue ou noire)
- [ ] Coloured plates and/or illustrations / Planches et/ou illustrations en couleur
- [x] Bound with other material / Relié avec d'autres documents
- [ ] Only edition available / Seule édition disponible
- [x] Tight binding may cause shadows or distortion along interior margin / La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure.
- [ ] Coloured pages / Pages de couleur
- [ ] Pages damaged / Pages endommagées
- [ ] Pages restored and/or laminated / Pages restaurées et/ou pelliculées
- [x] Pages discoloured, stained or foxed/ Pages décolorées, tachetées ou piquées
- [ ] Pages detached / Pages détachées
- [x] Showthrough / Transparence
- [x] Quality of print varies / Qualité inégale de l'impression
- [ ] Includes supplementary materials / Comprend du matériel supplémentaire
- [ ] Blank leaves added during restorations may appear within the text. Whenever possible, these have been omitted from scanning / Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été numérisées.

- [x] Additional comments / Commentaires supplémentaires: Continuous pagination.

CANADIAN MAGAZINE OF Science and the Industrial Arts. Patent Office Record.

Vol. XVII. JULY, 1889. No. 7

THE OCCURRENCE OF GOLD.

BY D. A. LOUIS, F.I.C., F.C.S.

In considering the occurrence of gold, there are two or three of its properties which it is useful to bear in mind in order to account for the unique position it holds in the mineral kingdom; these are:—its high specific gravity, the great disinclination it exhibits to enter into combination with other elements, and the peculiarity of its solubility.

Most metals occur in nature mineralised or combined with various elements; for instance, silver is found sometimes free, but most frequently combined with sulphur as in silver glance, also with arsenic or antimony and sulphur in pyrargyrite and proustite, with chlorine in horn silver, and with other elements. Lead is universally found combined with sulphur and galena, also with carbonic acid as cerussite or lead spar, and in other combinations; tin, in its best known ore, cassiterite, is combined with oxygen, whilst zinc in blende is combined with sulphur, and in calamine with carbonic acid. But gold is one of the few elements which exist in nature free or uncombined, and with the exception of its existence in comparatively small quantities, combined with the rare element tellurium, it is always found in the metallic state. Native gold, however, contains various proportions of impurities, the impurity in most instances being metallic silver, and perhaps copper; therefore we can dismiss the question of the chemical occurrence of gold with the statement that it generally occurs in the free state alloyed with more or less silver, and is sometimes found as telluride.

Turning to its mineralogical or petrological associations, a very similar degree of simplicity awaits us, for gold is, with few exceptions, found associated with the well-known non-metallic mineral quartz, whilst iron pyrites is the most general metalliferous mineral which accompanies gold, although copper pyrites, galena, blende, and arsenical pyrites are frequently auriferous, and some dozen other minerals are from time to time found to have particles of gold mixed with them. The rocks in which gold is found are mostly metamorphic, or those rocks which have in periods gone by been deposited during the decay of pre-existing rocks, but have, some considerable time after deposition, undergone changes and, in many cases, have been subjected to great heat, to violent upheavals, disruptions, and compressions, with the result that they have become more or less crystaline, and frequently flaky or schistose in structure, and are traversed by numerous cracks and fissures in which quartz has accumulated, and, with it, gold in many instances. The rocks in which these auriferous quartz veins are generally found are those schists which are named from their predominating mineral chloritic, talcose, micaceous, or hornblendic; it is found less commonly in diorite, in porphyry, and sometimes in granite. These rocks often contain gold in very minute proportions, which becomes sometimes more prominent in the vicinity of a fissure or crack, but it is never present in quantities which would permit of the idea being entertained of its commercial extraction from this so-called "country" rock; in the intersecting quartz veins, however, gold is frequently found in paying quantities, and such veins constitute the "gold reefs" found in different parts of the world. Gold is never found in these veins in continuous bands, as is the case with other metalliferous deposits; but it occurs in patches and accumulations, here and there, in the vein; such patches are known as bunches, shoots, pipes, chimneys, according to the length, breadth, size, and position of the accumulation. In some cases veins are filled with pyrites instead of quartz, or sometimes, in fact very frequently, both are present, and the pyrites is found to contain gold; it then appears not to be so bunchy as when it exists in the quartz veins. I have seen in Colorado thick bands of auriferous pyrites, which, from their appearance in many adjacent mines, may be presumed to be many hundred yards in length, and apparently more or less continuous. Gold tellurides are also found in veins in Transylvania, in Hungary, and in Boulder County, Colorado.

Gold, however, does not exclusively occur in reefs; in fact, the largest supplies have been obtained from "placers," where it occurs in beds of sand or gravel, which have been, or are even now, the beds of rivers. Other instances are known where gold occurs in deposits consisting of fragments of rock cemented together by silicious material, forming what is known as breccias, or conglomerates, or pudding-stone, or, in the Transvaal, as banket.

Both the auriferous sand and the banket owe their origin to the destruction—which is constantly going on now, and has been going on ever since the rocks have existed—of the auriferous rocks. The detritus, in the case of the sand, has been carried down the rocky slopes by streams of water, which have dissolved much of the rocky material, and carried away light particles, wearing away larger ones, and allowing the heavy gold and wear-resisting quartz to deposit themselves. In course of time the former has become concentrated in those parts of the river where the current has been interrupted by bends, etc., for the simple reason that the sand being lighter, is to a large extent washed away by eddies of water which would not be sufficiently strong to move the heavier particles of the precious metal (the specific gravity of quartz is 2·65, while that of gold is about 19). Such accumulations are called "pockets." The "banket" deposits possibly originated in much the same manner, only the conditions being favourable, much of the detritus, which has become pulverised, and concentrated as regards gold, as in the case of the sand, has subsequently acted as a cement to the larger fragments, and so given rise to the present deposits.

There is still another form of deposit in which gold is found, and which is also derived from the destruction of older rocks. In this case the amount of water has been limited, and consequently the more refractory products of decomposition, instead of washing away to form banket or sand remain on the spot or near it; moreover, they remain in great blocks permeated with vesicules and holes, which represent the positions previously occupied by the less refractory constituents, these having succumbed to the action of the various constituents of the atmosphere; that is to say, the moisture, the carbonic acid, and oxygen. The minerals left behind are principally quartz, some iron oxide, and gold, if present in the original rock; some of the gold will, however, dissolve. These spongy-looking deposits of ferruginous quartz are known as "gossan," and are generally found whenever the out-crop or the upper part of the lode is exposed to atmospheric action. If we take into consideration the enormous number of years during which these changes have been going on in nature, it is easy to realise that very extensive deposits of this description may have been brought into existence. They would, of course, be more localised than the banket deposits, which in their turn ought to be more localised than the alluvial or river deposits. The famous Mount Morgan mine in Queensland, Australia, is an instance of a deposit produced by atmospheric influences.

In alluvial deposits and in the various matrices the gold appears in many states of aggregation, which have received various names:—In nuggets, or pieces of irregular shape and of moderate size, in grains more or less crystalline, down to powder, which consists of individual particles invisible to the naked eye; or it occurs as thin sheet gold, leaf gold, foliated gold, down to mere films of gold; and sometimes in long, thin aggregates of gold, such as that known as wire-gold, of moderate thickness, down to mere threads of gold.

Gold is found in all parts of the world. In Europe it is found in largest quantities in Transylvania, and in Hungary, where mines were worked by the Romans. It is also found in Spain, in North Italy on the northern slope of the Alps, from Monte Rosa and Simplon to Aosta, in Sweden, in Wales near Dolgelly, in Scotland near Leadhills, in Ireland in county Wicklow; whilst auriferous sands exist in the following amongst other rivers: Rhine, Rhone, Reuss, Aar, Danube, and many Cornish streams.

In Asia gold is found in the Ural Mountains, where it was probably mined by the Scythians; also in Siberia and many other parts of Asia, notably India.

In Africa it occurs on the west coast, near Ashantee, known as the Gold Coast, and in the Transvaal, which is now so famous; it has been said that Matabele Land is one of the richest gold districts in the world. On the coast of Mozambique there are gold mines which are supposed to be the same which existed in Solomon's time under the name of mines of Ophir, which name has lately been applied to certain properties in that district, recently put on the London market. Gold also exists elsewhere in Africa.

In America, North, South, and Central, gold is very widely distributed. It is found in Mexico. In the United States, the gold mines of North Carolina, Virginia, Georgia, and South Carolina were once the great source of gold, but the discovery of gold in California in immense deposits soon eclipsed these and all other known gold deposits in the world; the subsequent discoveries in Australia, however, equalled them. Other States are gold producers—Colorado, Arizona, Idaho, Utah, some of the Eastern States, the newly-created States Dakota and Montana, and the territories of Washington and Oregon. British Columbia and Vancouver's Island have gold—the former promises well for the future; so has Alaska; whilst gold is also found on the eastern side of Canada and in Nova Scotia. In Central America gold occurs in many places, including Honduras, Costa Rica, etc.

In South America, Brazil has long been famous for its gold mines; but gold is also found in the Argentine Republic, Venezuela, Colombia, and Guiana.

Australia is famous for its gold, and all who visited the Indian and Colonial Exhibition will remember the great arches built to represent the output from Victoria and New South Wales. It is also found in Queensland, South Australia, New Zealand, etc.—*Knowledge.*

UNIVERSAL SYSTEM OF TELEGRAPHY.

Whenever we hear of a gigantic project, or an exceedingly striking invention, we have hitherto been accustomed to turn our attention to America, in the expectation of there meeting with the originator, and we have rarely been disappointed. The Americans have, however, now been outstripped by the French in the person of M. Eiffel, who has shown what Frenchmen can do by the construction of the tower which bears his name. Another remarkable, and at the same time, absurd project, was recently brought under the notice of the French Ministers of Commerce and of Posts and Telegraphs by M. Léon Roquet, who proposes the institution of a universal telegraphic language, which he claims would be of great service to the public. The project, as described by the author, is as follows:

"In private, commercial, and administrative telegraphic correspondence there is a large number of phrases which are very frequently employed, and it would be quite easy to replace these phrases by conventional combinations of figures and letters, such combinations to be published by the Administration. In order to collect and make such combinations, the telegraphic correspondence for the past few years would have to be investigated, so that the most frequently employed phrases could be noted and classed in a methodical manner in order to avoid repetitions. In front of each phrase would be placed either a figure or letter of the French or Greek alphabet. Suppose we have 50 elementary signs, figures, or letters. Fifty phrases, each distinguished by a distinct sign, would form a page. At the top of the page there would be placed one of the 50 signs, and each group of 50 pages would form a part. A volume would consist of 50 parts, each of which would be distinguished in the same manner. Fifty volumes would comprise a repertoire, and 50 repertoires a series. For instance, one page would contain 50 phrases, a part would comprise 2,500 phrases, a volume 125,000, a repertoire of 50 volumes 6,250,000, and a series 312,500,000 phrases."

"The author suggests that probably one volume of 125,000 phrases would be sufficient. With this system any one desiring to telegraph by conventional signs would consult the volume in the same manner as he would refer to the directory to find an address. Suppose a telegraph clerk were to receive the following sign telegram: *f k* 2 *d*. He would refer to volume (*d*), part (2), page (*k*), phrase (*f*), and finding the signification of the message would write it down upon the usual form to be sent to the addressee. With this system there could be expressed in six or seven letters or figures the elements of a telegram referring to a person's health or business, including the address. As illustrations of the benefits which would accrue from the adoption of this project, the author refers to the rates now charged from Washington to Paris (1s. per word), and from La Martinique (11s. per word) to Paris, and states that a great percentage would be saved in each message. Different nations would agree upon the establishment of a uniform type of volume of correspondence in such a manner that the same combination of three or four letters or figures would correspond to the same thought or phrase in all countries. A universal telegraphic language would then be created, a language written but not spoken."

The idea of the formation of a universal telegraphic language is excellent, but we are inclined to think that there are too many difficulties in the way to allow of such an introduction at the present time, or in the near future. The system of universal telegraphy, as proposed by M. Roquet, is certainly not based upon a rocky foundation, but rather upon one of sand, to be soon swept away. There are several objections to it. In the first place, the compilation of the code books would involve the expenditure of a very large sum of money and loss of time, and it is exceedingly questionable whether the different nations could be induced to adopt the language. Its institution would necessitate the employment of a larger staff of telegraph clerks and assistants—certainly a third more than at present—since there would be the additional labour of searching the codes on the receipt of each message in order to obtain the translation. This increase in clerical labour represents a serious item. Then, again, with Roquet's system the cost of sending a telegram would be reduced, so that the decrease in receipts and the increase in working expenses are of themselves sufficiently weighty considerations to cause the projected language to be rejected. It is exceedingly doubtful whether it would be favourably received by commercial establishments, many of which possess their own private codes, which they would by no means care to relinquish; but what, indeed, would be the effect upon the general public? Suppose an individual is in a great hurry to dispatch a message, and not having at hand a set of code books of his own, he proceeds to the telegraph office to look into those which it is fair to suppose the government would provide. On arrival at the office it would happen in ninety-nine cases out of one hundred that the code books would be engaged, that several people would be waiting to use them, and that the person in question would have to wait his turn. This would mean a serious loss of time, more especially as it would often happen that the person using the book on one's arrival would take up a lot of time through his or her ignorance of the code. How three or four letters or figures could be made to correspond to the same thought or phrase in different countries is a problem which we will not attempt to solve, but we have already said sufficient to demonstrate the impracticability and absurdity of M. Roquet's system.—*Electrical Review.*

An Improved Barrel Hoop.—A corrugated steel barrel hoop has been invented, which is said to be elastic and firm, hugging a package tightly. Four steel hoops will take the place of ten wooden hoops on a flour barrel. They are made at Worcester, Mass.

ASPIRATORS FOR LABORATORY USE.

BY GEO. M. HOPKINS.

Wherever a head of water of ten feet or more is available, an aspirator is by far the most convenient instrument for producing a vacuum for filtration and fractional distillation. It is also adapted to a wide range of physical experiments.

Besides the advantage of convenience and compactness the aspirator has the further advantage over piston air pumps in the matter of cost. They may be had at prices varying from $1.50 to $4 or $5.

Two kinds are in general use—one of glass, known as Bunsen's filter pump, and shown in Figs. 1 and 2; the other of brass, shown in Figs. 3, 4, and 5.

The glass aspirator can be purchased at almost any dealer in druggists' sundries or chemical glassware. Any expert glass blower can make it in a short time.

This instrument consists of an elongated bulb terminating in a crooked tube at the bottom and having a tapering nozzle inserted in the top and welded. The lower end of the nozzle is located directly opposite and near the crooked discharge tube. A side tube is connected with the bulb at a point near the junction of the nozzle and bulb.

This aspirator is used in the manner indicated in Fig. 2, *i.e.*, the upward extension of the nozzle is connected with a tap by a short piece of rubber tubing, and the side tube is connected by a piece of rubber tubing with the vessel to be exhausted. When the water is allowed to flow through the aspirator, it leaps across the space between the nozzle and discharge tube, and carries with it the air from the bulb, which is continually replaced by air from the vessel being exhausted.

It is necessary to securely fasten the ends of the rubber tube connected with the tap or the water pressure may force it off, thus causing the breaking of the instrument. To secure the best effects with this pump, it is necessary to connect a vertical tube 25 to 30 feet long with the discharge end of the pump.

The metallic aspirator shown in Figs. 3, 4, and 5 is of course free from all danger of being broken in use, and it has other qualities which render it superior to the glass instrument, one of which is a much higher efficiency, another is its ability to retain the vacuum should the flow of water be accidentally or purposely discontinued. It can be screwed directly on the water tap, and needs no additional pipe to cause it to work up to its full capacity; and where a head of water is not available, it may be inserted in a siphon having a vertical height of ten feet or more.

This instrument is made by Mr. C. E. Chapman, of Brooklyn, N.Y. Like all instruments of its class, it is based on the principle of the Giffard injector. Its great perfection, however, is due to Mr. C. J. Lawler and to its manufacturer. The construction of the aspirator is shown in section in Fig. 3. The water enters at A, as indicated by the arrow. The air enters at B, and both air and water are discharged at C. The water in going through the contracted passage forms a vacuum at the narrower part into which the air enters. The starting of the instrument is facilitated by a diaphragm which half closes the discharge tube. The water is prevented from entering the air pipe by a small check valve shown in the interior of the lateral tube. Much of the efficiency of this instrument is due to the accuracy with which the contracted passage is formed. A slight change in the shape of this passage seriously affects the results.

The vacuum produced by this aspirator is equal to that of the mercurial barometer, less the tension of aqueous vapor. That is to say, when the barometer is at 30 inches, the vacuum produced by the aspirator will be about 29½ inches. Such a vacuum can be produced by water under a pressure of five and one-half pounds.

In Fig. 4 is shown the aspirator applied to a Geissler tube. It quickly exhausts an 8-inch tube, so that the discharge of an induction coil will readily pass through. By placing a tee in the connecting pipe, the Geissler tube can be filled with different gases. Each will exhibit its peculiar color as the spark passes. The vacuum is not high enough for a perfected Geissler tube, but it is sufficient for the greater part of vacuum experiments. The aspirator can be arranged to produce a continuous blast sufficient for the operation of a blowpipe, and for other uses requiring a moderate amount of air or gas under pressure.

The method of accomplishing this is illustrated in Fig. 5. The instrument is arranged to discharge into a bottle or other vessel having an overflow, and the air for the blast is taken out through the angled tube inserted in the stopper of the bottle. The amount of air pressure is regulated by the water pressure and the height of the overflow pipe.

For many vacuum experiments a plate provided with a central aperture, and having a tube extending from the aperture to the edge of the plate, will be found useful. The tube is provided with a suitable valve, which closes communication with the aspirator, and which also serves to admit air, when required, to the receiver fitted to the plate. This plate and accessories are like the plate and accessories of a piston air pump. Communication is established between the tube of the plate and the aspirator by means of a pure rubber tube which is practically air tight.—*Scientific American.*

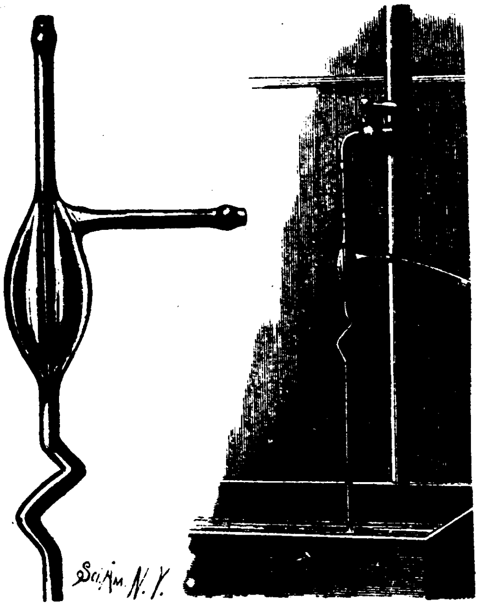


Fig. 1.—BUNSEN FILTER PUMP.—Fig. 2.

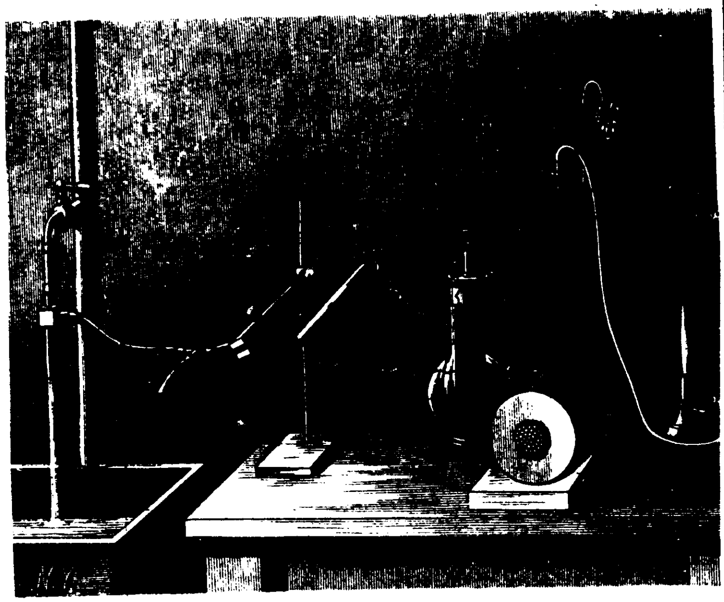


Fig. 4.—EXHAUSTING GEISSLER TUBE.

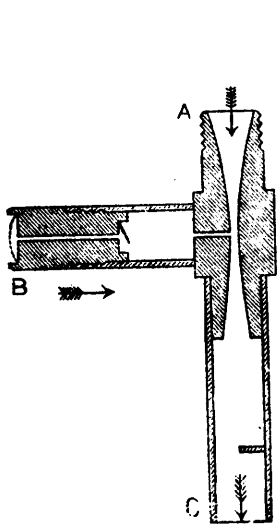


Fig. 3.—METAL ASPIRATOR.

Fig. 6.—PLATE AND RECEIVER FOR ASPIRATOR.

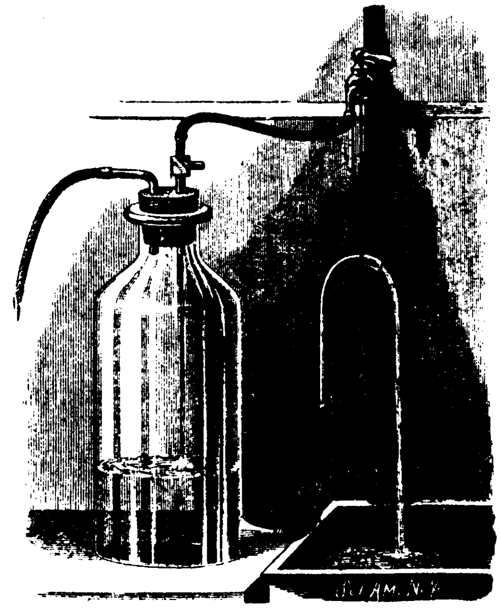


Fig. 5.—BLAST PRODUCED BY THE ASPIRATOR.

SOME EXPERIMENTS IN SOUND.

BY GEO. M. HOPKINS.

The most perfect exhibition of vibrating flames can be made only with expensive apparatus ; but the student can get very satisfactory results by the employment of such things as are shown in Fig. 1. A candle, a rubber tube, an oblong mirror, and a piece of thread are the only requisites, excepting the support for the mirror—which in the present case consists of a pile of books—and a little paper funnel inserted in the end of the rubber tube and forming the mouthpiece.

The thread is tied around opposite ends of the oblong mirror, and the mirror supported by passing the thread through the upper book of the pile, which juts over to allow the mirror to swing freely without touching the books. The mirror is made to vibrate in a horizontal plane by giving it a twisting motion. One end of the rubber tube is placed very near the base of the candle flame, and the other end, which is provided with the paper mouthpiece, is placed before the mouth and a sound is uttered which causes the air contained by the rubber tube to vibrate and impart its motion to the candle flame. The vibratory character of the flame is not noticeable by direct observation, but on viewing the flame in the swinging mirror, separate images of the flame will be seen. These images are combined in a series which, with a certain degree of accuracy, represent the sound waves by which the fluctuations of the flame are produced.

To show that these images result from a vibrating flame, it is only necessary to view the flame in the mirror. When no sound is made in the mouthpiece, only a plain band of light will be seen.

A somewhat more convenient arrangement of mirrors is shown in Fig. 2. In a baseboard is inserted a wire, one-eighth inch or more in diameter and about a foot long. On this wire is placed an ordinary spool, and above the spool a thin apertured board (shown in the detailed view), the board being about 8 inches long and 6 inches wide. The board is perforated edgewise to receive the wire. In the upper edge of the board, half-way between the centre and end, is inserted wire, upon which is placed a small spool, serving as a crank by which to turn the board. Upon opposite sides of the board are placed mirrors of a size corresponding to that of the board, the mirrors being secured to the board by strips of paper or cloth pasted around the edges. The image of the flame is viewed in the mirrors as they are revolved.

In Figs. 3 and 4 is illustrated an adjustable lens for showing the refraction of sound. The frame of the lens consists of three 12-inch rings of large wire, soldered together so as to form a single wide ring with two circumferential grooves. In the central part of the ring, at the bottom, is inserted a standard, and in the top is inserted a short metal tube. Over the

Fig. 1.—SIMPLE METHOD OF PRODUCING AND VIEWING VIBRATING FLAMES.

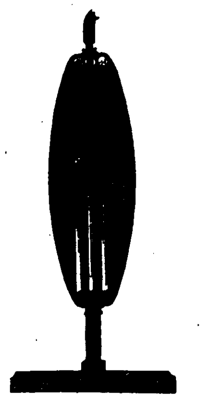


Fig. 4.—SECTION OF SOUND LENS.

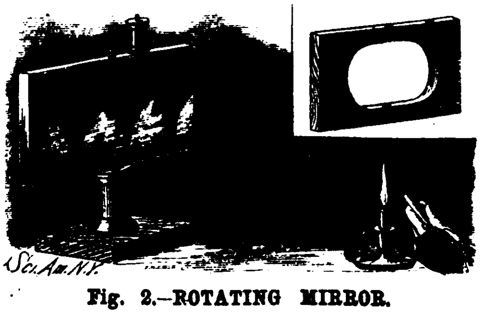


Fig. 2.—ROTATING MIRROR.

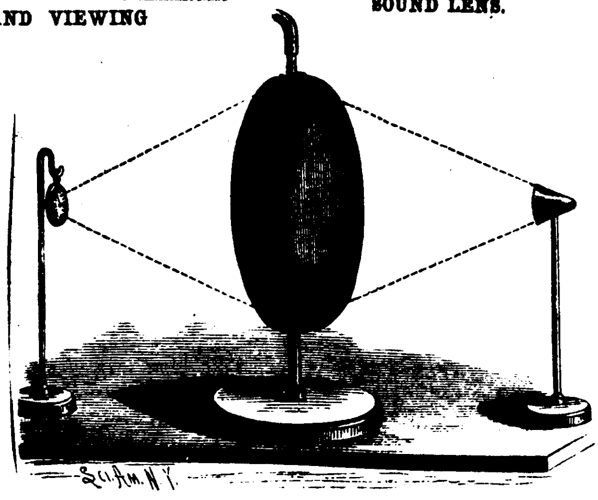


Fig. 3.—SOUND LENS.

edges of the ring are stretched disks of the thinnest elastic rubber, which are secured by a stout thread wound around the edges of the rubber, clamping them in the grooves of the ring.

By inflating the lens through the tube with carbonic acid gas, it may be focused as desired. A watch placed at the focus upon one side of the lens can be distinctly heard at the focal point on the opposite side of the lens, when it can be heard only faintly or not at all at points only slightly removed from the focus, thus showing that the sound of the ticking of the watch has been refracted by the lens, in much the same manner as light is refracted by a glass lens.—*Scientific American*.

NEW YORK TRADE SCHOOLS.

The working of the Trade schools in New York is said to be very satisfactory. A young man wishes to be, say, a bricklayer. He enters the school, if not under seventeen or over twenty-one years of age, on payment of a fee of 20 dollars. The instruction is given the class on three evenings each week for five months from 7 to 9.30 o'clock, and every day from 8 a.m to 5 p.m. for two weeks more at the close of the term. The young man is given a ticket after paying his fees, and for which he receives in return a trowel, which he returns every evening, receiving back his ticket. The course is divided into a series of exercises. The instructor shows the class how the work is to be done, and explains why it should be so done. The young men then endeavour to do what has been shown them, the instructor (one to every 25 pupils) correcting them when they are wrong. The first evening is spent in learning how to handle the trowel and spread the mortar, then follow three evenings on 8 in. walls, working to a line. he pupils are required to spread mortar over at least two bricks, to bond properly and strike the joints neatly. Three evenings more are given to 8 in. walls, when mortar must be spread over at least three bricks, and the wall pointed. Next follow lessons on 12 in. piers and the use of the plumb-rule. Then 12 in. walls are built for six evenings, twenty minutes each evening being occupied in spreading mortar. Then follow piers again; then 8 in. walls without a plumb-rule, so as to train the eye; then 12 in. walls with a chimney-breast and flues; then 8, 12, and 16 in. walls turned at right angles and with intersecting walls; these exercises are followed by arch construction of two and three rowlock courses. Afterwards the class is taught to build fireplaces, set sills, window-frames, and lintels, practise corbelling, and then work again on 12 in. walls. Instruction is also given on mixing mortar, cement, and concrete, in laying and levelling foundations, the principles of the arch, flue construction, strength of walls. The two weeks' day instruction at the close of course is a repetition of what has been done, one hour each day being passed in laying bricks on a 12 in. wall as fast as they can properly be laid. When the six months have been passed the young man can lay about 600 bricks per day on a straight wall, and can do almost any work that is required of the average bricklayer. A similar system is pursued in the classes of stone-cutting, carpentry, plumbing, plastering, and other trades.—*Building News*.

HARDENED STEEL TOOLS.—The *Scientific American* says that hardness on steel tools, almost equal to that of the diamond, is obtained by plunging them when white-hot into sealing-wax, repeating the operation until the steel is too cold to enter the wax. The tool is then just touched with oil of turpentine.

ON THE DISCHARGE OF A LEYDEN JAR.

FROM A LECTURE BY DR. OLIVER LODGE AT THE ROYAL INSTITUTION, ON FRIDAY EVENING, MARCH 8, 1889.

The main topic of discourse was the oscillatory character of the well known Leyden jar spark. Each spark is in reality not simple, but complex, and though it lasts only an inconceivably small fraction of a second, yet by a sufficiently rapid revolving mirror it can be analyzed into a number of distinct oscillations or alternations of current, separated by momentary pauses analogous to the vibrations of a loaded spring or the reed of a musical instrument. If the discharge be interrupted before it is complete, the jar can be found charged in a precisely opposite way to what it was at first. The fact is that the discharge has inertia and overshoots the mark, first in one direction, then in the other, precisely as happens with a swinging pendulum.

The original experimental discoverer of the fact of oscillation in a Leyden jar discharge was stated by the lecturer to be Joseph Henry, of Washington, in 1842. But the fact has been lost sight of, and it was Helmholtz, in 1847, who showed that oscillations were a necessary consequence of the conservation of energy; while in 1853 Sir Wm. Thomson gave the complete mathematical theory of the subject.

The oscillations have been seen, after considerable labor and careful experiments, by Feddersen in Germany; but they are ordinarily of extraordinary frequency. They are often more than a million per second, and usually more than a hundred thousand. They can be easily got as high as a hundred million per second, and if they were made very much more frequent still, they would begin to affect the eye with the sensation of light. It is this fact that light is excited by and consists of minute electric oscillations, as worked out in the mathematical theory of Clerk-Maxwell and now experimentally established by the recent brilliant discoveries of Herz—it is this fact, said the lecturer, which incloses the whole subject with such profound interest and importance.

Having sketched out this view of the subject and illustrated the mechanism of the oscillations by mechanical analogies, Prof. Lodge proceeded to show how he had found it possible to make the oscillations much slower, and ultimately to bring them within the range of audition.

He then proceeded to exhibit these comparatively slowly oscillating sparks to the audience, the whistling and musical sound of the sparks being most apparent, the lowest note obtained corresponding to about 500 vibrations per second.

These musical sparks were then analyzed in a slowly rotating mirror and spread out into a long and serrated band, having much the appearance of a singing flame similarly analyzed.

Having made this demonstration visible to the entire audience, the lecturer next proceeded to exhibit another recently discovered fact, viz., that the plane of polarization of light could be easily rotated by a Leyden jar discharge, and that the restored light was oscillatory in precisely the same manner as the spark.

A long tube of bisulphide of carbon, surrounded by a helix, was employed, and light, after being sent through this and through an analyzer, was submitted to the same rotating mirror as before, and the beaded band of light made distinctly visible.

These were the principal experiments; but other matters, such as sympathetic electric resonance, by which the discharge of one Leyden jar could be made to burst an air condenser properly timed to its oscillation period, were referred to, and also also demonstrated in the library during the evening.

The lecture was concluded with the following peroration :—

"An old and trite subject is thus seen to have, in the light of theory, an unexpected charm and brilliancy. So it is with a great number of old and familiar facts at the present time. The present is an era of astounding activity in physical science. Progress is a thing of months and weeks, almost of days. The long line of isolated ripples of past discovery seem blending into a mighty wave, on the crest of which one begins to discern some oncoming magnificent generalization. The suspense is becoming feverish; at times almost painful. One feels like a boy who has been long strumming on the silent keyboard of a deserted organ, into the chest of which an unseen power begins to blow a vivifying breath. Astonished, he now finds that the touch of a finger elicits a responsive note, and he hesitates, half delighted, half affrighted, lest he be deafened by the chords which it would seem he can now summon forth almost at will."

THE JOINER AND HIS TOOLS.

BY OWEN B. MAGINNIS.

The paring tools of the joiner consist of the draw knife and chisels, gouges, spokeshave, scraper, hatchet.

The draw knife as represented (fig. 25) is more a cooper's than a joiner's tool, yet it is most useful to the joiner in gauging, or rather bringing boards to a width by preparing them for the plane by taking off the superfluous stuff.

The chisel runs in sizes from $1\frac{1}{16}$ in. wide up to 2 ins. wide, and is undoubtedly indispensable, being necessary for paring and cutting. There are firmer (fig. 26) chisels, socket (fig. 27) and bevel edge chisels and mortise chisels, all useful in their own way, the socket for using under the mallet or by hand pressure, the firmer for paring and the bevel edge (fig 28) for getting into corners and fine fitting. The last is a beautiful chisel, and but little used. The mallet mentioned above is made as shown (fig. 29) of ash, beech, or hickory. Lignum vitæ mallet heads are common, but experience will show that a very hard mallet means many broken and split chisel handles.

Mortise chisels are used for making apertures or mortises in the wood with the chisel by striking the latter on its handle and making an incision in the wood by the blow.

Gouges are likewise made in sizes and of different radii. There are outside and inside cutting gouges (fig. 30), the latter being ground on the concaved side for paring and straightening concave work or sweeps, and the former for hollowing, or, technically speaking, gouging. To these are added bent gouges for shaping interior mouldings, etc. The spokeshave finishes what the gouge has gone over, making it smooth and obliterating the gouge-marks and making ready for scraper and sand-paper. The sketch in fig. 31 shows this tool; the edge of the cutter can be set for different purposes. The ordinary scraper is a thin plate of well-tempered steel about $3 \times 4 \times \frac{1}{16}$, with the edges burred to insure its cutting; a piece of a broken saw-blade answers the purpose admirably if the temper be good, but it is difficult to cut the blade to the required size. Scrapers are now made similar to a plane, or like fig. 37, but the above is the original, and when well sharpened will take off a shaving. It is sharpened by jointing the edge perfectly square and straight with a flat file and then turning arrised corners with a smooth instrument as a gouge.

Saws are thin plates of steel diminishing in width to the point so as to throw the weight to the handle, and cut on one edge into triangular or wedge-shaped teeth, which are set or slightly bent every other to each side of the blade. They are used by pushing it forward and drawing it back again, the power being applied vertically in pushing. The back of the teeth make different angles with the saw line, and are filed to suit their several purposes.

The joiner requires six saws, namely :

The ripper (fig. 32).
The cut-off or cross-cut (fig. 33).
The panel (fig. 34).
The tenon (fig. 35).
The compass (fig. 36).
The keyhole (fig. 40).

All joiner's saws, excepting the tenon and dovetail, should be of parallel thickness of teeth and diminish to the back to enable the saw to run easily in close-grained stuff. When buying a saw the joiner takes it by the handle and shakes the blade to try if it is buckled. He always selects a warranted make of the best known makers, so that he can change it if defective.

The ripper (fig. 32) is 28 in. long and 8 in. wide, diminishing to $2\frac{1}{2}$ in. on the point, made stiff with a double handle fastened by screws to the blade, and has its teeth with their front or right angles to the saw line and filed square to the side of the blade.

It is used for ripping or cutting the wood with the grain, and cuts like a chisel. Its teeth are about 3 to 5 to the inch.

Hand saw or cross-cut is used for cutting the wood across the grain only, and varies in length from 24 to 26 inches. It is usually with the teeth at less rake than the ripper or rip-saw, and with a slight flem or bevel to rapidly sever the fibres. The teeth are now cut from 7 to 10 to the inch, and the saw has a slight crown or convex curve on the teeth line. This saw is well ground to the back to avoid buckling and sticking in the wood when working.

Panel saw (fig. 34) is employed in fine panel work or for cutting panels and trimming in houses, as the fine teeth and thin blade make a close, clean cut. It is usually from 10 to 20 inches long, and the only saw with which a close joint can be made. The teeth are spaced from 10 to 12 to the inch.

Tenon saw (fig. 35). The joiner uses the tenon or back saw to cut the shoulders of tenons or to a knife mark in making a perfectly straight shoulder or butt joint across grain. Its length runs from 14 to 19 inches and the teeth from 8 to 15 to the inch. As it is only used for keying or making shallow cuts, its blade is a very thin, rectangular plate of steel stiffened with a thick piece of iron or brass, bent over its upper edge as shown, thereby preventing the blade from buckling.

The dovetail saw is employed in dovetailing; the length of its plate is about 9 inches and the handle is single.

The compass saw (fig. 46), as its name implies, cuts round sweeps or circles struck with the compasses. Its handle is single, teeth about 7 to the inch and blade about 8 inches long, diminishing from 1 inch broad at the handle to $\frac{1}{4}$ inch at the point. It ought to be concaved or diminished to the back.

Keyhole saw or pad saw is inserted in a pad or handle slotted through from end to end to let the saw run into the handle. The lower end is fitted with two set screws to set the blade fast in the handle. On account of its being

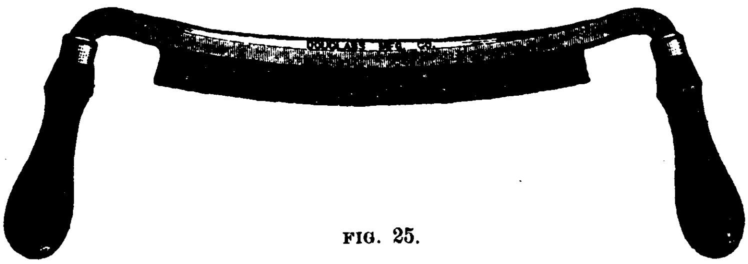


FIG. 25.

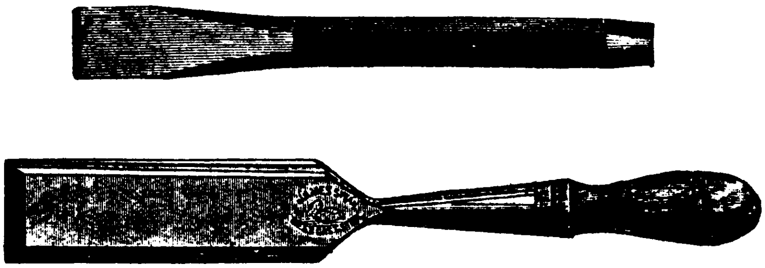


FIG. 26 AND 28.

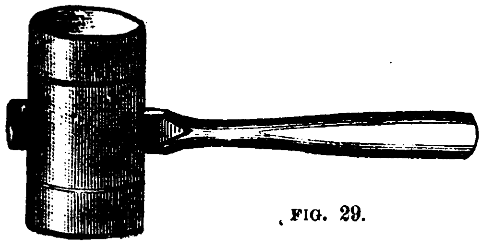


FIG. 29.

FIG. 30.

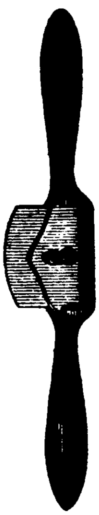


FIG. 31.

FIG. 36.

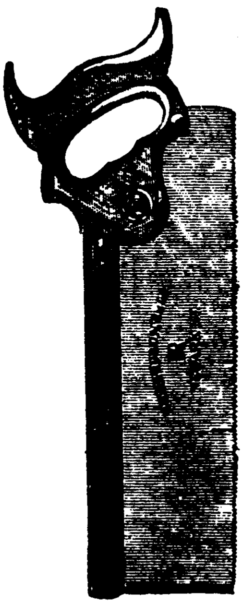


FIG. 35.

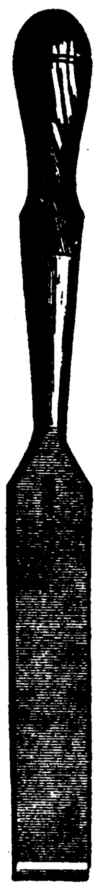


FIG. 27.

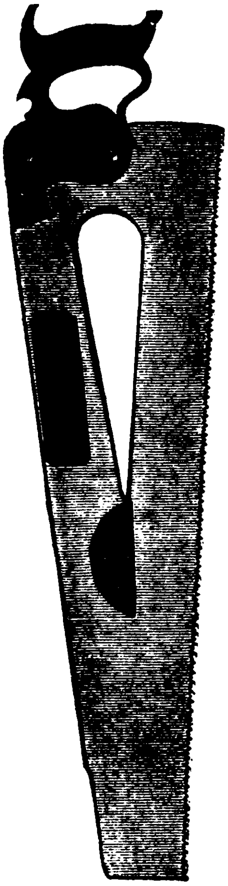


FIG. 32.

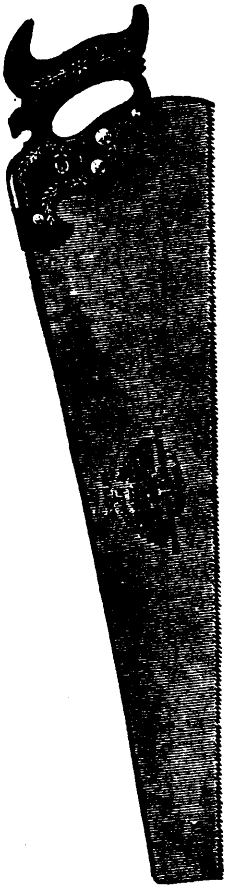


FIG. 33.

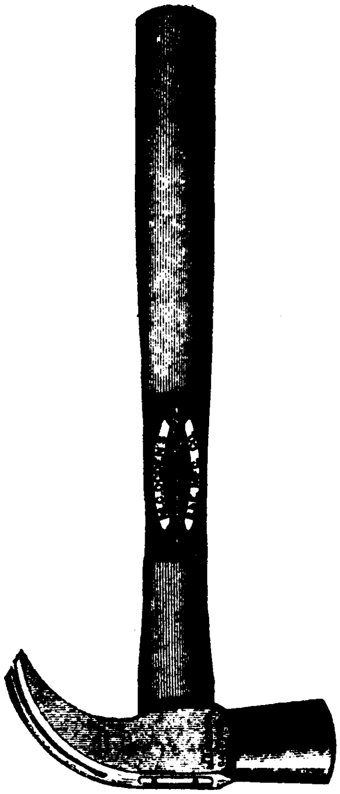


FIG. 41.

FIG. 34.

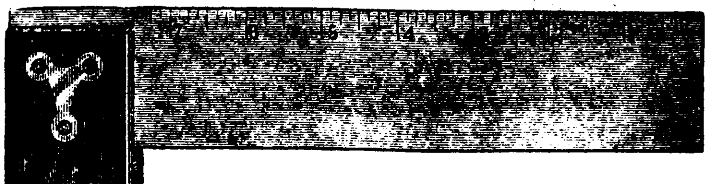


FIG. 40.

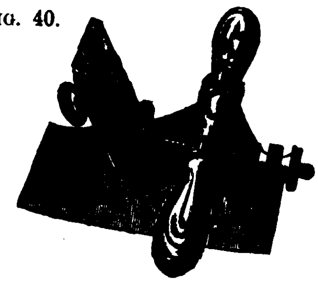


FIG. 37.

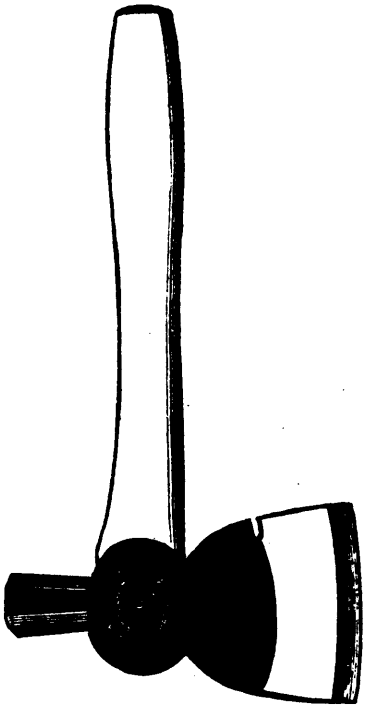


FIG. 38.

adapted for cutting quick curves or keyholes it is named as above.

Hatchet (fig. 38) is a small axe with a hammer head forged on the opposite end. It is very useful to the joiner in making plugs to insert in walls for fastening his work, and the hammer head is then employed in driving them into their holes.

Plugging chisel (fig. 39), a prism of steel, about 9 inches long, with which the joiner forms holes in masonry or brick work into which he drives his wooden plugs to which the work is fastened.

Try-square (fig. 40) consists of a stock and blade. The stock is a rectangular piece of hardwood, generally ebony or rosewood, its inside edge being covered with a brass plate.

Hammer (fig. 41). The modern joiner's hammer is exactly like fig. 41, and is a solid steel casting with a smooth, round face on one side of the head for the purpose of driving in nails by rapid percussive strokes on the nail head. On the other side a double split claw, useful for drawing out old nails by catching the nail in the split and using the handle as a lever and the percussion head as a fulcrum to pull out the nails needed. The handle is of turned ash and wedged into the adze-eye or socket in the head with iron wedges to prevent the head slipping the handle. It usually is made in the shape shown, in this country, and with a straight pene or point in Europe. The adze-eye application was invented by Mr. Maydob, and is now universally in use.—*Builder and Woodworker.*

THE EDUCATION OF AN ELECTRICAL ENGINEER.

The present activity in the electrical world is causing many to adopt the profession of the electrical engineer, as there must be in the near future a great demand for properly qualified men. The field is so new that the precise training required is yet open to discussion, and the different opinions expressed on the subject by those who ought to know are often most bewildering to the would-be beginner. Broadly, there are two methods of training in vogue; the one is to be obtained at the various colleges in the Metropolis, some of which are entirely devoted to the teaching of electrical engineering; the other is that hitherto adopted by mechanical engineers of an apprenticeship to some firm or company actively engaged in manufacturing or installation work. A lad who learns his craft by working side by side with ordinary mechanics undoubtedly gains an insight into one part of his future profession that no amount of mere college training can ever impart. It must be remembered, however, that the steam-engine is so exceedingly simple that most lads have already learnt its action from some popular book before leaving school. Why the piston moves forward with a certain pressure of steam behind it is obvious, and how the motion is transmitted to the fly-wheel can be seen at a glance; but to this day no full explanation of what electricity and magnetism really are has yet been given, and many a University graduate in science is utterly unable to explain why or how a dynamo machine works at all. A youth may be turned loose in an electrical company's workshop, and see every detail of construction, without having the least idea of why the various pieces of apparatus are constructed as they are; why, for instance, if a piece of copper is moved in one way between the poles of a magnet an electrical current flows from it, whilst a slightly different movement produces no effect whatsoever. Before an electrical engineer can hope to be able to be anything more than a mere rule-of-thumb man; indeed, before he can hope to be more than a superior kind of workman, he must know at least the elementary theories of his subject. This theoretical knowledge is unquestionably best acquired in a properly-conducted college, and although it is frequently urged that a student straight from college is of little use in carrying out contracts, and that whilst able to discourse learnedly on what has already been done by others cannot by himself perform some of the most ordinary work, and that, furthermore, in cases of emergency he loses his head and is worse than useless, yet no student will ever be guilty of the egregious blunders daily committed by the so-called practical man. When extreme and contrary views on any subject are held, a good plan of getting at the truth is to strike a average between them. This leads us to believe that the proper training for the embryo electrical engineer is a course of lectures and laboratory work at a college, followed by a short pupilage at a manufactory or central station, where he can see his knowledge practically applied on a large scale. The managing director of a well-known company has recently been advising the boys fresh from school to become practical mechanics first, and then to study electricity. With this we totally disagree. At the age of 16 or 18, when a boy leaves school, his mind is more receptive than at any other period of his life; whatever knowledge he may possess of mathematics, natural philosophy, or chemistry is still fresh in his memory, and to him the discipline of a college and book work in the evening come naturally. We very much doubt if the average lad will take kindly to study again after he has given it up for two or three years, got rusty in everything he ever learnt, and become accustomed to manual labour in the shops. To the question, "What theoretical instruction do you give your apprentices?" the manufacturer always replies: "We expect our apprentices to study at home in the evening." This is simply nonsense. A boy who has begun work, possibly at 6 o'clock in the morning, with the workmen, when he gets home in the evening either wants to go to bed tired out, or to have some amusement. Advocates of the purely theoretical or purely practical training always point to the careers of certain eminent electrical engineers as proving the truth of their advice. To such advocates we would point out that men of untiring energy and great natural ability will train themselves and become famous under any circumstances. Indeed, one of the most brilliant men, and perhaps the most successful designer of electrical plant of the present day never had any special education at all. Fortunately, as long as colleges charge fees, and firms require premiums, further confusion will not be made by people being advised to follow this example and become electrical engineers without any training at all, either practical or theoretical. Our advice that a judicious combination of both is the right thing may meet the views of both parties.—*The Citizen.*

THE MOST PERFECT PENDULUM.—What is supposed to be the most perfectly acting pendulum, especially in respect to simplicity, is in operation at the University of Glasgow, Scotland. According to this plan a small shot of about $\frac{1}{18}$th of an inch in diameter is suspended by a single silk fibre (half a cocoon fibre) two feet long in a glass tube of three-fourths inch internal diameter, exhausting the latter to about one-tenth of a millionth of an atmosphere. Starting with a vibrational range of one-fourth inch on each side of its middle portion, the vibrations can be easily counted after a lapse of as many as 14 hours, a fact not realised elsewhere.

ELECTRICITY PRODUCED BY WIND POWER.

The employment of the wind for motive power purposes on land is a subject which has for many years past engaged the attention of the scientific world, but so far the results obtained from experiments made have not been very successful, and we seem at present to be as distant as ever from the attainment of any really practical issue in the matter. That windmills for grinding corn have been employed for generations is a well-known fact, but their use is gradually being discontinued owing partly to their inefficiency as compared with steam-driven mills, and partly to the variable nature of the wind which renders it impossible for a windmill to be kept constantly in operation. In Holland and Egypt there are many windmills employed to drive pumps for raising water, and in America they may be counted by thousands. In the latter country they are used for keeping up a supply of water in agricultural districts and in the reservoirs at railway stations. In our opinion these few instances represent, with one single exception, the only modes in which the wind has been employed on land for motive power purposes.

The exceptional case referred to is at present to be found in France in connection with the Nord Lighthouse at the extremity of the Cap de la Hève, which is about two miles distant from Havre. Electricity is employed as the lighthouse illuminant, and at the time of the putting up of the installation it was resolved to endeavour to utilise the motive power of the wind for driving dynamos. Accordingly, a windmill, or "wind-motor" as it is termed, of the modified Halladay type, was erected, and it develops about 18 H.P. when the wind is blowing at the rate of 33 feet per second. The wind-motor, which is mounted upon a wooden framework fixed upon blocks of masonry, imparts motion, by means of a vertical shaft and conical gearing, to a horizontal shaft placed at a suitable distance from the ground. On the horizontal shaft are mounted two pulleys which, by means of belting, drive two dynamos of different sizes which are connected to a series of accumulators. The speed of the wind-motor is automatically regulated by an apparatus which opens or closes the sails according to the velocity of the wind. The intensity of the current of the smaller dynamo is 8 ampères when the latter is running at 100 revolutions per minute, and 40 ampères when the speed is 200 revolutions; whilst the larger dynamo gives a current of from 40 to 100 ampères for a speed of from 250 to 650 revolutions. The mechanical efficiency is 4 H.P. for the small and from 4 to 6 H.P. for the large dynamo. The dynamos are run alternately, according to the quantity of energy stored in the accumulators.

It will be seen from the foregoing that this installation is certainly unique in character. It was put up some time ago as an experiment, and has answered the expectations of those concerned. That this should be the case is not surprising, when we consider the fact that the installation is on a *small scale*, but what would happen if a proportionate success could be obtained in central stations, say, of the size of that at the Grosvenor Gallery, or that in course of construction at Deptford? Would not the directors of our electric lighting companies rub their hands and dance for joy at this El Dorado—at being able to dispense with steam engines and boilers, which decrease in initial cost would enable them to supply light probably at the same price or even cheaper than gas? The gas companies would be at their wits' ends, their shares would go considerably below par, and our gas contemporaries would have to shut up their offices. What tremendous excitement there would be at the half-yearly meetings of our electric lighting companies, and how satisfied the shareholders would be to think that dividends were *at last* going to be paid. The electric lighting panic of 1882 would stand no comparison with what would take place under such circumstances. Shares would be at an exceedingly high premium, and the electric lighting millennium would commence!

Alas! It is to be regretted that such a fanciful dream cannot be realised, for the simple reason that there are three serious objections to the use of windmills for driving dynamos. In the first place there are the periods of calm, during which no movement of wind appears to take place; in the second place, the irregular velocity of the wind; and in the third place, the imperfect construction of the receivers or windmills. It is quite manifest that the first objection is insurmountable. The second has partly been overcome in the instance described above, by the employment of an automatic apparatus which opens or closes the sails according to the velocity of the wind; but how far such an arrangement could be used on a large scale we will not venture to predict. The last objection is, doubtless, one which might be surmounted; but the impossibility of overcoming the first objection, and the indefiniteness of the second, are sufficient proofs to show that the wind will never be utilised on an extensive scale for motive power purposes, and especially as regards electric lighting.—*Electrical Review.*

A SIMPLE AIR BATH FOR LABORATORY USE.

BY T. O'CONOR SLOANE, PH.D.

The air bath ordinarily used in chemical laboratories for drying precipitates, for making determinations of water by loss, and for similar purposes, is usually a rather expensive piece of apparatus. The iron or copper closet, with its door, tubulure for thermometer, shelves, stand, etc., works no more satisfactorily because of its somewhat elaborate or difficult construction. In the cuts is shown a simple substitute for this apparatus, that as regards simplicity cannot well be excelled, while its other good features certainly operate to commend it. It consists of an inverted flower pot sustained upon an ordinary tin pan or sand bath, the whole being carried by a tripod or retort stand. The aperture at the top serves to receive a perforated cork, through which a thermometer is passed. An ordinary Bunsen burner is used to heat it. As the sand bath directly over the burner becomes very hot, it is advisable to invert a second smaller sand bath within the first, as shown in Fig. 2. This prevents too direct a radiation of heat from the hot metal. Upon this the little stand or bent triangle supporting the crucible or watch glass containing the substance to be heated may be placed. The thermometer should be thrust down through the cork until its bulb is near the substance to be dried, so as to obtain a correct indication of the temperature at that point. The entire arrangement is shown in external view in Fig. 1.

To place a vessel in it or to remove one, the flower pot is lifted off the sand baths. It will be observed that its porous nature provides a species of ventilation, while its composition assures it against corrosion. It even protects the plates below to a considerable extent, as drops of water or other fluid cannot run down its sides as it cools.

But convenient as it is in the role of air bath for simple drying operations, it will be found more so where drying tubes or retorts have to be manipulated at constant temperature. The flower pot can be perforated at any place, and holes of any size or shape can be drilled and cut through it with an old knife, file, or other implement. Thus in Fig. 3 it is shown in use for drying a substance at constant temperature in a

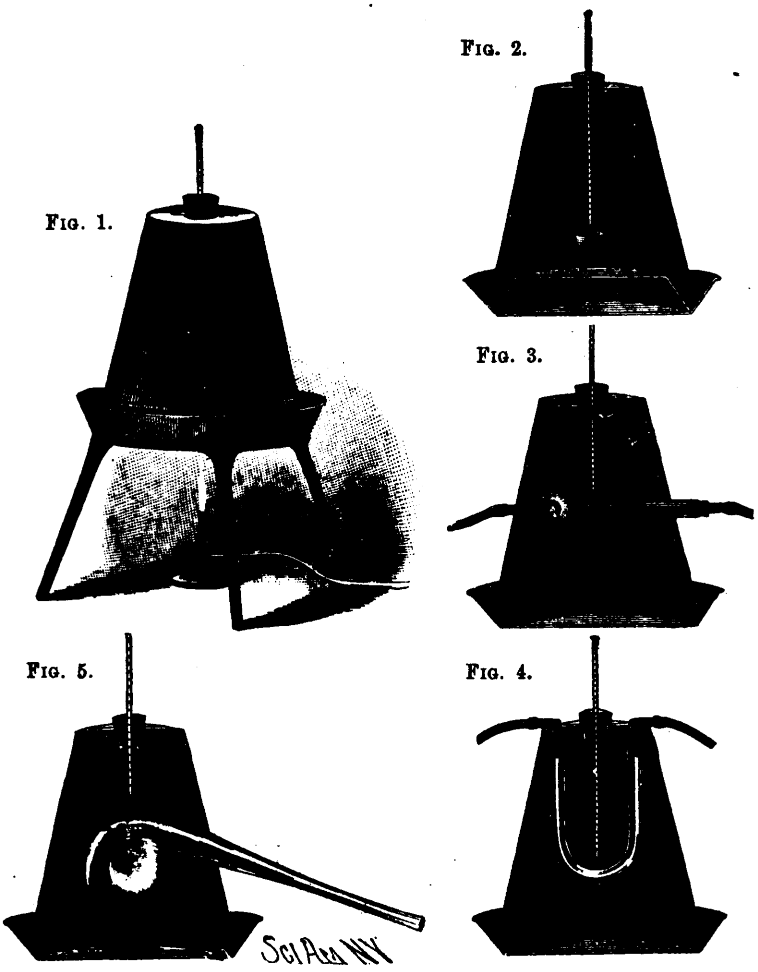


Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5.

A Simple Air Bath for Laboratory Use.

straight drying tube. The holes to receive this tube can be drilled in a few minutes. The arrangement as shown is of the simplest kind, but if the usual bath was used, it would require a special tubulation to be introduced or contrived for the tube to pass through. Flower pots cost so little that there need be no hesitation in preparing them for special uses.

In Fig. 4 a U tube is shown as being heated, while in Fig. 5 a retort occupies the bath, and is in use for fractional distillation or other operation requiring a constant temperature. In all cases it is better to use the second bath inverted within the chamber. It conduces greatly to the maintenance of an even temperature throughout the whole space. A hint may also be taken from the heavy drying plate formerly perhaps more used than at present. If for the light metal pans a heavy plate one-eighth inch or more in thickness is substituted, the temperature will not be subject to as rapid variations, and less difficulty will be experienced in keeping a constant temperature. The tray furnished with the next large size of pot may be used instead of the sand bath upon which to rest the inverted flower pot. This gives an absolutely non-corrodible construction.

When the bath is in use for drying substances, its top, which is at a rather low heat, affords an excellent place for drying precipitates wrapped in their filter papers. It acts in two ways. It is generally just hot enough to dry them with reasonable quickness without danger of spurting, and it also acts by capillarity to absorb the water directly. It represents in the last respect the porous tile or blotting paper—appliances too little appreciated by chemists here. It must be remembered that the drying of a precipitate by evaporation leaves all the impurities of the wash water concentrated therein, while capillary absorption removes a great part of both wash water and its impurities, thus conducing to the accuracy of the work.—*Scientific American.*

THE SODA FOUNTAIN.

BY JAMES VERNOR.

The main points upon which the success of a soda water business depends are few in number, but although apparently trifling, they are in reality of the most vital importance.

First, we must be able to offer the public a beverage that the great majority will really like. It must not only be palatable, but satisfying, and the more satisfying it is, the better the result will be on the business. No matter how pleasant or palatable a beverage may be, if the public decide that it is "thin" or that it has "nothing to it," its sales will be limited. The day of "sweetened wind" has gone by, and the failure of many a fountain to pay may be accounted for by the fact that nothing but that article was ever drawn from it. There are dozens of good beverages offered by manufacturers in the form of "extracts," any one of which will yield handsome profits, and the man who is unwilling to purchase those extracts because the manufacturer makes a profit on them, and because he imagines that he can make something similar which will do just as well, while costing but a trifle, might in ninety-nine cases out of a hundred just as well give up the soda water business, for he will rarely make a success of it. I grant that an occasional success may be attained, but the risk is a very great one, and at the best it will require years to arrive at the point where, had the other plan been pursued, a single season would have found him.

No matter how many special drinks are drawn, every fountain should, as a basis, draw soda water, and it should be something more than "sweetened wind." The water should be perfectly filtered and thoroughly charged with carefully washed carbonic acid gas, until, after plenty of agitation, the gauge indicates 100 pounds pressure. The sirup should be heavy with pure cane sugar (12 pounds to the gallon of water). Fruit sirups should be made from pure fruit juices, which, if you are too indolent to make for your own use, you can always buy, although not quite as good nor quite as economical. The vanilla should not be tainted with tonka bean, nor the ginger with capsicum, the coffee should be a very strong decoction of the most fragrant berry, in each gallon of which should be dissolved while still hot 12 pounds of granulated sugar. The chocolate should be made from the very best cocoa, and should be free from fat and rich in sugar. All sirups should be dispensed in connection with good, plain, pure, rich cream, whether called for or not, and ice cream should be relegated to the "ice cream parlors," where it more properly belongs, and where it will not spoil a good glass of soda nor the genial disposition of the gentleman who is endeavoring to place before the public something better than "slops" and "sweetened wind." Cases will occur where customers cannot take cream in any form. Experience has shown that with such customers a little dash of vanilla sirup, added to any order they may give, usually elicits a remark complimentary to the beverage drawn from that fountain, showing the wisdom of the French makers of chocolate, who realize the importance of the vanilla bean as a valuable adjunct to their products.

The next point is the temperature at which the drink is to be dispensed. Experience has shown that the public desire an extremely cold drink, and the dispenser should see to it that they have what they want. It is poor economy to save on ice or block tin pipe. Buy all required of both to have every glass of the beverage that crosses the counter uniformly cold. A thermometer plunged into a glass of it during your busiest moments, that will not fall to 45°, should be accepted as evidence that more cooling facilities are necessary, and the same should be procured with the least possible delay. The necessity for uniformity in temperature, as well as taste, of any beverage cannot well be overestimated. Attendants should be trained to use an exact amount of sirup and cream, coarse stream, and fine stream, each and every time that they wait upon a customer. A standard should be established, and every attendant should be expected to live up to it, the object being to thoroughly impress upon the mind of the customers that when they come to that fountain they will get just what they call for, and can be certain that it will taste just as they expect and desire it to. The result will be that, other things being equal between two stores, the one in which the customer knows such a state of things to exist will get the benefit of his patronage every time. Next in order is the glasses. They should be just as fine in quality as possible, and always scrupulously clean. The use of thin glassware necessitates a considerable expense, not alone in breakage, but also in the help necessary to keep them clean, but in my opinion it is much more than counterbalanced by the increased business induced by their use. It is a popular belief that all beverages taste better when drank from thin containers. How long would champagne retain its popularity if served in thick coffee cups? or the popularity of the after-dinner coffee, were it not for the dainty china used? The wise man takes advantage of these little things that have such a hold upon the public and turns them to his own benefit. Another nice point is the cleanliness of the glasses. It is not sufficient that a glass after use be swashed around in a pail of water and then turned upside down upon a drainer until it is to be used again. The very sight of a dozen or two glasses in the various stages of the drying process, from the one dripping with moisture and clouded with cream to the one dried till it looks as if it were afflicted with leprosy, is enough to turn the stomach of a strong man, to say nothing of the ladies. There is but one way to wash a glass and have it clean, and the sooner that every soda water dealer realises that fact, the better will it be for him and for all concerned. Take the matter to yourselves and your own homes; your wife or child uses a glass and places it upon the sideboard, and yet, although you know that none but them could have used it, should you desire a drink you will take a fresh glass, and notwithstanding that fact, the public at a soda fountain are expected to use a glass after every one, although the last lips that pressed its edges may have been smeared with tobacco juice or festering with disease, and what excuse have you to offer for it? Custom, custom and nothing else, but it is a custom that has done more to drive people away from a healthful and pleasant beverage than any other one thing. Let us have a grand reform in this particular, and let us in the future give no one cause that likes them to refrain from indulging in harmless drinks.

What applies to soda water applies with equal force to every beverage that is dispensed at the fountain, and while "soda" is an absolute necessity in a successful fountain business, it is frequently an item of minor importance as a source of revenue, being outsold by a special popular drink like ginger ale, mead, celery phosphate, koumiss, etc. Experience seems to indicate that each dealer should have a specialty, and the phenomenal success of some of the above certainly speaks volumes in favor of specialties, and that success again emphasizes what the writer has already stated, that uniformity in beverages is of the utmost importance. Uniformity can only be attained approximately where a beverage is drawn with a sirup, as the eye is depended upon to measure the sirup, and it simply insures less uniformity in proportion to the increased number of attendants at the fountain. On the contrary, a special beverage, like ginger ale, is made by weight and measure, then charged in the fountain and drawn complete, and uniformity is of necessity attained. Ginger ale becomes more popular each season, while the lives of sirup-made drinks like moxies and the maltos are principally distinguished by their brevity and their lack of ability to fill the bill.

There is another feature of the soda water business that unfortunately is almost universally overlooked, and that is the metallic contamination liable to occur in the carbonated water while standing in the fountains and coolers. We buy these containers lined with tin in some shape, and that tin will not last forever. Do not leave the discovery to your customer that it has given out. Do not wait until he tells you that your soda leaves a queer taste in his mouth. Do not wait until he tells you that your soda water made him ill. Do not wait until you are sued for damages, but rather be ever on the alert, make weekly or monthly inspections, drawing a little carbonated water and dropping it into a crystal of yellow prussiate of potash. A change of color will satisfy you at once that something is wrong. Search for it, find it, or stop drawing soda water, as you will have otherwise attained the highest point you will reach, and your trade, instead of increasing, will certainly and rapidly leave you. I have known instances of copper contamination in an apparatus that was supposed to have no brass or copper about it. Once it was a copper cooler tinned outside and inside, and sold as a solid block tin can cooler, a thing that does not exist. Again, the contamination was traced to a brass coupling, originally tinned, but from which the tinning had been worn off. I have known new apparatus to yield contaminated water through one of the parts having been put in without tinning, undoubtedly unintentionally, but the result to the business would have been just as disastrous had it not been for proper care and watchfulness.—*Pharmaceutical Era.*

LOOK TO THE ARCHITECT.

The cry for sanitary reform is likely to crowd the plumber unjustly close. The occasional hint that the tinker of pipes of the future will have to be a sanitary scientist is inspiring an assault upon him as the cause of all drainage trouble. This is a mistake. The plumber may justly be held blamable for any departure from the plans of an architect, or for any slighting of the specifications, or for botching his work; but it would seem that responsibility for the scientific arrangement of water service, drainage pipes, and ventilating flues should lie between the architect and the plumbing inspector; and if there is no inspector it should rest upon the architect alone.

The small boy who as "helper" to-day carries the furnace and solder-pot, is the plumber of to-morrow. His work is not of an attractive nature, and between him and the achievement of recognition as a journeyman with a journeyman's pay there are difficult, wearying, and disgusting tasks. If he is assiduous and is in charge of an instructor of the right sort he will eventually become a proficient workman; if not he will take a place among the botchers who annoy patrons and bring down condemnation on plumbers in general. This line of training does not beget sanitary scientists. Unless the apprentice is naturally studious and retentive he will be a mere reflection of passing theory.

On the other hand, the architect is brought up in an atmosphere of calculation and systematic design. He is taught to analyse everything, and to leave nothing to chance. No dullard can "help" himself into knowledge of the business by simply packing tools from place to place. The training of an architect involves the inculcation of scientific principles, and therefore the architect is more capable of assuming the responsibilities of applying sanitary science than the plumber.

An ordinance has been introduced in the Common Council of Chicago which, if adopted, will compel each master plumbel to file a bond in the sum of 10,000 dols. for damages that may result from his ignorance as to the arrangement of the water service and drainage systems. The ordinance also contemplates the establishment of a board of examiners of plans, to consist of a practising physician, an employing plumber, and a journeyman plumber; this board's duty also to include the examing and licensing of plumbers.

The proposed ordinance is misdirected. It should require the filing of a bond by the architect, and should hold that individual responsible for non-observance of common sanitary rules. The architect and the plumbing inspector should divide the duty of arranging systems of drainage, water service, and ventilation, and the plumber should be held responsible for the quality of his work only.

When this responsibility is rightly placed there will be fewer death-traps built by conscienceless Budensicks.—*The Evening Wisconsin,* U.S.A.

HOW TO MAKE A GOOD FLOOR.

Nothing attracts the attention of a person wishing to rent or purchase a dwelling, store-room, or office, so quickly as a handsome, well-laid floor, and a few suggestions on the subject, though not new, may not be out of place.

The best floor for the least money can be made of yellow pine, if the material is carefully selected and properly laid.

First, select edge-grain yellow pine, and not too "fat," clear of pitch, knots, sap, and split. See that it is thoroughly seasoned, and that the tongues and grooves exactly match, so that when laid the upper surfaces of each board are on a level. This is an important feature often overlooked, and planing-mill operatives frequently get careless in adjusting the tonguing and grooving bits. If the edge of a flooring board, especially the grooved edge, is higher than the edge of the next board, no amount of mechanical ingenuity can make a neat floor of them. The upper part of the groove will continue to curl upward as long as the floor lasts.

Supposing, of course, the sleepers or joists are properly placed the right distance apart and their upper edges precisely on a level and securely braced, the most important part of the job is to "lay" the flooring correctly. This part of the work is never, or very rarely ever, done nowadays. The system in vogue with carpenters of this day of laying one board at a time and "blind-nailing" it, is the most glaring fraud practised in the trade. They drive the tongue of the board into the groove of the preceding one by pounding on the grooved edge with a naked hammer, making indentations that let in the cold air or obnoxious gases, if it is a bottom floor, and then nail it in place by driving a sixpenny nail at an angle of about 50 degs. in the groove. An awkward blow or two chips off the upper part of the groove, and the last blow, designed to sink the nail head out of the way of the next tongue, splits the lower part of the groove to splinters, leaving an unsightly opening. Such nailing does not fasten the flooring to the sleepers, and the slanting nails very often wedge the board so that does not bear on the sleeper. We would rather have our flooring in the tree standing in the woods than put down that way.

The proper plan is to begin on one side of the room, lay one course of boards with the tongue next to, and neatly fitted to the wall (or studding, if a frame house), and be sure the boards are laid perfectly straight from end to end of the room and square with the walls. Then nail this course firmly to the sleepers, through and through, one nail near each end of the board on every sleeper, and you are ready to begin to lay a floor.

Next, fit the ends and lay down four or six courses of boards (owing to their width). If the boards differ widely in colour, as is often the case in pine, do not lay two of a widely different colour side by side, but arrange them so that the deep colours will tone off into the lighter ones gradually. Push the tongues into the grooves as close as possible without pounding with a hammer, or, if pounding is necessary, take a narrow, short piece of flooring, put the tongue in the groove of the outer board, and pound gently on the piece and never on the flooring board. Next, adjust your clamps on every third sleeper and at every end joint, and drive the floor firmly together by means of wedges. Drive the wedges gently at the start and each one equally till all the joints fill up snugly, and then stop, for if driven too tight the floor will spring up. Never wedge directly against the edge of the flooring board, but have a short strip with a tongue on it between the wedge and the board so as to leave no bruises. Then fasten the floor to the sleepers by driving a flat-headed, steel wire nail of suitable size, one inch from either edge of every board, straight down into each sleeper. At the end joints smaller nails may be used, two nails in board near the edges and as far from the ends as the thickness of the sleeper will permit. Proceed in this manner until the floor is completed, and you will have a floor that will remain tight and look well until worn out.

Such minute directions for so common and simple a job sound silly, but are justifiable from the fact that there are so many alleged carpenters who either do not know how, or are too lazy, to lay a floor properly.—*Southern Lumberman*, U.S.A.

THE RATING OF GROUND RENTS.

In a paper on "The Rating of Ground Rents," recently read at the Surveyors' Institution, Mr. George Beken dealt with the question—Whether the proposed measure, if enacted, would benefit occupying tenants?

He stated that ground rents are not paid by them, that an occupier does not necessarily know whether there is a ground rent on his house or not, and in negotiating for a tenancy does not even ask the question. The existence or non-existence of a ground rent is the concern of his immediate landlord, and depends upon whether he (the landlord) holds a lease only, or has bought the freehold. If he has only a lease, and consequently has to pay a ground rent, that does not enable him to obtain a higher rent; and if he were empowered by legislation to make deductions, in respect of rates, from the ground rent he pays, that would not necessitate his accepting less rent.

Mr. Beken's conclusion is that the rating of ground rents would not have the slightest effect upon occupying tenants.

It would merely, he held, shift the burden from one set of investors to another set, that is, from leaseholders to their ground landlords, notwithstanding that the former, by having agreed to pay all the rates, have obtained their leases for less than they otherwise would.

He then discussed the reason generally put forward in support of rating ground rents, viz.—That new imposts which were not contemplated when the leases were taken, and which are alleged to benefit the lessors' property, have been thrown on the rates. If this be so, he contended that, as a set off, account should be taken of the benefit the lessees receive from the expenditure. And if leases were to be se-aside in order to give one party redress for "the unforeseen," similar redress could not be fairly refused to the other party.

He was of opinion that in many cases, if the benefit accruing to a lessee from what may be termed "Improvement expenditure" could have been foreseen when he took the lease, he, or someone else, would have been willing to give a higher ground rent, in anticipation of that benefit outweighing any resulting increase in the rates.

He gave instances of claims and counter-claims which he considered would arise in going behind leases, as suggested, and said the necessary calculations would throw an amount of trouble and worry upon both parties that would be perfectly intolerable, whilst the net result, which would as often be against the lessee, as in his favour, could only be approximate, and would generally be trivial compared with the cost.

The measure would be especially hard upon investors in ground rents, who are content to take a low rate of interest in consideration of receiving a safe and regular income with little trouble.

In conclusion, Mr. Beken was of opinion that any legislative interference would do more harm than good, and he asked, if leases were to be revised whenever any covenant might become disadvantageous to either of the parties, why not subject every other kind of contract to similar revision? The logical sequel would be, he said, that no contracts, for any purpose whatever, would be binding, the effect of which upon enterprise generally would be most prejudicial.

To Clean Small Screws.—Screws that are too small for separate treatment may be cleaned from rust as follows: Take a pound of screws and place them in a small box—a cigar-box will do; put a small quantity of oil on them and shake for a minute; then put a piece of cotton-waste in the box and repeat for a minute; finally, put a handful of sawdust in the box and shake for another minute or so, and remove the sawdust by sifting it from the screws in a fine sieve.

Glazed bricks are now largely used for both interior and exterior decoration. They are manufactured in Philadelphia and elsewhere in the United States. For this purpose an ordinary light-colored or red brick is used, and a suitable enamel is produced on the surfaces to be exposed. Some colors are very easily obtained. A simple lead glaze or a cheap buff brick makes a good yellow. A manganese and iron glaze is used for black. White and blue are the most difficult to produce, since the red color of the brick must first be hidden by an opaque layer of white before the finishing glaze is applied. Green must be made in the same way.

Little Ones in Spectacles.—A writer in the Boston *Herald* says that the very general and growing prevalence of near sight is largely due to carelessness with children. The number of children who wear spectacles has become a serious subject of remark. That a radical wrong exists somewhere, when children only four years of age are thus hampered for life, is only too palpable, but whose the blame, and what the remedy for this evidently increasing affliction? Are future generations to be *sans* eyes as well as *sans* teeth? The defects in vision necessitating spectacles are inherited, or infants scarcely able to read would not be hurried to opticians and fitted to glasses that must bother them while they live. Oculists give many sensible reasons for this weakness of the optic nerves. But no one impresses the necessity of care in the management of eyes until the damage is done, and then it is too late. Young mothers who cover the baby's face with a veil, or who wear spotted lace against their own eyes, and who allow their children to read by insufficient light, are laying up trouble for themselves, though oculist and optician will be better off for their criminal ignorance. As to the schoolrooms, where children spend so many hours of the day, do parents ever ask or know how they are lighted, and whether the scholars face windows, and whether they are obliged to strain their eyes by blackboard exercises in half-lights? A little precaution in the use of the eyes, and some knowledge on the subject of improper lighting, would be a pound of cure in this matter of spectacles.

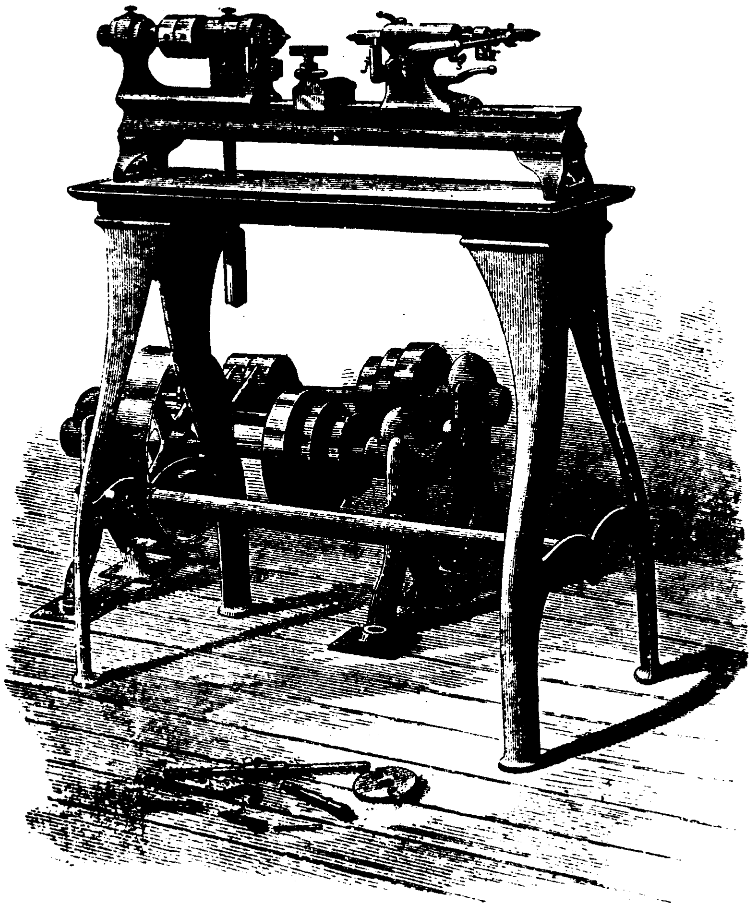


FIG. 1.

THE UNIVERSAL HAND LATHE.

There is scarcely a more prominent example of progress in machine tools than that of the Bench Lathe, a tool that, although a long time on the market, has only, comparatively speaking, recently found favour with machinists. This is due to the marked improvements in their construction, embodying great handiness in the way of control, etc., and complete adaptability to a large variety of work. The bench lathe is rapidly becoming a popular tool.

The following matter and illustrations are descriptive of the Universal Hand Lathe, manufactured by the Brown & Sharpe Manufacturing Co. :—

Fig. 1 is a general view of the Lathe. As there shown it rests upon a table, but is frequently used as a bench lathe, and is furnished without the table.

To prevent the bed from being sprung or twisted when the lathe is set, there is a pin in the top of one of the legs, which allows it to swivel sufficiently to compensate for any slight unevenness of the floor or bench. The other leg is firmly secured to the bed.

The top of the bed is scraped flat and affords a bearing over its entire width of the foot stock, and slide, or other rests, whose bearing surfaces are also scraped.

The foot stock is fastened to the bed by a clamp screw, and can be easily shifted, or taken from the bed ; its spindle moves in a steel bushing, and is operated by a hand lever which has its fulcrum on an adjustable stud, back of the spindle. This spindle may be clamped in any position, and has a movable stop r, Fig. 1, which serves to limit the forward motion, when brought against the adjustable stop screws.

The spindle and boxes of the head stock are steel, hardened and fitted by grinding. The hole through the spindle is one-half inch in diameter, the greater part of its length, and tapers at the front to three-fourths of an inch in diameter. The tapering portion of the hole is ground. A thread to receive a face plate or lathe chuck is cut on the front end of the spindle, and when not in use is protected by a guard nut. The end motion is taken up by a step screw and collar.

The spindle boxes are fitted into taper holes in the head stock, and held in place by nuts. On one side they are cut open and when adjusted, are drawn forward by nuts, and practically closed from all sides. The alignment of the spindle is thus preserved.

When the adjustment is made, the spindle is run loosely in the boxes until the bearings become warmed to their ordinary running temperature, then the boxes are closed sufficiently to take out all play, but not tight enough to grip the spindle. If they were closed when the bearings were cold, the spindle might stick when the bearings became warm.

As the fits are carefully made before the lathes leave the works, the boxes will not require attention until they have been long in use.

The spindle bearings are thoroughly protected from grit and dust, and are lubricated from beneath.

A Shell Chuck, which is frequently used for holding small work, is made the same taper as the hole in the spindle and at the outer end is slit open longitudinally into three parts. A spring under a sleeve, draws the chuck back into the spindle, and closes it on the work, the sleeve being free to move under the action of the spring and being connected with the chuck by a screw. The work is released by a lever, which terminates in a fork that spans the sleeve at the upper end and acts upon a friction ring.

Chucks of this character are made in a great variety of forms as required by the shape of the work. Fig. 2 shows one that will hold three sizes of disks.

An iron shelf is fastened to the bed at the back of the head stock, and is arranged to hold extra chucks, etc.

The tool holder guides, *j*, *j*, on the head and foot stock, Fig. 1, may be set in or out and enable the lathe to be used for turning small shafts, studs, screws, etc., either straight or taper.

The overhead work consists of two counter-shafts. The first has tight and loose pulleys, 6 inches in diameter, 2½ inch face, also a three step cone pulley. The counter-shaft has a corresponding cone pulley, and a driving pulley. The hangers have adjustable and self-oiling boxes. The first shaft should run about 300 revolutions per minute.

To find the diameter in inches of the pulley on the line shaft, divide 1,800 by the number of revolutions of that shaft per minute.

The lathe swings 9 inches over bed and receives 14 inches between centres. The bed is 36 inches long, the table or stand on which the bed rests is 12 x 40 inches, measured over all. Height of table from floor, 34½ inches; height of centres from floor, 44½ inches; floor shape, measured over extreme points of movement of lever on foot stock, 25 x 53 inches.

The weight of the lathe, complete, ready for shipment, is about 500 lbs.

The accessories furnished with the lathe are one spanner wrench, one $\frac{5}{16}$ inch and one ½ inch standard wrenches, one centre drift, one pair centres, one collet for head stock spindle, one shell chuck, one tool holder 12 inches long, one face plate 3½ inches diameter, two guides for tool holder, and one tool rest.

The tool rest can be clamped to the bed at any angle, and can also be adjusted vertically.

A slide as shown by Fig. 3, is furnished when ordered.

Other special tools can be supplied at an extra charge.—*American Engineer.*

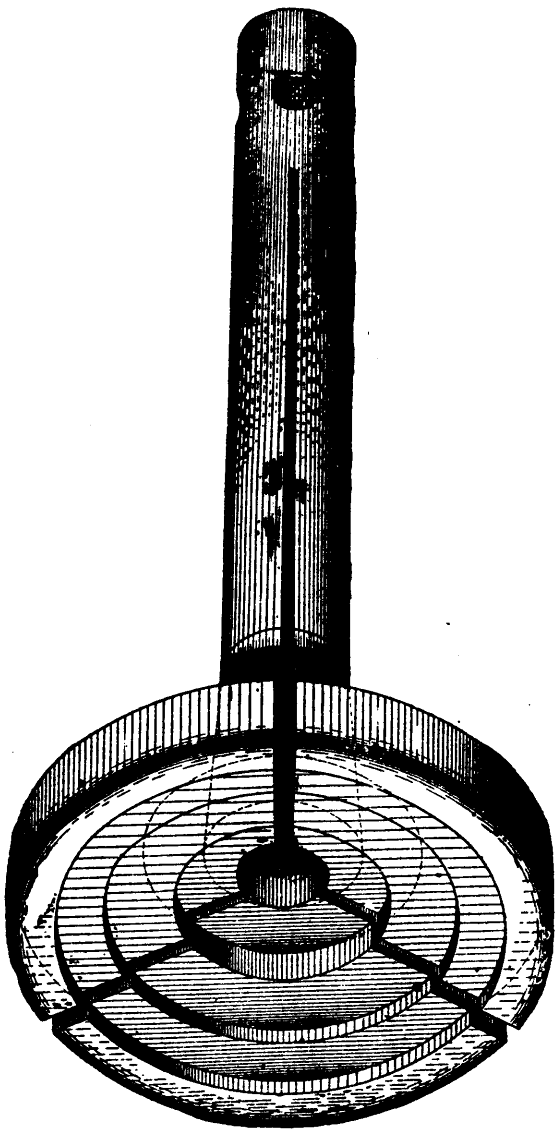


FIG. 2.

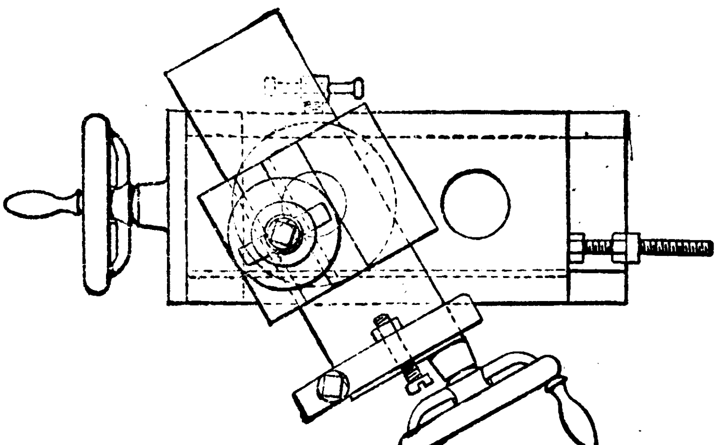


FIG. 3.

PRACTICAL ADVICE RESPECTING THE USE AND CARE OF CIRCULAR SAWS.

The following exceedingly good, practical suggestions upon the subject named in the title, are issued by one of the leading American manufacturers of saws, for the information of the users and makers of saws. We present them without further comment.

Hanging the Saw.—It is the practice of the manufacturers of saws to indicate by some device which is the "log side." Before placing the new saw upon the mandrel, be sure that the side so marked comes next to the log on the mill; if it does not, it should be sent to the factory to be hammered so as to suit the mill. Be sure that the mandrel is level, and that the saw, when placed on it and the flanges screwed up, is perfectly plumb. The holes in the saw should be an easy fit on the mandrel and lug pins. Be sure that it does not bind on the mandrel or the pins. If it does, the least warmth of the mandrel will be sure to cause it to expand, bind, and spring the saw. It should slip on readily—neither tight nor loose. Saws are often pronounced crooked when the fault is in the collars. If the position or "dish" of the saw is changed in the least by tightening the collars for work, the defect should be remedied at once. Put a straight-edge on the log side of the saw, and ascertain whether the fault is in the saw or in the collars.

Thin saws, and saws of high speed, are put up very open, so that the centre will pull through, and the saw, when hung on the mandrel, may show concave or convex on the log side when standing still; but when run up to the speed for which it is hammered, it should straighten up and be flat, or nearly so, on the log side.

When hung upon the mandrel and the collars tightened, the saw should be perfectly round, so that every tooth will do its proper work. Should the saw be too crowning, or too dishing, on the log side, the difficulty may be overcome by papering between the saw and the collars. Cut a ring of paper of the size of the collar and about three-fourths of an inch wide, wet it with oil, and lay it on the loose collar. Cut a smaller ring of paper of the same width to fit the mandrel, and place it on the mandrel against the fast collar. If one thickness of paper is not sufficient, add another ring, and so on until the saw, when clamped between the flanges, is brought to the proper position. Should the saw be too crowning on the log side, reverse the position of the paper rings, placing the large one next to the fast collar and the smaller one next to the loose collar. For making the rings, letter-paper is preferable, being solid and firm.

Lining the Saw with the Track.—Take all the end play out of the mandrel, run the carriage up past the saw, so that one end of the head-blocks will be opposite the centre of the saw, fasten a square piece of board on the head-block and let the end of the board touch the face of the saw at its centre, then run the carriage back from the front of the saw 20 feet, draw a line from the end of the board past the saw, parallel with the track. The line, where it passes the centre of the saw, should be from one-eighth to one-fourth of an inch from the face of the saw. This would show the track, at 20 feet from the centre of the saw, on a line with the saw, and that the track at the centre of the saw, if put down right, is from one-eighth to one-fourth of an inch further off from the saw than at 20 feet distance.

Some saws require more inclination toward the track than others, and the track, being adjusted properly, any small variation required may be accomplished by means of the set-screws on the box. The track should be solid, level and perfectly straight, and the saw frame anchored. Trouble is often caused by a neglect to keep the track in order, and it should be examined frequently.

Lead.—It has been shown that the lead of the saw to the log may be adjusted by its position to the track. It may be held to its work in the log by beveled filing on the back of the tooth. The teeth, if properly filed, should always be perfectly square on the front side; but if the saw tends to lead in or out of the log, it may be held to the proper position by beveling the back side of the tooth at the point. If the front of the tooth is filed perfectly square, and the teeth are beveled on the back, on the board side, this will lead the saw into the log; or, if beveled on the log side, it will lead the saw out of the log. Should the saw lead in and out (or what is called "snaky"), it needs hammering—the rim is too large for the centre, and the saw needs opening out at the centre. Such a saw may be run warm at the centre, and the difficulty may be overcome in this way, otherwise it will require hammering.

Points to be Observed.—See that the track is solid, level and straight; that the saw shaft is level and the saw hangs plumb; that it goes on the mandrel easy, is a close fit, and that the lug pins have a bearing; that the tight collar is a little concave and the loose one perfectly flat; that the saw is straight on the log side when the collars are screwed up and the saw run up to the required speed; that it is in line with the carriage and a little inclined toward the log; that the saw is perfectly round, and has throat room sufficient for the dust; that the teeth are not too high on the back side; that the teeth are filed perfectly square on the front side, and swaged sufficiently to give clearance for the body of the saw; that there is very little, if any, end play to the mandrel; and that the guides are perfectly adjusted when the saw is standing still.

Do not try to lead the saw with the guide pins, but by adjusting it properly to the track, and by proper filing. If it be desired to run the saw warm at the centre, the sawyer can create friction by reducing the set or spread of the teeth. If the saw heats too much in the centre, give it a little more set. If the saw heats on the rim, it is because the teeth have not sufficient throat room for clearance of the dust, or the backs of the teeth are too high. If the saw is too tight on the rim, increase the motion if possible, and be sure to keep it cool in the centre. The saw should be run at uniform speed both in and out of the cut. If the guide pins are run too close, the saw will heat at the rim and run "snaky." If gum is allowed to collect on the sides of the saw, the rim will heat from friction.

Trueing the Saw on the Mandrel.—If the saw is in proper tension, and does not run true, take all the end play out of the mandrel, rest a small piece of board, with one end sharpened, upon the saw frame, hold the sharpened end against the board side of the saw near the rim, mark with chalk the high places, or those that touch, and on the opposite side the hollow places, or those which do not touch the board. The operator should then turn the saw so as to bring the high points directly over the arbor, with a sharp pull bend the parts which are high on the board side towards him, and with a sharp push bend the parts which are high on the log side from him. By testing and bending in this way, the operator may make a saw run perfectly true on the mandrel, which has been sprung, or does not, from any cause, run true.

Causes for Heating on the Rim.—Guide pins set too close; teeth have not enough spread, or set; backs of the teeth too high; not throat room enough for sawdust; accumulation of gum on the teeth; saw not open enough in the body for speed.

Causes of Heating at the Centre.—Teeth have not enough spread, or set; saw lined too much out of log; mandrel runs too warm; saw too open in the body, or centre, for the speed; speed not sufficient to expand the rim; saw dished too much to or from the log.

Hammering and Tension.—All mechanical arts require a skill acquired by long practice for their perfect execution. No art is more difficult of acquirement than that of saw-making. All the conditions under which a saw has to be run, need to be exactly known and provided for in the construction and final finishing of the saw. The following explanations of the general principles involved in the hammering and tension of circular saws may may be serviceable to sawyers and others:

The practice taught by masters of the art thirty years ago, when saws of small diameter only were used, was, that a circular saw, to do proper work, should be left firm between the centre and the rim, and open as to its whole diameter, whereas experience has shown, and it is the practice of the best artists, to open out the body of the saw between the centre and the rim to the extent required for the speed the saw is to run.

Very high speed and thin saws require that the saw be opened out until it takes a strong push or pull to throw the centre either way when the saw is standing upon the floor. When the saw is in proper tension, and is shaken or pulled through, the body only of the saw should vibrate, while the rim should be nearly, or quite, steady.

Gumming a circular saw, or the alternate heating and cooling of the rim, will permanently expand a saw at the rim, and, in consequence, it will become too stiff in the centre or body of the saw, and run "snaky." A few strokes of a round-face hammer on both sides of the saw, at the proper place, will restore the tension (see Fig. 1). The portion of the saw to be hammered is indicated by the dotted lines. The same treatment is required if the saw is put up for too low speed. The rule is that it must be more open, or limber, in the body of the saw for fast speed than for slow speed; for hard than for soft wood.

When the saw is standing on the floor and shaken with the hand, and the centre and rim both vibrate, the saw requires more hammering on the line nearest the rim (Fig. 1). When opening out the body of the saw, do not hammer within 6 to 10 inches of the centre.

Observe the motion of the saw when on the mandrel and running up to speed; if it runs wavy on the rim, it needs opening out in the body of the saw on the dotted lines. If it runs steady and true out of the log, it is the fault of the hanging, lining, fitting or management if it does not run steady and true in the log. The dotted lines indicate where the face of the saw must be hammered on both sides with the round-face hammer to open the body of the saw for high speed, or when it runs wavy on the rim in full motion.

Fig. 2 illustrates the mode of examining the saw with the straight-edge in adjusting the tension—the centre of the saw resting on the anvil, the rim back of the anvil supported on a narrow bench extending from the anvil to the wall, the opposite point raised with the hand, and the straight-edge extending from the centre towards the rim of the saw. If the saw is properly opened in the body, the portions indicated by the dotted lines in Fig. 1 will drop away from the straight-edge (Fig. 2) equally all around the saw. To equalize the tension, the parts which drop least require hammering until the tension is equalized and all parts indicated by the dotted lines drop equally around the saw. The centre line should drop a trifle more than the others.

Hammering to take out lumps should always be done on the high side, or on that point which touches the straight-edge. Lumps or ridges upon or near the rim may be found with the straight-edge by examining that part of the saw with the centre of the saw resting on the anvil; but lumps or ridges in the body of the saw should be found with the saw standing upon the floor perfectly perpendicular (Figs. 3 and 4). Mark with chalk the high points which touch the straight-edge, on either side of the saw, and hammer where marked, either on a slightly oval wooden block or on an anvil (the anvil is preferred by practical saw-makers). If the anvil is used, allowance must be made for change in tension, produced by the blow of the hammer, as every blow upon the anvil stretches and opens the saw at the point hammered. If the end of a wooden block is used in taking out lumps, the tension will not be affected. The tension must be adjusted by hammering on the anvil. Lumps usually run in ridges, and should be hammered out with a cross-pene hammer, the pene following the ridge in the direction in which it runs as discovered with the straight-edge. Round lumps may be hammered down with the round-face hammer, or with the cross-pene hammer by changing the hammer over between each blow, so that the strokes cross each other. The strokes should be directly on the lump or ridge.

The adjustment of tension is preferably done with a hammer having a slightly oval and perfectly round face. Figs. 3 and 4 illustrate the examination of the saw for lumps and ridges when standing on the floor. Move the level across the saw from *a* to *b*, Fig. 3, all over the surface on both sides of the saw, rolling the saw on the floor while making the examination, and mark the points which touch the straight-edge—the lumps **X**, and the ridges ∽∽∽.

Test the saw with the straight-edge between the centre and edge from *c* to *d*, Fig. 4, all around the saw, marking the lumps and ridges as before. Hammer lightly on the points marked. After leveling, examine the tension; if it remains as before, your saw is ready to go on the mandrel for test, but if not, adjust the tension again with the round-face hammer; then level it again, and, if necessary, adjust again for tension, and so on until the saw is perfect. If the saw has an even tension, put it on the mandrel and run it up to speed. If it runs steady and true, it is ready for fitting, and when properly hung and fitted, it will stand up to its work.—*Manufacturer and Builder.*

A new compound, containing aluminium in a lower state of oxidation, corresponding to ferrous iron, has been obtained.

Another Use for Steel.—The high price of brass has led the clock manufacturers of Ansonia, Walesburg, and Thomaston, Conn., and other places to experiment with steel for certain parts of the cheaper grades of clocks, and the result has been gratifying. Soft steel has been put under the dies, and many working parts are now made entirely of steel which were formerly composed of brass.

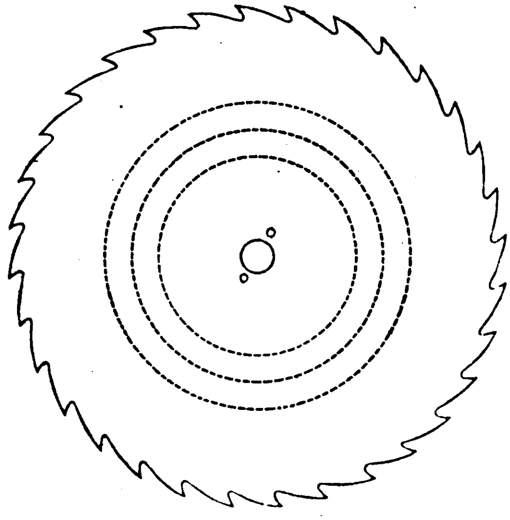


Fig. 1.

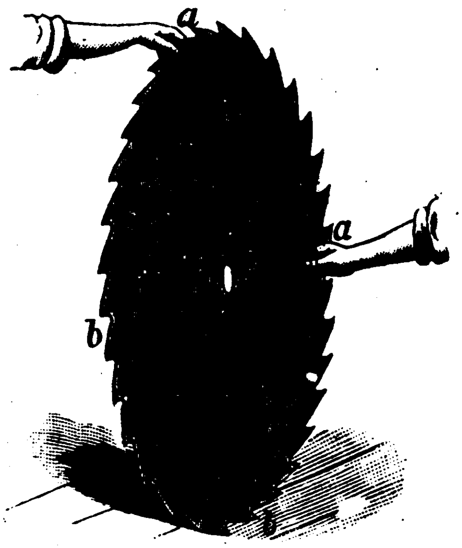


Fig. 3.

Fig. 2.

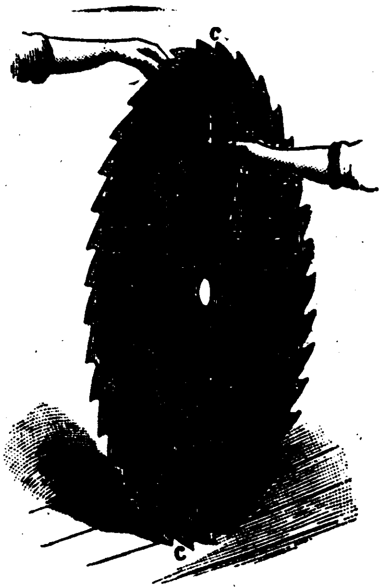


Fig. 4.

CARE OF CIRCULAR SAWS.—(PAGE 210.)

SCOTT'S ELECTRIC LOG AND REVOLUTION INDICATOR.

Electrical contrivances for use on board ship seem to be continually on the increase, but the above seems likely to take a leading position on account of its great utility and comparative simplicity. The object of the apparatus is to enable the officer in charge of the vessel on the bridge, or at any point where it may be preferred to fix the apparatus, to tell exactly the number of revolutions of the engine shaft or the distance travelled by the ship in an exact half minute.

It is frequently necessary to know the number of revolutions of the shaft, as this is sufficient indication of speed, and the usual method is to communicate with the engine room, whence an answer can only be obtained after the necessary readings have been made there.

But with this instrument not only can the officer in charge tell by the end of a half minute exactly how many revolutions have been made during the previous half minute, but by the mere turning of a switch he can tell half a minute afterwards how far the ship has travelled with that number of revolutions, or, in other words, the speed can be determined at any minute either in number of revolutions or actual knots per hour. The arrangement is the outcome of actual experience at sea, and has been tried by Captain Percy Scott, R.N., the inventor, and by others under very various conditions of weather. The electrical portion of the apparatus is exceedingly simple.

It consists of a small base, fig. 2, on which is fixed a small electrical clock having a dial divided into two concentric circles, one making revolutions per minute and the other knots per hour. The clock contains an electro-magnet which, by the passage of a current, allows the hand to go forward one division.

In series with this electric clock is another ordinary clock with balance movement, but so arranged that by depressing a spring lever the clock will go for about 35 seconds. During exactly 30 seconds an electric contact is made by the minute hand. On the main shaft of the engine is fixed a commutator, so that by its revolution contact is made with a fixed brush a certain number of times.

Two Leclanché cells are included in circuit to actuate the electric clock. When, therefore, the contact-making clock is started the current is free to pass for half a minute exactly on each contact of the segments of the commutator with the brush as the shaft revolves. Each contact causes the hand of the dial to move forward one degree. At the end of half a minute contact is broken by the contact clock, and the hand stops, having marked the number of revolutions during the previous half-minute.

A press-button on the electric clock brings the hand back to zero ready for another reading. The indications on the dial are so marked as to show directly the number of revolutions per minute.

The clock is capable of working at a considerable speed with perfect accuracy, but the instrument designed for men-of-war is arranged to give one contact for each revolution of the shaft, and the dial will read up to 140 revolutions per minute.

For the speed indicator the usual form of trailing log, fig. 1, with fan is used, but in the interior is arranged a water-tight compartment, and connections are so made that every sixth revolution of the fan gives one contact. The pitch of the fan will, of course, determine the distance travelled between each contact.

The steel wire by which the log is made fast astern is thoroughly well waterproofed and insulated, so that the exterior of the case may be used to make contact with the water, whic is used as a return wire. Of course, it would do equally well to have the lead and return comprised in one cable, and, perhaps, difficulties of insulation would be less likely to arise.

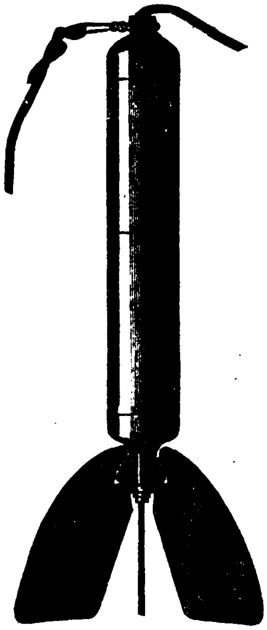


FIG. 1.

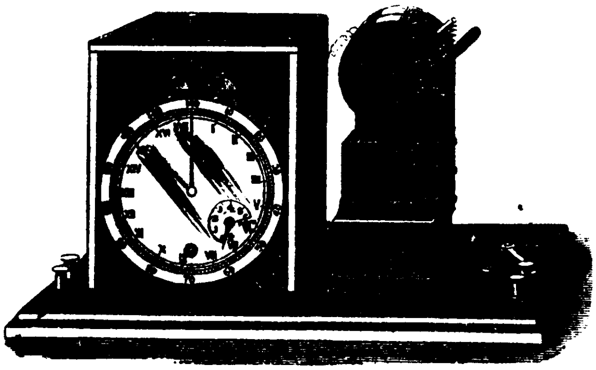


FIG. 2.

A NEW METHOD OF SETTING BOILERS FOR BURNING SAWDUST.

A law recently enacted by the Maine legislature prevents the owners of saw mills from dumping their sawdust in the rivers of that State and makes it necessary to dispose of their refuse in some other manner. Burning it was the natural thought, but the problem presented itself that there was more sawdust made than was required by the boilers, and also that the smoke from this extensive burning would be a disagreeable fact. To overcome both of these objections, says the Boston *Journal of Commerce*, the Hartford Steam Boiler Inspection and Insurance Company was appealed to and it has devised and erected at Bangor and other cities in Maine absolutely smokeless furnaces that will dispose of all sawdust as fast as made, whether required to make steam or not. The great danger from burning sawdust has been that the heat in the combustion chamber has been most intense and out of proportion to what it is over the fire. The sawdust is usually dampened before being thrown in, and even if not, the constant opening of the fire door to throw in the fuel cools that portion of the boiler over the fire while the heat in the combustion chamber continues to be very high. The efficiency of the boiler is also considerably impaired, besides the danger from the unequal heating of the shell.

Instead of placing the fire box as in the usual setting for horizontal tubular boilers, the Hartford company now builds, to burn sawdust, a furnace directly in front of the boiler, thus making the combustion chamber extend the whole length of the boiler. The sawdust is taken from the mills through pipes by means of blowers and deposited directly into the furnace, to be burned. The bridge wall is not constructed in the usual way, but is solid, the gases passing through two large circular passages, inclined upward and set to approach each other when delivering into the combustion chamber so that the gases from one passage will cross and mingle with those entering the chamber from the other passage. At the same time a sufficient quantity of air is admitted, and mingling with the now united gases, the combustion becomes perfect, and the gases pass under the boiler and back through the tubes to the up-take. In the chimney the ordinary damper is placed to control the generation of steam in the boiler, and just inside the bridge wall in the combustion chamber is placed another damper leading to an underground passage, and thence to the chimney, so that when it is desired to stop the steam production, the regular damper being closed and the relief damper opened, the products of combustion are diverted from the boiler into the underground passage and escape without passing through the boiler. In this manner all the sawdust that is made is burned without handling, and as the relief damper is at the bottom of the combustion chamber, the combustion is perfect whether the gases are used or not, consequently there is no trouble from smoke. Indeed, when the boilers were first tried in this way no smoke whatever issued from the chimney, and one of those interested in the mill came down to see why they were not running, he supposing them to be shut down because of the absence of smoke, and this same smokeless feature has existed ever since. The setting has been very carefully constructed with fire brick, and the dampers made of fire-proof material, and up to this time everything has worked in a most satisfactory manner, and the efficiency of the boilers increased so much that the relief dampers can be left open all the time and the steam production controlled by the regular damper.

This principle of an external furnace is to be applied to boilers burning soft coal and other fuels, and with the perfect combustion that will be obtained by the introduction of heated air where the two columns of gases cross each other, together with the increased efficiency of the shell, will no doubt prove a valuable method of setting a boiler. For using coal the construction would differ a little, as the air would need to be heated instead of introduced cold, as is now the case. The furnace and setting has been secured to the Hartford company exclusively, by letters patent, and a large number of boilers are being set in this manner, not only in Maine, but in other sections where sawdust can be used as fuel.

WHAT EVERY FIREMAN SHOULD KNOW.

A man may become a good fireman without having any knowledge of the laws of nature which control combustion, says the *American Engineer*, but he attains his skill by long practice and groping in the dark for the right way.

The fireman who has learned his calling in this manner is not, however, perfect master of the art of firing, for any change of furnace arrangement is likely to bewilder him, and he finds himself compelled to repeat his first experience in experimenting until he happens to hit the best method. This entails a waste of fuel and repeated delays for want of steam.

The nature of fuel, the composition of the air that fans the fire, the character of the gases formed by the burning fuel, and the proper proportions of air and fuel required to produce the greatest degree of heat, are the principal points in the laws of combustion which should be studied in this connection. Oxygen and carbon are the two most important elements of combustion in the fire box.

These elements unite freely and combine very rapidly, when heated to a high temperature, producing violent evolutions of light and heat. Oxygen is the vital part of the atmosphere, and carbon is the fundamental ingredient in all fuel used for making steam, anthracite containing the larger per cent. of pure carbon.

When the fireman has learned to combine these two elements in proportions which shall produce the greatest amount of heat, he will have solved the problem of making steam with the greatest economy of fuel and manual labor. Take a locomotive fire box for example: a common form of locomotive fire box is 72×35 inches, which gives about 17 square feet of grate area with the only draught through the ash pan. If an engine of this kind is required to draw a fairly heavy train at a running speed of forty miles per hour, it will be necessary to burn sixty pounds of coal per mile, or 2,400 pounds per hour, to maintain steam for this work. This would require the burning of about 141 pounds of coal on each square foot of grate surface every hour. In this case the supply of air must be liberal and the oxygen will be separated from the air and combine with the carbon in the proportion of twelve parts of carbon, by weight, to thirty-two parts of oxygen, by weight, which produces carbonic acid gas. If, however, the supply of air is restricted the carbon takes up a smaller proportion of oxygen, giving us carbonic oxide gas, which produces much less heat than carbonic acid gas.

One pound of carbon uniting with oxygen to form carbonic acid gas generates 14,500 units of heat; or, sufficient to raise eighty-five pounds of water from the tank temperature to the boiling point.

On the other hand, when one pound of carbon unites with oxygen to produce carbonic oxide gas, only 4,500 units of heat are generated; or, sufficient to raise twenty-six and a half pounds of water from the temperature of the tank to the boiling point. In both cases, the same quantity of fuel being used, the difference is that less oxygen occurs in the mixture.

The combining proportions of carbon and oxygen to produce carbonic acid gas being twelve to thirty-two, the combustion of each pound of carbon requires two and two-thirds pounds of oxygen. It takes 435 pounds of air to supply one pound of oxygen; therefore it will require eleven and a half pounds of air to provide the gas essential to the economical combustion of one pound of coal.

So far the problem seems simple enough, the solution being to give the fire plenty of draught; but there are several practical objections to having the air blow through the grates like a hurricane.

The fuel should be kept saturated with the air containing oxygen; a large volume of air is required, but it should not be forced through the furnace and tubes at too great a velocity, the result of which is to send the gases into the flues and through the stack without being ignited. Further, the heat in passing through too fast is not given time to impart itself to the water. From these statements it will be seen that loss of heat is threatened from two opposite directions. If there is not enough air admitted, a gas of inferior heating quality will be generated; if too much air is allowed, heat will be wasted.

It is a matter of common observation that fuel will not burn until it has attained a certain heat, and different materials require different degrees of heat to ignite them. Hence unless the fire in a fire bok be kept up to a condition to impart the necessary igniting temperature to its various parts as well as to new fuel passed into it, a large amount of waste will occur in the distillation of the combustible gases and the passing away of these gases before ignition. This takes place proportionately to the power of the draught, both in the stationary and the locomotive fire box, and requires constant watchfulness, so that sufficient intensity of heat be maintained at all points in the fire box, and that, withal, the fire be not allowed to become so thin as to permit of the passage of a greater volume of cold air than the capacity of the fire to impart the required temperature.

MILK AND SOME OF ITS PRODUCTS.

BY JOHN CROWELL, M.D.

Milk is the most popular, the most simple, as well as the most nutritious of any of the articles of food used by the great mass of human kind. It is easily attainable, and it contains the necessary elements for sustaining life. This is especially true of cow's milk, containing carbon, oxygen, nitrogen, and hydrogen, combined in fairly equal proportions in the form chiefly of water, casein, albumen, fat (or butter), lactose, and numerous salts. Having these chemical qualities, it is possible to sustain life for a long time upon an exclusively milk diet. This, however, soon becomes wearisome, and gastro-intestinal derangements are apt to result after a few weeks. In this exclusive use there often follows a disagreeable nausea, and the smell and taste of the milk causes great loathing.

This disagreement is caused from the fact that there is too much nitrogenous matter in proportion to the carbo hydrates, and in order to obtain sufficient carbo-hydrates, too much protein is taken, which greatly interferes with the process of digestion. But, although an exclusive milk diet seems essential in the first years of human life, it is not sufficient for adults. It is usually omitted from the dietary of athletes in process of training, and in many persons it causes derangement in digestion, resulting in constipation and other disagreeable conditions.

On the other hand, it is often used with the most satisfactory results in cases where no other form of diet can be tolerated, and in almost any febrile condition its use is of the first importance, especially where the nitrogenous metabolism is great. The time required for the complete digestion of milk, in its normal process, is three hours. Oftentimes the milk of the cow disagrees with the stomach, and, especially with infants, cannot be tolerated. This is owing to a variety of causes, as contamination by disease germs from the cow, poisonous foods eaten by the cow, extraneous disease germs, pollution of the milk by the dealer, souring or decomposition of the coagula formed in the stomach, when the gastric juice fails to disintegrate the casein within a reasonable time, owing to the weak state of that organ.

Whenever, therefore, a child is unable to retain the milk that is ordinarily given to it, inquiry should be made into the sources from whence the milk is obtained, and it will often be found that the trouble lies with the habits of the cows. These animals, especially in the dry weather of late summer, often seek low places in the meadows and eat poisonous herbs and grasses, and sometimes the simple change in the character of the feed will be a sufficient cause to affect the milk and render it unfit for use.

The most evident differences between human and cow's milk are that woman's milk is sweeter, it contains less butter and casein, and the casein forms in much smaller clots and is more quickly dissolved. The milk of the mother is normally alkaline, while the reaction of cow's milk varies, and it may be acid.

Goat's milk, because of its richness in fat, disagrees with many, occasioning nausea and vomiting. Its disagreeable odor is also objectionable, and infants do not thrive under its use. Mare's and ass's milk contains less nitrogenous matter and fat and more sugar than cow's milk—that of the ass being very sweet and easy of digestion, although it sometimes causes diarrhœa if taken alone. When milk is boiled, a thin scum of albumen appears upon the surface, which, when removed, is quickly replaced by another. Boiling expels about three per cent of gases, and the loss of oxygen diminishes the formation of lactic acid, and consequent souring. It somewhat affects the taste of the milk, and its use for any length of time produces constipation.

Should raw milk be given to infants?

This question has given rise to much discussion, and high authorities sharply differ upon the matter. We certainly know that, in many cases, pure milk does no harm, and that children thrive upon its constant use. Boiling the milk arrests the development of germs and fungi, with which it may have been contaminated, and thus it may prevent occurrence of certain diseases, and the process of souring and coagulation is certainly retarded by boiling.

The quality of the milk depends largely upon the breed and proper care of the cows. Much neglect in this direction is common among the producers of milk. There should be absolute cleanliness in handling everything belonging to the care of the herd, as well as in the process of milking and the use of the vessels for receiving the lacteal fluid. Sometimes the milk is put at once into glass bottles, tightly corked. The pails and cans should be carefully washed, and often insured from germ poisoning by scalding with boiling water. In large establishments, there should be an inspection of the sanitary surroundings, either by a physician or by an expert in hygienic science. The condition of the yards and stables should be thoroughly inspected, and care should be taken that the animals are not fed upon swill and garbage, and that certain kinds of food should be avoided, especially such substances as will give to the milk a disagreeable odor, like garlic, cabbage, etc. It has been suggested by good authority that there may be danger of tuberculous disease by drinking milk from cows having "pearl disease," which is believed to be analogous to tuberculosis, but there is really no authentic case where this result has been produced in man, although lower orders of animals are thus infected. This is a matter for further investigation, for certainly the milk of animals having the above named disease is below the normal standard of nutrition.

The inspection of milk by legal authority is of great importance, and in many States the requirements are specific. In New York, the specific gravity is ascertained by the lactometer; in Massachusetts, Rhode Island, and Maine, a chemical analysis is required. The normal average specific gravity allowed is 1·030+.

The total quantity of solids in milk should, according to Letheby, amount to fourteen per cent. Such inspection has been made necessary because of the adulteration of this important article of food. The most popular and simple form of adulteration is the addition of water. In order to give the milk a thickened look, after this dilution, chalk or flour is sometimes added. Bicarbonate of sodium and salicylic acid are often added, to prevent souring. If milk inspectors are honest men, and understand their business, it is a very easy matter to detect any of these base frauds upon the public.

The most popular products from milk are butter and cheese—those well known condiments and appetizers all over the world. Cheese is the separated casein of the milk, and it forms a highly nutritious article of diet, and, in some countries, where meat is scarce and dear, the people consume large quantities of cheese, to supply the nitrogenous elements of diet, using the heavy and less highly flavored of the cheeses. The wealthier classes use as a condiment the more highly flavored cheeses, such as the Rouqefort, Edam, Cheshire, etc. Taken in moderate quantities, these cheeses aid in promoting digestion, and are very palatable to the epicure.

Butter is made from cream by the mechanical rupture of the albuminous follicles which inclose the fat globules, which then adhere together into small masses. Butter contains six neutral fats, four of which being volatile, give to it taste and odor. The adulteration of butter is accomplished by dealers, by beating it up with water, and by adding other fats, especially suet and oleomargarine. Butter will not support life for any considerable length of time when taken alone. Taken in connection with other food, it is a highly digestible and nutritious, and often fattening, food.

Fermented, or "rancid," butter causes violent gastric derangement, and it is therefore important that it be thoroughly worked with a spatula, and frequently washed, and seasoned with at least two per cent of salt. In California they have an ingenious way of ridding butter of a rancid taste, by subjecting it to the action of an electric battery. The butter is melted in a tub, and the poles of an electric battery, incased in flannel, are placed in it, so that a current of electricity when passed through the butter from one pole to the other, determines a collection of the acids which caused the rancid taste, at one or the other pole. In striving to reach the pole, the acids sink into the flannel, and may thus be removed.

Condensed milk, which is so much used for the food of infants, is prepared by slowly evaporating the water of milk by moderate heat. There are two varieties, the plain, which is condensed to about one-fourth of its bulk, and superheated, and to which no sugar is added, and the stronger variety, which is more condensed, and to which cane sugar is added in excess, yielding about forty-five per cent of sugar among its solid ingredients. This excess of sugar prevents the decomposition of the milk, and it will keep fresh for many hours after the can has been opened.

Condensed milk, because of its convenient form, is used largely among the poorer classes, and infants seem to thrive well for a time. But, although they often grow fat, they develop poorly, and are less able to resist disease than children who use the pure milk.

According to Heubner, condensed milk has been used successfully in dysentery, and is a preventive of that dreaded disease of summer—scurvy.

Koumiss is another form in which milk is prepared for dietetic and medicinal uses. This is a fermented milk, prepared in a peculiar way, and used largely by the Russians. It is mildly stimulating, and sometimes intoxicating, and is used in cases of phthisis and intestinal derangements, and other wasting diseases. Its virtues have, no doubt, been exaggerated, the cures having been due more to the favorable climate along the steppes of Russia, where the patients under treatment resort, than to the curative qualities of the specific. The koumiss has been introduced into this country, where its curative qualities have been highly lauded. It is strongly diuretic, quenches thirst, increases the cardiac force, improves the muscular tone, aids general nutrition, and beautifies the complexion.

This preparation is made from cow's milk, by various firms in the United States, and preserved in glass bottles, but it does not contain the peculiar flavor and the essential qualities belonging to the native article, which is made from mare's milk, and kept in smoked-out leather bottles, and subjected to various manipulations, which cannot be imitated, even by Yankee ingenuity.—*Popular Science News.*

A "FAULT" IN AN OCEAN CABLE.

The value of laying ocean cables containing two cores was shown during the violent storm of November 25th, 1888, when a fishing schooner about 26 miles from Gloucester, Mass., dragged her anchor for some distance until at last she hooked the Rockport cable of the Commercial Cable Company's system, riding to it for about 48 hours and producing the fault shown in the illustration. It was found when picking up the cable during the repair, that she had dragged along it for some 400 yards, tearing off the outer covering of jute and compound, also one of the armour wires, rolling it up into a tangled mass and at last driving the end of the steel armour wire between the sheathing of the cable and through one of the cores, but leaving the other absolutely intact. With a single core cable of the ordinary type, communication would have been interrupted until repairs were effected ; but in this case, by means of the uninjured core, traffic was passing continuously, with the exception of a few hours during which the repair steamer had the cable cut in order to remove the fault. Considering the extreme violence of the gale and the large size of the vessel, it is surprising that the cable did not part, and the incident speaks well for the mechanical strength of the Commercial Cable Company's cables.

The repair was made by the steamship "Pouyer-Quertier," which was chartered for the purpose, as she was the only available cable steamer on this side of the Atlantic. Captain S. Fossard, who commanded the steamer, showed such great skill in manœuvring her that although two and a half miles of cable was picked up and relaid across a tideway of four knots an hour, it was found on completion of the repair, that the cable was only lengthened by a few yards.

The electrical department on board was in charge of Mr. Chas. Cuttriss, the company's electrician.

This remarkable "fault" has now been placed on exhibition at the Paris Exposition by the Commercial Cable Company, who also exhibit there the Cuttriss recorder and types of cables showing damage by ice, etc.—*Electrical World.*

MOTORS AND DYNAMOS.

BY C. O. MAILLOUX.

It is often stated that an electric motor is merely a dynamo reversed in its functions, that is to say, a dynamo which, instead of being set in motion by power to produce electrical energy, is set in motion by electricity to produce motive power. This duality of function of the same machine is indeed a peculiarity which has been again and again demonstrated. Added to this is the remarkable circumstance, shown quite conclusively by the practical experience of designers and experimenters, namely, that the same principles of construction underlie the efficiency of the machine in both cases, and that as a rule a machine which gives good efficiency as a dynamo or generator is found to be of equally good efficiency as a motor, and *vice versa*.

To the uninitiated it might appear, therefore, inasmuch as the same machine by virtue of its reversibility can be made to perform either of the two functions at will and equally well, that the distinction between dynamos and motors must be a more or less useless one. In reality, however, such is far from being the case. The fact is that the conditions and requirements which are to be met are usually so different in the motor and generator or dynamo, that the design and construction are almost of necessity made divergent from each other. One of the fundamental reasons for this divergency is that in the case of the motor the efficiency may sometimes be sacrificed to other considerations, such as lightness, compactness, shape, etc., while in the dynamo the efficiency remains the foremost consideration, with very few exceptions.

While the quantity and weight of material are not usually limited in the dynamo, they are generally restricted in the motor by the considerations of lightness, adaptability, etc. On the other hand, while the speed of dynamos is generally placed at as low a limit as possible, the speed of electric motors is allowed a much greater range. The ends attained by regulation in both cases may also influence the design. In the electric motor the prime consideration is usually the control of the speed. Thus we see plainly that the problems which are to be encountered in designing dynamos are not necessarily the same as those met in designing motors. This justifies the distinction that is usually made between the two things, and explains why the theoretical property of reversibility is not more frequently utilized to make the one perform the functions of the other. There are analogous examples of reversibility in many other forms of apparatus for utilizing energy by converting one of its forms into another, and these illustrate the same divergency as the result of practical requirements.

Thus the air compressor and the steam engine are theoretically reversible; nevertheless the practical requirements they have to meet in their respective "stations," make them practically quite different, and the one is never used for the other.

These distinctions between dynamos and motors, or between distinct types of each, are not, as a rule, so clearly perceptible to the ordinary observer as to experienced persons. In truth, they all appear to represent very much the sameness and repetition of type or form which steam engines seem to present to the uneducated eye. But just as the engineer sees an important difference between engines, even in such details as the proportions of the cylinder, the amount of clearance, the kind of valve, the mechanism controlling it, the governor, etc., so the electrician ascribes like importance to the proportion of the armature, the form and arrangement of the field magnet, the mode of winding, even the very size of wire used, or the weight of iron, for a given purpose. In both steam and electrical engineering certain principles of construction have become fixed standards, so to speak, because they have been confirmed and sanctioned by practice; and the types of engines or motors are bound to exhibit convergence towards each other, in so far as they conform to these standards. In the dynamo and motor, this process of standardization has been directed, apparently, more toward the armature than to any other part.

It is interesting to note that, in spite of inventors and patents, the great Darwinian principle of the "survival of the fittest" has remained in control, and that practice has gradually gravitated down to but two types of armatures, and these, strictly speaking, modifications of the same principle. This principle is that of closed circuit winding, first invented and applied by the Italian physicist, Antonio Pacinotti, in 1860, but re-discovered and made public ten years later by Gramme, whose name it has retained. In this case the coils or sections are wound around a ring or annular band of finely divided iron, and so connected as to constitute a continuous circuit just as if made of one length of wire. Shortly after, this was modified by Siemens, who wound the wire coils entirely around the outside of the core, which now took the form of a cylinder instead of a ring, the same principle of connection of the coils to each other and to the commutation being retained. These are the two forms of armature, the Gramme and the Siemens, which have stood the test of time, to the exclusion of all, or nearly all, others. However, even within the apparently narrow boundaries of these standards, there remains ample scope for ingenuity and inventive ability, not to say technical knowledge and skill. The mechanical structure of the armature, the kind of iron and the form it should present to utilize the field magnetism to the highest advantage, the prevention of parasite currents and consequent heat in its mass, the easiest mode of winding the commutator, are to-day topics of even greater interest and importance than ever. It may be said, moreover, that there is no more dangerous customer to judge of by its "shape and appearance" than an armature, so great yet so little apparent may be the differences.

With regard to the magnets, or that portion which serves at once as the foundation or frame work, and at the same time as the "field" in which the armature performs its functions, a much greater variety of types and forms has continued to exist; and it is here that the divergency in forms between motors and dynamos is more striking. In the electric motor the considerations we have referred to already, often impose as to weight, size or from certain limitations on restrictions, which do not, as a rule, apply to dynamos. These and other requirements, such as, for instance, speed regulation, may even react upon the design of the armature itself.

Even here, however, one can perceive a tendency towards standardization of types and forms. As between the two principles of magnet construction in dynamos and motors, the single magnetic circuit has quite evidently made more progress in practice, of late, than the double magnetic circuit field with "consequent" poles. There is, however, an interesting struggle which has just about begun, between magnetic fields with a single pair of poles and those with more pairs than one, "multipolar" machines. It is not impossible that they may divide the field and the honors between them. It is nothing less than remarkable that so much progress can have taken place inside of three or four years in the evolution of the circuit motor. It is certainly a promise of a brilliant future that in so short a time it should have reached the same plane of perfection on which the steam engine itself now stands to-day, and which admits of no better excuse than ignorance for those who fail to accomplish results. In both there is still considerable room for inventive talent, but far more for engineering skill and ability.—*Power Steam.*

PHOTOGRAPHIC NOTES.

Negatives Developed during Exposure.—M. Tondeur has again shown negatives developed during the camera exposure. He contents himself, in order to obtain this result, with immersing the plate in hydroquinone developer and draining it, then he exposes it in the camera. If the time of exposure is sufficiently long, the development is completed simultaneously; if, on the other hand, the negative has been taken simultaneously, it must be left the necessary time for development. What escapes us for the moment is the practical application to be made of this method of action. However this may be, it is well to take notice of everything fresh, the question of application being one ulterior to that of the possibilities that may be in store.—*Leon Vidal, in Photo. News.*

Apparatus for Automatic Photography.—Mr. Enjalbert, who has already furnished proofs of his ingenuity in contrivances, has worked out a very curious automatic apparatus, in which all the operations are mechanically effected by an electromotive engine. This apparatus is prepared for the Paris exhibition, where it will be seen in work ; but we have been favored with an opportunity for inspecting it and seeing it in action. It is certainly a marvel of ingenuity. The apparatus is started by placing a 10 centime piece in it, and the subject having placed himself in the prescribed place, a ferrotype plate is coated with collodion, bathed, and adjusted to the focus of the lens, when the exposure is made. It is then led into a developing solution, fixed, and washed, and in a very short space of time the portrait comes out of an opening in the machine, accompanied by a small frame in which to place it. The ingenuity required to work out all these operations automatically is truly astonishing.

Photographing on Wood.—The following method, taken from the *Revue Photographique* (translated in the *Photographisches Archiv*), can be recommended as a good one : 8 grammes of gelatine are soaked in 500 c. c. of water, dissolved on a water bath, and 8 grammes of white soap are added to it gradually, well stirring all the time. The mixture is filtered through muslin, a little zinc white added to it, and then rubbed well into the wood block and allowed to dry. The film should be as thin and even as possible. When dried, the following solution is applied to the wood by the aid of a broad brush :—

Albumen	30	grammes.
Chloride of ammonia	1·2	"
Citric acid	0·2	"
Water	24	c. c.

The albumen is beaten up to a froth, allowed to settle, and then is added the water, the chloride of ammonia, and the citric acid, exactly in order given here. When dry the film should be sensitized by pouring on the following solution, spreading it with a glass rod :—

Nitrate of silver	3·2 grammes.
Water	31 c. c.

The excess of this sensitizing solution is poured off and allowed to dry again. Printing is effected as usual in the printing frame. It is not necessary to overprint. When sufficiently printed, the wood block is held with its surface for three minutes in a diluted solution of common salt. The print will become only slightly paler in it. Wash and fix for four or five minutes in a concentrated hypo. solution, wash again for ten minutes in running water, and allow to dry.

Photography Applied to the Prediction of the Weather.—With regard to the accident which has occurred to the German navy at Apia, it might be advisable to refer once more to the theory of Dr. Zenger, of Prague, who suggested, as it will be remembered, to make use of photography for the prediction of the weather. According to the doctor, photographs of the sun taken on orthochromatic plates offer a most infallible means to indicate with almost absolute certainty the approaching atmospheric and subterranean disturbances at least twenty-four hours before their setting in. In these photographs zones are often to be seen around the sun's disk—*i.e.*, rings of circular or elliptical form, of white or grayish color —and if these zones appear of very large diameter, and of unusual heaviness, this indicates that violent storms, thunderstorms, or magnetical disturbances will soon set in at the place of observation. At every ships' station should therefore be established a small photographic laboratory, in which photographs of the sun could be taken as often as possible. A much more reliable prediction of the weather would be afforded by this means than by the aid of the barometer now generally in use for this purpose, and precautions could therefore be taken in good time.—*H. E. Gunther, in Photo. News.*

PRIZES FOR NEW INVENTIONS.

A grand exhibition of safety apparatus is to be held at Berlin next summer, and the magnitude and importance of the undertaking is beginning to be appreciated. Until recently its character and scope were misunderstood. It is not to be a mere collection of apparatus and devices for the protection of the persons of workpeople, brought together to promote the interests of a small number of manufacturers. It will be rather a great industrial exhibition, superior to any yet held in Germany. A number of industrial operations will be carried on within the spacious building now in course of erection. Among these will be spinning, paper making, corn grinding, brewing, chocolate making, shaft sinking by the Pœtsch freezing process, and other mine engineering work. This exhibition may be justly regarded as international.

Prizes have been offered for the following inventions : A prize for $2,500 for a satisfactory means for preventing the inhalation of dust in mills for grinding basic slag, a prize of $1,000 of a similar means applicable to the mercury vapor in mirror factories, and several smaller prizes for a more efficient brake for the wheels of brewers' drays.—*Scientific American.*

Petroleum Fuel.—An English firm has been using petroleum for fuel in a torpedo boat, and getting a speed of 21 knots. The oil is carried in the vessel's double bottom. The boilers, it is said, steamed excellently.

The tinfoil so commonly used to wrap Neufchatel cheese, chewing gum, various kinds of candy, and all kinds of chewing tobacco, is said to be dangerous on account of the lead in it. Its use for wrapping articles of food has been forbidden in France.

THE MEASUREMENT OF THE CANDLE POWER OF ELECTRIC STREET LIGHTS.*

In measuring the candle power of electric street lights while burning in their position on the street, one has certain difficulties to contend with which are absent in ordinary photometric measurements. The chief of these difficulties lies in the facts that the lamp to be tested is at a considerable height above the horizontal plane which the photometer can, in most cases, conveniently occupy, and that the work must be done out of doors. In compliance with the request of the editor of the *Journal*, I will briefly describe the way in which I have sought to solve the problem which presents itself.

In the first place, the photometer must be modified, so that the light coming from a point considerably above its plane shall yield a beam parallel to the bar. This may be done in two ways:

First.—By having the photometer bar horizontal, as usual, and placing at one end of it a reflector, which shall throw the beam from the electric light along the bar. This reflector must, of course, be a plane surface, and may be an ordinary mirror or a totally reflecting prism.

Second.—By inclining the bar in the vertical plane so that it shall point directly at the lamp. Of these two methods I prefer the latter, because the use of a reflector of any sort involves loss of some light, the amount of which must be carefully determined and introduced as a correction in the final calculation, while it offers no advantage over the direct method to compensate for the greater trouble and liability of error in the results.

In the second place, a direct measurement of the distance from the arc to the Bunsen screen is, in general, not easy, and the modified photometer should provide some way for its indirect, and, at the same time, accurate determination.

Thirdly, the photometric work must be done in the open air, and in a number of more or less widely separated places on the same evening. The photometer must, consequently, be readily portable, and at the same time must be provided with a special lantern to protect the standard light from draughts, and with screens to cut off all extraneous light.

To meet these points I have constructed my photometer as follows: The graduated bar is fastened by a pin passing through one end to the edge of a thick board which serves as the base of the instrument. On this pin it moves freely in a vertical plane. At a convenient distance from the pivoted end a graduated circular arc, of some 50°, is attached to it in such a position that when the bar is raised, the arc plays in a slot in the edge of the base board. By means of a thumbscrew the arc can be clamped to the base at any point, and thus serve both as a support for the bar at any angle above the base and as a means for determining this angle by the reading of the graduation. The base has fastened to it a carefully adjusted level. The lantern containing the standard light is mounted on the base just beyond the pivoted end of the bar. When a measurement is to be made, the photometer is first brought into the same vertical plane with the electric lamp, and the base accurately leveled. The bar is then raised until it points directly at the lamp, and clamped in this position. The carrier, with its Bunsen screen, is then mounted on the bar together with blackened diaphragms, which serve to cut off all light except that coming from the standard and the lamp to be tested. If the night is a dark one, and other lights not too near, no further precautions in the way of screens are necessary; otherwise, the photometer is mounted in a covered waggon.

After the readings have been made [giving the distances of the Bunsen screen from the zero mark at the pivoted end of the bar], the horizontal distance from the zero mark to a point vertically beneath the electric light is measured, and the angular elevation of the photometer bar is read on the graduated arc. From these data the direct distances from the screen to the electric light are readily calculated. The corresponding distances from the screen to the standard are obtained afterward by placing the bar at the angle noted and measuring directly from the screen [at its reading] to the point which the standard occupied in the out-door work.

* By Prof. J. T. Stoddard, Smith College, Northampton, Mass. in the *American Gas Light Journal.*

ELECTRICAL TERMS.

We, in common with most of our mechanical brethren, use electrical terms with "fear and trembling," always looking forward to the inevitable electrician's letter saying "how stupid." Our present purpose is not to define electrical terms, but to suggest a method of arriving at their meaning, by comparison with those applied to dynamic qualities. The terms now in use are the result of a learned commission appointed by the British Association in 1863, who, after eight years of effort, produced the "volt," "ohm," "ampere," "coulomb," "watt," *et al.* We mean the values these terms apply to.

The "volt" is a measure of electro-motive force, or original energy. Corresponding to the dynamic term "pressure," but not of "power." It is based upon the product of one Daniell cell of a battery.

The "ohm" is the measure of resistance, and compares to the dynamic term of "loss by transmission." It is based on the resistance offered by a copper wire .05 inch diameter, 250 feet long; or a copper wire, 32 gauge, 10 feet long.

The "ampere" is the measure for current, or what passes; the intensity it may be called, and is comparable to the dynamic term of "power transmitted," or "effect." It is the residual force or one "volt" after passing through one "ohm" of resistance.

The "coulomb" is a measure of current, qualified by time; one ampere acting for one second of time, comparing in nature with the dynamic "foot pound."

The "watt" is the unit for dynamic effect produced by electro-motive force, or current. It equals 44.22 foot pounds, or 1,746 horse-power.

These terms, and many more, are derived from the names of celebrated electricians and scientific men. The reasons for a new and distinct nomenclature is the minute quantities to be dealt with, and also the want of dynamic terms to fit the peculiar conditions.—*Industry.*

NEW METALS.

According to the *Chemiker Zeitung* (Coethen), at the last sitting of the Russian Mineralogical Society, K. D. Chrustschoff demonstrated the existence of a new metal which he has just discovered, and to which he gives the name russium. It approximates closely to thorium, and is one of the bodies whose existence was foreseen by Prof. Mendelejeff. We learn also that Dr. Kruss has named the metal which he has detected along with nickel and cobalt, gnomium.

POINTS FOR ENGINEERS.

The area of a chimney is generally made 0.16 of the area of the fire-grate.

The average quantity of incombustible matter is 16½ per centum.

All grates should have an inclination of about one inch in every one foot of length, sloping downward from the fire door toward the bridge wall.

When airis admitted behind a bridge wall to aid in consuming the gases, it must be at a point where the temperature is not less than 800° Fah.

When wood is to be the fuel employed under a boiler, the grate area should be from 25 to 40 per cent. larger than if coal is to be used.

The aggregate amount of air opening through the grate should never be less than one quarter the total grate area, as a minimum, and may be increased with advantage.

Look well after the masonry of a boiler ; stop all cracks in the walls with mortar or cement as soon as discovered. They impede the draught and cool the plates of the boiler, causing a waste of fuel.

The benefits derived from heating the feed-water are found not only in a saving of fuel but also in a diminution of the intermittent contraction and expansion, in purification of the water, and in steadiness in steaming.

The part of the bottom of an externally fired boiler acted upon most severely by the fire is just behind the bridge wall, and if a girth seam unavoidably comes at that point, the edge of the lap must not face towards the fire.

Plates of iron are tested cold by punching holes near the edges, and by bending them to angles of different degrees, corresponding to the thickness of the plates. They should bear these tests without showing any signs of cracks or laminations.

Remember that the efficiency and safety of a boiler depend as much upon the efficacy of the water circulation as they do upon the strength and disposal of the boiler, therefore crowding of tubes in a boiler should be avoided.

One very important cause of deterioration in boilers is due to the fact of their becoming too small to do the work without forcing, so that the pulsations of the engine cause a well marked succession of shocks on the boiler, which results in a weakening of the material. By placing one's hand on the head or shell of the boiler, the vibrations of the metal can be felt, similar to the rising and falling of a man's chest while breathing.

Whenever a hard patch is to be put on a boiler, it must have the same thickness as the sheet to which it is to be riveted, and should be of the same quality of material, and it should be so arranged that no pocket is formed for the collection of scale or sediment.

When a safety valve of more than five inches in diameter is required for a boiler, it is preferable, as well as much safer, to make use of two valves, each having an area of one-half the total valve. Valves having a diameter of more than five inches are apt to spring on their seats, are clumsy to handle, and more difficult to keep tight.—*Manufacturer and Builder.*

A new color to stain wood is a rich violet, and the stain is thus made: The wood is heated with a bath of 4½ ounces of olive oil, same of soda ash, and 2½ pints of boiling water. It is then dyed with magenta.

APPRENTICES AND THE PLUMBING TRADE.

On all hands we hear that the apprenticeship system is dead. Nobody wants to take apprentices or cares about teaching them. The only people who seem to care about this, so at least we are informed, are tradesmen to whom the premium is a matter of consideration, and who are not too flush of work. This fact, if fact it be, need not cause plumbers in particular to feel uneasy about the future of their trade, for the same phenomenon manifests itself in all branches of trade, and even in such professions as architecture and engineering. If, then, we must make up our minds boldly to face this wholesale decay of the system of apprenticeship, is it not time, if we have the supremacy of English industries and English commerce at heart, to see whether something cannot be done to take its place? In other words, we must begin to take a broader and more patriotic view of technical education, we must recognise that technical education is the only possible modern substitute for apprenticeship, and we must no longer regard it with jealous eyes. Tradesmen are too much inclined to think that technical education means opening wide the doors of the inner holy of holies of the arts and mysteries of trades, and that it exposes to unlimited competition those who already know and practise it, and earn their precarious living by it. This, however, is a mistaken idea. Unless technical education becomes the recognised means of training youths to trades, a time will come—nay, it is already nearly at our doors—when we shall have no tradesmen at all, but only tinkers. Nobody supposes that a youth can be instructed in all the particulars of a trade, and that by going to school he can be initiated into the mysteries of a guild, and turned out a perfect craftsman. This is impossible. But there can be no doubt that a youth who has some knowledge of the rudiments of a trade, and who knows the principles of it, will be found a more useful operative than one who has wasted his time as an apprentice with possibly a bad master. This is the important point, and it is to be hoped that we shall speedily grasp it and cheerfully act upon it.—*Plumber and Decorator.*

ENCOURAGING SCIENCE.

The Vermont Microscopical Association has just announced that a prize of $250, given by the Wells & Richardson Co., the well-known chemists, will be paid to the first discoverer of a new disease germ. The wonderful discovery by Prof. Koch of the cholera germ, as the cause of cholera, stimulated great research throughout the world, and it is believed this liberal prize, offered by a house of such standing, will greatly assist in the detection of micro-organisms that are the direct cause of disease and death. All who are interested in the subject and the conditions of this prize, should write to C. Smith Boynton, M.D., Sec'y of the Association, Burlington, Vt.

The English are contemplating an idea to lay down a postal tube between Dover and Calais. The plan is to suspend two tubes of about a yard each in diameter by means of steel cables across the channel, forty yards above the level of the sea. The steel cables will be fixed to pillars at distances of about 800 yards, and in each tube a little railway will run with cars capable of carrying 450 pounds in weight. No parcel of greater weight than this will be taken, and the cost is estimated at the modest figure of $5,000,000.

SILVERING IRON.

A new Austrian patented process for silvering articles of iron is thus described: The article is first plunged in a pickle of hot dilute hydrochloric acid, whence it is removed to a solution of mercury nitrate and connected with the zinc pole of a Bunsen element, gas carbon or platinum serving as the other pole. It is rapidly covered with a layer of quicksilver, when it is removed, washed, and transferred to a silver bath and silvered. By heating to 300° C. (572° F.) the mercury is driven off and the silver firmly fixed on the iron. To save silver the wire can be first covered with a layer of tin; 1 part of cream of tartar is dissolved in 8 parts of boiling water and one or more tin anodes are joined with the carbon pole of a Bunsen element. The zinc pole communicates with a well cleaned piece of copper, and the battery is made to act till enough tin has deposited on the copper, when this is taken out and the ironware put in its place. The wire thus covered with tin chemically pure and silvered is much cheaper than any other silvered metals.

TEN GOOD THINGS TO KNOW.

1. That salt will curdle new milk, hence in preparing milk porridge, gravies, etc., the salt should not be added until the dish is prepared.

2. That clear boiling water will remove tea stains and many fruit stains. Pour the water through the stain and thus prevent its spreading over the fabric.

3. That ripe tomatoes will remove ink and other stains from white cloth, also from the hands.

4. That a tablespoonful of turpentine boiled with white clothes will aid in the whitening process.

5. That boiled starch is much improved by the addition of a little sperm salt or gum arabic dissolved.

6. That beeswax and salt will make rusty flat irons as clean and smooth as glass. Tie a lump of wax in a rag and keep it for that purpose. When the irons are hot, rub them first with the wax rag, then scour with a paper or cloth sprinkled with salt.

7. That blue ointment and kerosene mixed in equal proportions and applied to the bedsteads is an unfailing bedbug remedy, as a coat of whitewash is for the walls of a log house.

8. That kerosene will soften boots or shoes that have been hardened by water, and render them as pliable as new.

9. That kerosene will make tin tea kettles as bright as new. Saturate a woolen rag and rub with it. It will also remove stains from varnished furniture.

10. That cool rain water and soda will remove machine grease from washable fabrics.—*The Sanitarian.*

THE VALUE OF COVERING STEAM PIPES.

In the *Michigan Engineer's Annual*, which is the report of the proceedings of the Michigan Engineering Society, of January, 1889, Prof. M. E. Cooley, M.E., of Ann Arbor, gives the following experience on the value of covering steam pipes:

"The benefits of covering steam pipes to prevent radiation, are strikingly illustrated by the following example:

The Thomson-Houston Electric Light Plant in Ann Arbor has about 60 feet of 7-inch pipe connecting the boilers with the engines, and two large steam drums above the boilers.

In March, 1887, the steam at the far end of this pipe was tested to determine the amount of entrained water, the pipes and drums at the time being uncovered. An average of nine experiments gave 31.01 per cent of moisture. In June of the same year, after the pipes were covered with magnesia sectional coverings, the quality of the steam was again tested, the average of five experiments giving 3.61 per cent moisture. The tests were made by the same men, from the same connections, and in the same manner. The pipes and steam drums in March were subjected to a draught, which, of course, aided the condensation. Enough water passed into the cylinders to retard the engines, producing a disagreeable noise. In June, the weather was warmer, and the pipes and steam drums were well protected; the quality of steam at the boilers was tested in June, and showed about three per cent of moisture.

Assuming that 100 I.H.P. were being developed at the time, and that each horse power required 30 pounds of steam per hour, we would need 3,000 pounds of steam. If the steam is assumed to have 25 per cent entrained water due to condensation in the pipes and connections, then 4,000 pounds of steam will need to be produced in the boilers, or 1,000 pounds more than necessary. To produce this steam will require about 125 pounds of good coal per hour or 1,000 pounds per day of eight hours. One-half ton per day at $3 per ton for 300 days = $450, which at six per cent pays the interest on $7,500. The actual cost of the covering put on complete, probably did not exceed $150."

PAINTING FLOORS.

A French writer observes that painting floors with any color containing white lead is injurious, as it renders the wood soft and less capable of wear. Other paints without white lead, such as ochre, raw umber, or sienna, are not injurious, and can be used with advantage. Varnish made of drying lead salts is also said to be destructive, and it is recommended that the borate of manganese should be used to dispose the varnish to dry. A recipe for a good floor varnish is given as follows: Take two pounds of pure white borate of manganese, finely powdered, and add it little by little to a saucepan containing ten pounds of linseed oil, which is to be well stirred and raised to a temperature of 360° Fahr. Heat 100 pounds of linseed oil in a boiler till ebullition takes place, then add to it the first liquid, increase the heat and allow it to boil for twenty minutes. Then remove from the fire and filter the solution through cotton cloth. The varnish is then ready for use, two coats of which may be used, with a final coat of shellac, if a fine polish is required.

The *Medical Record* says: The alkaline bichloride treatment of yellow fever, as suggested by Dr. Sternberg, was carried out during the epidemic at Jacksonville, and Dr. Sollace Mitchell reports that it was very effective. The formula finally used was:

℞. Sodii bicarbonat.................. gr. x.—lx.
Hydrarg. bichlorid................ gr. $\frac{1}{16}$.
Aquæ puræ .... ℥ iv.

M. Sig.—Give ice cold drink every hour during the day, and every two hours during the night.

The bichloride has a powerful diuretic effect on the kidneys, lessening the albuminaria. The alkaline corrected the acidity of the intestinal contents.

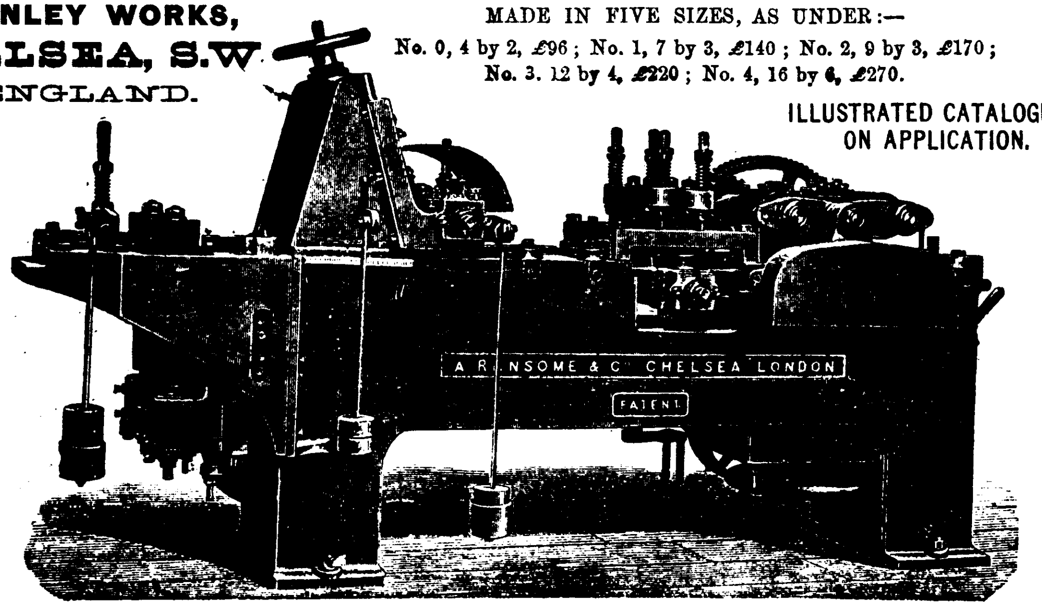
A. RANSOME & CO.'S NEW PATENT PLANING AND MOULDING MACHINE.

STANLEY WORKS,
CHELSEA, S.W.
ENGLAND.

MADE IN FIVE SIZES, AS UNDER:—
No. 0, 4 by 2, £96; No. 1, 7 by 3, £140; No. 2, 9 by 3, £170;
No. 3. 12 by 4, £220; No. 4, 16 by 6, £270.

ILLUSTRATED CATALOGUES ON APPLICATION.

CAN BE SEEN IN DAILY OPERATION AT THE WORKS.



FEED UP TO 40 FEET A MINUTE.

"It is in the contemplation of the superhuman accuracy with which these marvellous machines do their delicate work that the immense value of such appliances is borne in with irresistible force upon the mind of a spectator. Anything more remarkable than the precision and exquisite finish with which every detail of the work is carried out cannot easily be conceived."—*British Mercantile Gazette.*

"We can only say that having seen most of these machines in actual every-day use in mills and works in different parts of the country, we have never come across one which, under capable management, did not perform its allotted task with that measure of efficiency and speed essential to perfection of production and economical working."—*British Architect.*

"Some idea of the economy effected by the use of these machines in preference to the ordinary type may be arrived at when it is understood that while doing more than twice the work of one machine, they do not cost so much money as two machines, take up less than half the space, and only about half the horse-power, besides the fact that the labour for running the second machine is entirely obviated."—*Timber.*

HELLIWELL'S PATENT.

GLAZING WITHOUT PUTTY!
AND
ZINC ROOFING WITHOUT EXTERNAL FASTENINGS!

Direct Importers of Vieille Montagne and Lipine Zinc.

WATERTIGHT. FREE FROM RATTLE. SAVES ALL OUTSIDE PAINTING. NO DRIP FROM CONDENSATION. OLD ROOFS RE-GLAZED.

30,000 ft. of old Putty Roofs have been Re-Glazed on this System. Extensively used by H.M. Government, and generally throughout the country for STATIONS, MARKETS, PICTURE GALLERIES, and every description of Roof and Horticultural Buildings.

References to most Eminent Engineers and Engineers of all the leading Railways. For particulars apply to

T. W. HELLIWELL, BRIGHOUSE, YORKSHIRE; AND 5 WESTMINSTER CHAMBERS, LONDON.

To preserve Wood against Decay, Dry Rot and Fungus.
To preserve Ropes and Leather against Weather.
To prevent Dampness in Walls.

APPLY

CARBOLINEUM AVENARIUS

REGISTERED.

Used with immense success by Military Authorities, Boards of Works, Railway Companies, Tramways, Mines, Engineers, Builders, Contractors, Public Gardens, Estates, Breweries, &c.

For Prices and Particulars apply to

PETERS, BARTSCH & CO., DERBY, ENGLAND.

Carbolineum Avenarius can only be had from Peters, Bartsch & Co., or their Authorized Agents.