SCIENTIFIC AMERICAN

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IMPROVED MACHINE FOR POLISHING MOLDINGS AND SURFACES.

In the ordinary process of making wood moldings, when the strips leave the cutting tools, they have a rough face, which must be finished before they can be oiled or painted. This operation is now done by hand by the use of sand paper, emery, etc. Like all hand labor, in which the workman becomes a mere animated machine, this proceeding is both tedious and costly; besides, it is at best imperfect, since the peculiar forms of certain patterns frequently prevent neat and careful work. In brief, the operation is one which so specially invites the labor of the machine that it will probably be a matter of some surprise for our readers to learn that, despite the immense variety of woodworking apparatus in the market, apparatus seemingly capable of converting wood into every possible shape and form, there has hitherto been no device for accomplishing so necessary and yet, as compared with a score of other every-day processes, simple a requirement. We need hardly preface the following description by saying that the machine referred to, and herewith illustrated, bids fair to be a very useful invention, the more so since its capabilities are not confined to moldings alone, but include the scraping and finishing of veneered surfaces, and the polishing of coach bodies, of metal work, of glass, and of marble.

In Fig. 1 we give a perspective view of the invention, from which its mechanical construction will easily be comprehended. Either of the pulleys, A, may receive the belt and serve as the driver, each having a pitman which connects with, and so imparts a reciprocatory motion to, the carriage, B, in which the polishing arrangements, described further on, are located. From a small pulley on the same shaft as pulleys, A, descends a belt to another parallel shaft, on the ends of which are two more small pulleys, one of which appears at C. The pulleys last mentioned are connected to the wheels, D, at one side of the machine by a crossed, on the other by a straight, belt. Against each of said belts rests a tightener, E, having a handle conveniently located, as shown, and so arranged as to be firmly secured, so as to hold the idler away from or against the belts, as desired. The object of this arrangement is to enable either belt to be thrown into action at will, so that the shaft of pulleys, D, may be caused to travel in either direction. Said shaft imparts motion to the lower feed rolls, the upper ones of each pair of which are respectively represented at F and G. These rolls are covered with rubber so as to grasp the molding placed between them, and carry it under the reciprocating polisher, H, and so out of the apparatus. It will be seen, however, that, since the machine, as already described, may be caused to run in either direction, the strips may be introduced at either end, or may run through one way and (the motion being reversed) sent back again, and thus kept traversing to and fro under the polisher as long as may be desired. The rolls may be easily adjusted, as to their separation, by the screws shown above them, and are rigidly connected to the table, which last, however, is entirely detached from the frame on which the polisher works. It has a vertical motion, imparted by the handle at L, and thus the work held between the rollers may be raised or lowered bodily, and so adjusted with any degree of pressure against the rubbing materials.

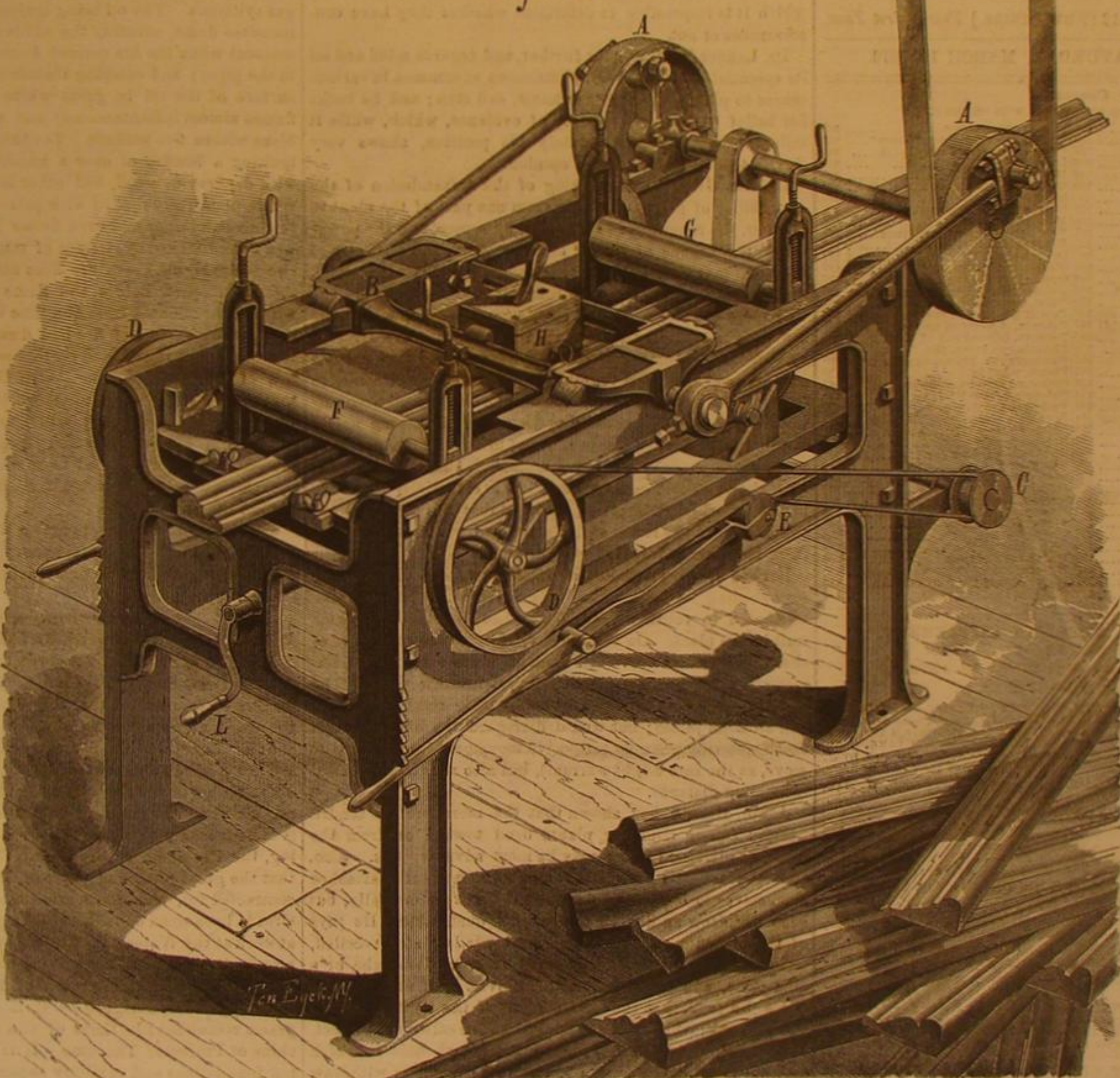
So far we have described merely a neat mechanical contrivance of well known devices—the practical appliance whereby the gist of the invention is adapted for use. The essential feature of the whole lies in the rubber, H, an enlarged sectional view of which is presented in Fig. 2; and in the making of this, resort is had to a simple and ingenious process, namely, artificial stone manufacture. It being required to dress a certain pattern of molding, a small piece of the material is very carefully finished by hand to the exact form. This serves as a mold for a concrete of prepared materials, which set and crystallize very rapidly, producing, in hard fine-grained stone, every curve and angle of the pattern, reversed, of course, but duplicated with sharpness and accuracy.

It remains now to secure the slab shown at J, Fig. 2, and separately in Fig. 3, to a wooden back, interposing between it and the latter a sheet of india rubber, K, to add to the elasticity, and then to fasten the whole in the box, H, by means of the set screw shown on the latter in Fig. 1. In the box, however, as will be further seen from Fig. 2, is a simple arrangement for supplying emery dust, glass, or pumice, between the stone and work, or even for admitting water to the same locality when desired. The emery is introduced through the aperture shown in the cover, and falls to the bottom of the box, whence, if not prevented by the closing of the slide, L (operated as shown by the handle above), it gradually escapes through small holes to the face of the stone. The polisher then, as already described, travels to and fro, constantly rubbing the molding; while at the same time, having a free lateral play, it readily adapts itself to any twist in the same.

We have witnessed this machine in operation and can state that it turns out excellent work, the moldings certainly possessing much cleaner and sharper angles and corners than could be produced by the hand process, unless the polishing stone were removed from the apparatus and operated by hand, as it well might be, although of course at the expense of time. Hard wood or soft wood surfaces are polished with equal ease, a matter of some difficulty in the last instance, as soft faces are usually gummy and difficult to dress, and the use of loose powder effectually relieves this trouble.

Patented June 29, 1875. For further particulars regarding price of machines, and for rights, address the patentee, Hon. John A. Dayton, 20 Hanson Place, Brooklyn, N. Y.

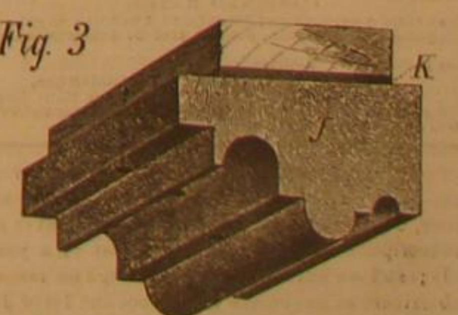
Fig. 1



DAYTON'S MACHINE FOR POLISHING MOLDINGS AND SURFACES.

Fig. 2

Fig. 3



A NEW cheap coating for wood, which is very adherent even when exposed to the weather, consists in simply brushing the surface with a solution of persulphate of iron of 2° to 2¼° Baumé. The blue gray tint which this acquires on drying changes to an agreeable brown when linseed oil varnish is applied.

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IF our own experience is any evidence of improvement in the times—and we believe it is—there is a vast change for the better, over last year. Our patrons have never renewed their subscriptions at the commencement of a year more promptly; and we have never had so large an accession of new subscribers as have come to us since the 1st of January. Notwithstanding the provision we had made for a large increase in our circulation, by printing several thousands extra of the first ten numbers of the year, we find some of the editions are already exhausted, which will prevent our sending complete sets of back numbers from the commencement of the volume. The first six numbers can be supplied, and some of the subsequent issues, but, we regret, not all. If persons, when remitting their subscriptions, express a wish for such back numbers as we can supply, those not out of print will be sent: otherwise, the subscriptions will commence from date of their receipt.

MIND IN PLANTS.

"'Tis my faith that every flower
Enjoys the air it breathes."

So wrote Wordsworth long ago, and very often the poet's prophetic spirit anticipates results which slowly demonstrating Science arrives at only after many years of patient observation and logical deduction. Is it possible that Wordsworth's faith in the capacity of vegetation to enjoy was really such an anticipation, that the consciousness which enjoyment presupposes is in any degree a function of plants?

There is certainly a growing disposition on the part of scientific men to accept such a position, and the evidence in support of it has already become too abundant to be overlooked or despised.

As Dr. Forbes Winslow has remarked, vegetable life is so universally assumed to be, as a matter of course, unconscious that it appears to many a mere folly to express a doubt of the correctness of the assumption. But, he continues, let a close observer and admirer of flowers watch carefully their proceedings on the assumption that they not only feel but enjoy life, and he will be struck with the immense array of facts which may be adduced in support of it. Endow them hypothetically with consciousness, and they appear in a new and altogether different aspect. His conclusion is that they are undoubtedly in the same category in this respect with the lower forms of animal life, respecting which it is impossible to determine whether they have consciousness or not.

Dr. Lander Lindsay goes further, and regards mind and all its essential or concomitant phenomena as common in various senses to plants, the lower animals, and man; and he backs his belief with a cogent array of evidence, which, while it fails to demonstrate absolutely his position, shows very clearly the drift of scientific opinion.

Dr. Asa Gray, after speaking of the transmission of the excitability of sensitive plants from one part of the plant to another, the renewal of excitability by repose, and the power which the organs of plants have to surmount obstacles to positions favorable to the proper exercise of their functions, goes on to say that, when we consider in this connection the still more striking cases of spontaneous motion which the lower algæ exhibit, and that all these motions are arrested by narcotic or other poisons—the narcotic and acid poisons producing effects upon vegetables respectively analogous to their effects upon the animal economy—we cannot avoid attributing to plants a vitality and a power of making movements toward a determinate end, not differing in nature, perhaps, from those of the lower animals. Probably, he adds with characteristic cautiousness, life is essentially the same in the two kingdoms; and to vegetable life faculties are superadded in the lower animals, some of which are here and there indistinctly foreshadowed in plants.

Darwin has observed in the *drosera rotundifolia* a faculty for selecting its food, which in animals would certainly be attributed to volition. Mrs. Treat has described the same trait in the plant. On being deceived by means of a piece of chalk, the drosera curved its stalk glands towards it, but, immediately discovering its mistake, withdrew them. The plant would bend toward a fly held within reach, enfold it, and suck its juices; but would disregard the bait if out of reach, showing not only purposive movement (or a refusal to move, as the case might warrant), but also a certain power of estimating distance.

Again, Darwin has shown that the more perfect tendril bearers among climbing plants bend toward or from the light, or disregard it, as may be most advantageous. Also, that the tendrils of various climbers frequently attached themselves to objects presented to them experimentally, but soon withdrew on finding the support unsuitable. He says of the *bignonia capreolata* that its tendrils "soon recoiled, with what I can only call *disgust*," from a glass tube or a zinc plate, and straightened themselves. Of another bignonia, he says that the terminal part of the tendril exhibits an odd habit, which in an animal would be called an instinct, for it continually searches for any little dark hole in which to insert itself. The same tendril would frequently withdraw from one hole and insert its point in another. In like manner, spirally twining plants seem to search for proper supports, rejecting those not suitable.

Speaking of phenomena of this sort, Dr. Lindsay makes this strong remark: "In carnivorous and climbing plants, there is a choice or alternative between action or inaction, acceptance or refusal; and the choice made is not always judicious. There may be an error, and the error may be corrected; but in order to such correction, there must surely be some kind of consciousness or perception that a mistake has been committed: an exercise of will in making further efforts at success, and a knowledge of means to an end, with their proper adaptation or application."

According to Professor Laycock, organic memory is common to both animals and plants, and certain *lianas* seem to exhibit it in a marked degree in their antipathy to certain trees. The botanist Brown has remarked that the trees which the lianas refuse to coil round are physically incapable of supporting the climbers.

And not only do many plants act, as one might say, reasonably, but some exhibit the opposite quality. In his "Vegetable Physiology," Professor Lawson speaks of the eccentric movements of the side leaflets of *hedysarum gyrans*, which make it appear as though the whole plant were actuated by a feeling of caprice.

In many cases observers are, no doubt, self-deceived, and mistake a mechanical and wholly unconscious mimicry of intelligent action for an actual exhibition of intelligence: still such men as Dr. Gray and Mr. Darwin are not apt to be deluded by mimicry or figures of speech; and however much it may run counter to popular notions of what is proper to plant life, the hypothesis that intelligence does not end with animal life seems by no means inconsistent with a multitude of trustworthy observations.

FIRE EXTINGUISHER TRIALS.

A large vacant lot in the upper part of this city was recently the scene of some remarkable experiments upon a new fire-extinguishing apparatus. The trials were devised by Mr. Joshua Rose, and were prepared on a scale of magnitude sufficiently near to a good-sized conflagration to put the invention to a test of exceptional severity. The apparatus, like most fire extinguishers, involves the use of carbonic acid gas, which, after being produced in a generator, is either mingled with water in large receptacles, or else forced under heavy pressure into a battery of six strong cylinders. The general idea is to avoid making the gas on the spot where it is used, and either to convey it thither compressed in the cylinders, whence it is allowed to escape and mingle with the hydrant stream, or else conduct it by pipes to the surface of oil tanks, for extinguishing petroleum fires.

On the experimenting ground, a large brick tank, 20 feet wide by 30 feet long, was constructed, and into this about a foot of water was placed, covered with the contents of three or four barrels of crude petroleum. Along two sides of the tank extended perforated pipes, which connected with the gas cylinders. The oil being ignited, the vapor burned with immense flame, covering the whole 600 feet of area. At the moment when the fire seemed fiercest, the gas was admitted to the pipes; and escaping therefrom it rushed out over the surface of the oil in great white clouds, cutting off the flames almost instantaneously and wholly extinguishing the blaze within five seconds. The succeeding trial consisted in igniting a bonfire of over a hundred rosin barrels packed with dry leaves, wood, and other inflammable material, the whole plentifully soaked with petroleum. In a few minutes this made a larger and even fiercer fire than did the oil. It was then attacked by streams of mingled gas and water from two seven-eighths inch fire hose nozzles. Probably not ten seconds elapsed before the flame was under control; and within four minutes from the time the streams were first applied, every vestige of fire had disappeared. A heap of dry wood was next raised, and on this were placed two full barrels of crude petroleum. With the blaze thus produced the gas and water made short work, putting it out in about two minutes. Lastly, it was shown, by practically comparing the stream delivered from the hydrant with the same stream after gas had been admitted to mingle with it, that the latter was projected to a distance of some fifty feet beyond the former.

The inventor of the apparatus is Dr. J. H. Connelly, of Pittsburgh, Pa. We expect shortly to publish a fine engraving of it, together with a complete description of its capabilities.

THE UNITED STATES METAL-TESTING BOARD.

A session of this Board was recently held at the rooms of the American Society of Civil Engineers in this city. Our readers will remember that the board was appointed by the President, under authority of an act of Congress, last spring, and the circulars of the Secretary and of the Committees of the Board have given the readers of the SCIENTIFIC AMERICAN a knowledge of the scope and the plan of its work, and have awakened an unusual degree of interest in a scheme which is of national importance. We are informed that at this meeting, the President of the Board, Colonel Laidley, reported that the great testing machine of 400 tuns capacity had been contracted for, and that a considerable amount of work had already been upon done it. It is expected to be completed and at work at the Watertown Arsenal before the close of the current fiscal year. It is the invention of A. H. Emery, but has an independent straining mechanism, fitted with a strain diagram apparatus, designed by C. E. Emery to produce diagrams somewhat like those of the autographic testing machine of Professor Thurston. It is expected to cost, including foundations and auxiliary apparatus, about $50,000. The machine is said, by those members of the Board with whom we have conversed, to be a beautifully ingenious apparatus, and it is expected to do wonderfully accurate work. The beam of a ten tun scale, made on a similar plan, has been known to turn with the weight of a nickel cent. No doubt seems to be felt of its strength and durability.

The committees reported progress in their work. The committee on wrought iron is working up an extensive series of experiments made at the Washington navy yard, under the direction of the navy department. The effect of proportion upon strength of members of wrought iron structures, the value of various sizes and qualities of metal for chains, the modification of quality by change of size, and the effects of time and the phenomenon of the elevation of the elastic limit by strain, as well as the simple determination of the strength and other qualities of iron of the various well known kinds in our markets, are all under investigation by this committee, of which Commander Beardslee is chairman.

General Gilmore, chairman of the committees on iron for armor plate and on cast iron, is engaged with his committee in collating information and planning experimental work in directions equally important. The records and experiments of the war department are extremely rich in this kind of material; and the reports of these committees will embody a vast amount of valuable practical knowledge. The distinguished officer who is directing the work will probably be able to put it in most useful and accessible form.

Chief Engineer Smith, of the U. S. Navy, gave an account of the work undertaken by the committee on steel for tools at the Washington navy yard. All of the best steels in the market are obtained and made into tools, and their value is determined by actual use in the machine shops of the navy yard. A dynamometer is used to determine the power expended, while the losses in weight of the tool and of the metal cut by it are carefully determined and compared. Finally, a careful chemical analysis of the tools is made; and the comparison of their constitution with the data, derived, as described, will indicate what a good steel really is. It was stated that no comparisons by name—which might well be deemed "odious" by the less fortunate makers—will be made in the report. It is intended that the work of the board shall be entirely impersonal, and that its results shall do as much good and as little harm as possible.

General Sooy Smith, chairman of committees on girders and columns, gave the board an outline of the results obtained during a very valuable series of experiments, recently carried on at the shops of the Cincinnati Southern Railroad, to determine the strength of compression members of structures, and stated that other equally important investigations were to be made for the board at an early date. Incidentally, the effect of cold in altering the resisting power of the metal, a subject which has been discussed at length in the columns of the SCIENTIFIC AMERICAN, had received some further elucidation, both at Cincinnati and at Washington.

Mr. A. L. Holley, the well known pioneer in the introduction of the Bessemer process in the United States, and who is chairman of the committees on chemical research and on modern steel processes, stated that a chemist—Mr. Andrew Blair, of St. Louis, Mo.—had been appointed under authority of the board, that a laboratory had been fitted up at the Watertown Arsenal, and that the chemist had been for some time engaged in the analysis of irons and steels sent in for test, and on metallic alloys tested by the committee on alloys. Promise was given of securing much information that may prove of exceptional interest and value. Coincident chemical analysis and mechanical testing have never before been systematically attempted on such a scale, and this one peculiarity in the method of investigation followed by the Board is likely to make its work one of vastly greater value and of more permanent usefulness than any similar investigation ever attempted. In this matter the work of this Board is unique. Mr. Holley's committees are gradually collecting a very complete assortment of metals, and the work of testing can be commenced immediately upon the completion of the machine and the appropriation of the required funds. A Pittsburgh firm is preparing a set of several series of steels, each of which series is peculiar in its gradation of some one element. It is expected that by testing these series, the precise effect of each of the more important elements present in steel may be traced with accuracy. Nothing like this has been attempted before, except in the determination of the effect of varying proportions of carbon in researches by Professors Leeds and Thurston, recently, at the Stevens Institute of Technology.

Professor Thurston, chairman of the committees on abrasion and wear, on metallic alloys, and on the effects of temperature, reported a large amount of work accomplished. A specially devised apparatus for determining the effect of variations of temperature on the quality of material had been designed and partly constructed, and this research had been planned. Another season will probably see the work done. The work of the committee on abrasion and wear will be commenced immediately upon the completion of preparations now being made under the direction of the chairman of the committee. Meantime, a series of experiments on the value of the various standard kinds of unguents in the prevention of abrasion and wear of the metals is in progress, under the eye of the chairman, in the laboratory for technical research of the Stevens Institute of Technology.

The work of the committee on alloys is reported to be well advanced. A large amount of valuable information and a very extensive collection of important data are recorded; and the time of the Board was largely occupied in the examination of the results of a long series of experiments on bronzes, for the publication of which all engineers and mechanics will look with interest. No investigation so complete, so extended, or so accurate has ever been undertaken previously. Every grade of bronze, from the copper to the tin end of the series, has been examined. The transverse, tensile, compressive, and torsional resistance, the elasticity and the modulus of elasticity, the changes of chemical composition due to fusion and to liquation or separation, the density, co-efficient of expansion, state of crystallization, character of fracture, mechanical condition of aggregation, and, in fact, all that the engineer wishes to know, are to be determined; and Professor Thurston is directed by this committee to make the research so thorough that, if possible, the necessity of its repetition at any time in the future may be avoided.

There are many other matters in hand, which the Board are expected to make useful to the country and to the engineering profession; but we have no space to consider them here. Some of this work will be described at greater length hereafter, and we shall endeavor to keep our readers informed of the progress made by the Board, whenever the publication of their work may enable us to do so. When the extent and importance of this national work is fully comprehended, we shall expect to see that the assistance, which the circulars issued by the several committees ask of other members of the engineering profession, is rendered gladly and effectively. The members of the Board state that, with the exception of that given by a few of the most distinguished and public-spirited engineers and manufacturers, but little valuable aid has been given them in their investigations, although they have received encouragement from all sides by the generally awakened interest in the subject. Some very interesting and valuable material has been sent from Europe, where great interest is, evidently, felt in this subject. MM. Tresca, Launhardt, Millar, Thompson, and other equally distinguished men have shown such practical appreciation of the work.

[For the Scientific American.]

ARTIFICIAL ICE MANUFACTURE.

BY P. H. VANDER WEYDE.

The ice crop has failed this winter, and ice will be consequently dear during the next season; it will therefore be interesting to investigate how far artificial ice, of which so much has been said in late years, can supply this want, and form, besides, a lucrative business for those who feel disposed to commence it. In order to understand the following descriptions, it must be remembered that the thermometer alone cannot be relied on for measuring definite quantities of heat, as the amount of heat which will raise the thermometer 10° will depend largely on the quality and quantity of the matter to be tested, in which the thermometer is suspended. When, for instance, one thermometer is suspended in a pint of water, and another in a pint of mercury, it will be found that it will take nearly 2¼ times as much heat to raise the temperature of the water than to do the same with the mercury; but mercury is 13½ times heavier than water —1 pint of water weighing about 1 lb., and 1 pint of mercury weighing 13½ lbs—so that it takes 2¼ times more heat to heat 1 lb. water than 13½ lbs. mercury, and $2\frac{1}{4}\times13\frac{1}{2}=30$ times more to heat 1 lb. water than to do the same with 1 lb. mercury. This number 30, divided into 1, adopted to denote the specific heat of water, gives 0·033, and this is called the specific heat of mercury, and so the specific heat of iron is found to be 0·11, of copper 0·095, of lead, 0 03, etc. So much for the influence of the quality of the matter, but the quantity still more affects the amount of heat required: for to heat a gallon of water will evidently take 8 times as much heat as is required to heat a pint. And as these differences in the required amounts of heat cannot be indicated by degrees on the thermometer alone, it is necessary to establish a standard or unit of heat which actually indicates its amount; and it has therefore been agreed upon to accept an amount of heat sufficient to raise the temperature of 1 lb. of water 1° Fah. as the unit of heat, by which all other amounts can be measured and compared.

It is obvious, from the specific heat of iron, copper, mercury, and lead, given above, that 1 unit of heat will cause a rise in temperature of 1° Fah. in 1 lb. water, in 9 lbs. iron, in 10½ lbs. copper, in 30 lbs. mercury, and in 33 lbs. lead: which numbers correspond to 1 divided by the fractions respectively denoting the specific heat of the different metals.

Of more importance than the specific heat is the latent heat, that is, the heat which bodies absorb when changing from the solid to the liquid state, and which they again give out when returning from the liquid to the solid condition. So ice when melting, on changing into water, will absorb heat, and cause it apparently to disappear; and this to such an extent that 1 lb. of ice of 32° Fah. will require 1 lb. of water of 174° to melt it, when the result will be 2 lbs. of water of 32°. It is then seen that the ice has absorbed 142 units of heat to change it into water of 32°. These 142 units are called the latent heat of water; and in the process of congelation they have to be extracted. On this principle is ordinarily based the method of making artificial ice. The practice of this manufacture, however, involves another principle, that of the latent heat of vapors. When water is changed into steam, it again absorbs heat; and when 1 lb. boiling water is evaporated and converted into steam of the same temperature, 212° Fah., it absorbs as much heat as would be sufficient to raise 5⅓ lbs. water from 32° to 212°, that is, $5\frac{1}{3}\times(212-32)=5\frac{1}{3}\times180=960$ units of heat. This is the latent heat of steam, and is given out again when steam condenses into water: hence the effectiveness of steam for heating buildings by the condensation of steam, in pipes and other contrivances.

MAKING ICE BY EVAPORATION IN VACUO.

On this principle is founded one method of making ice, namely, the forced rapid evaporation of water by means of a vacuum. In an old experiment in the physical lecture room, a small quantity of water is placed on a watch glass, under the bell jar of a good air pump; a vacuum is rapidly made, and the water will at first commence to boil, and the vapor evolved will absorb so much heat from the water that at last it will freeze, and form a small piece of ice. As the latent heat of the steam or watery vapor is 960 units, 6¾ times as much as the 142 units of latent heat absorbed from the water to freeze it, it will require the evaporation of about ⅙ of the water to freeze the remaining ⅚. In order to aid the air pump in the rapid removal of the watery vapor arising, it is well to place also under the bell jar a cup of strong sulphuric acid, which has great affinity for watery vapor and absorbs it, causing the experiment to succeed in less time, and also with a less perfect air pump. This method of ice-making is now in operation, on a small but practical scale, in the leading restaurants in the principal cities of the European continent. A strong glass bottle is about ¾ filled with water, and its neck is connected with the pipe of a good air pump, worked either by hand or by power. Between the bottle and the pump is a reservoir containing sulphuric acid, over which passes the air and watery vapor which the pump draws from the contents of the bottle; the sulphuric acid absorbs the vapor, and experience shows that, conformably to the theory above stated, when about ⅙ of the water has been removed by evaporation, the rest will rapidly freeze to a solid mass. Then the bottle is detached and placed on the table of the guest; where, if necessary, some water may be added, which it will then soon cool to about 32°. If no sulphuric acid is used, it is hard work to freeze a pint of water with such a machine, requiring, as it does, the continuous labor of a man for about half an hour, and also the condition that extraneous heat is carefully excluded by covering the bottle with non-conducting material, the absence of which would lead to a loss of the cold produced. The amount of labor required is perfectly in accordance with the theory of the mechanical equivalent of heat, which is that 1 unit corresponds with 776 foot pounds; and as from every pound of ice-cold water 142 units have to be extracted to transform it into ice, the abstraction will be equal to 142×776, or 110,192 foot pounds. As the power of a man is about 4,000 foot pounds per minute, it will take $\frac{110192}{4000}$, or 27 minutes' work, equal to 4,000 foot pounds each, to effect this abstraction. If the work is done by machinery, we find, in the same way, that a horse power, equivalent to 33,000 foot pounds per minute, will abstract 110,192 units in $\frac{110192}{33000}$ or nearly 3 minutes, that is, it will freeze 1 lb. of water every 3 minutes, or 20 lbs. per hour; and as in a good steam engine a horse power can be obtained at the expense of 2 lbs. coal per hour, we see that 2 lbs. coal will be sufficient to produce 20 lbs. of ice, or 1 tun of coal 10 tuns of ice. If, however, we use as an aid the intense affinity of sulphuric acid for watery vapor, we may surpass this estimate; but it must be considered that ice is usually wanted in warm climates or during hot seasons, and the loss of cold from, or rather the incursion of external heat to, the different parts of the apparatus is so considerable that it is necessary to use all possible precautions, and to employ all known means, if we expect to attain the theoretical maximum of 1 tun of coal producing 10 tuns of ice.

We have seen that it lately has been claimed that, with one of the modern ice machines, 1 tun of coal would produce 20 tuns of ice; but this is an estimate in which the loss of power involved in changing heat into motion by the intervention of the steam engine had been overlooked or intentionally neglected; and we are satisfied, as well by practical experience as by the theory above stated, that the ratio of obtaining 10 tuns of ice by the combustion of 1 tun of coal will be the maximum to be hoped for as long as we have to use the present form of steam engines; and more can only be hoped for when we shall have found how to obtain a horse power out of 1 lb. of coal or less per hour.

SCIENTIFIC AND PRACTICAL INFORMATION.

POISONING FROM PARIS GREEN.

A correspondent of the *Medical and Surgical Reporter*, Dr F. Horner, of Virginia, wrote recently that a case of poisoning from the effects of Paris green, arsenite of copper, occurred during the late summer, near Winchester, Virginia. Four members of the Van Meter family died, with symptoms of arsenical poisoning, after eating apples gathered from the ground of an orchard which was planted with potatoes, on which had been sprinkled Paris green in powder, and in the midst of which had fallen the apples subsequently gathered for domestic purposes. No example has been reported of this substance causing death by transmission through absorption by the plant.

RUSTING OF IRON.

It has usually been supposed that the rusting of iron depends principally upon moisture and oxygen. It would appear, however, from the late Dr. Calvert's experiments, that carbonic acid is the principal agent, and without this the other agencies have very little effect. Iron does not rust at all in dry oxygen, and but little in moist oxygen, while it rusts very rapidly in a mixture of moist carbonic acid and oxygen. If a piece of bright iron be placed in water saturated with oxygen, it rusts very little; but if carbonic acid be present, oxidation goes on so fast that a dark precipitate is produced in a very short time. It is said that bright iron placed in a solution of caustic alkali does not rust at all. The inference to be derived is that, by the exclusion of moist carbonic acid from contact with iron, rust can be very readily prevented

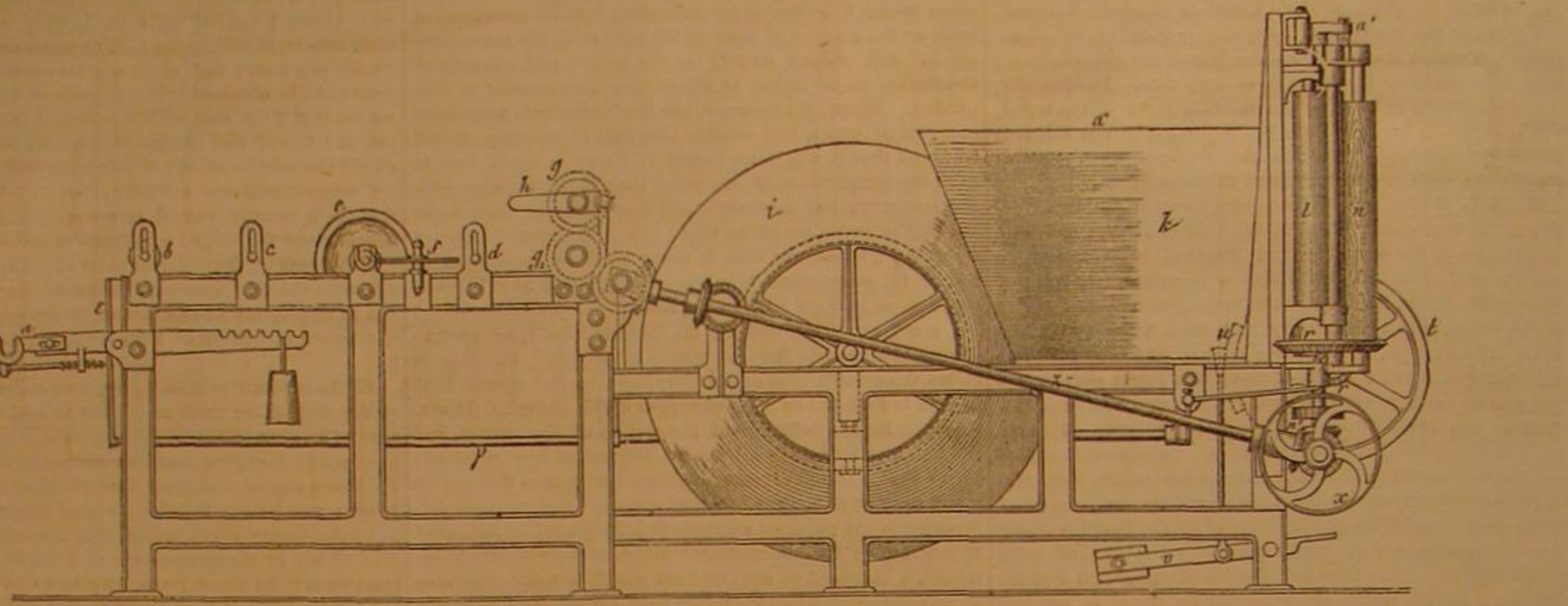
REFINING GLASS.

M. E. Frémy states that the difficult portion of the manufacture of glass is the process of refining, the object of which is to render the mass homogeneous, and expel as far as possible the bubbles of gas which are produced in abundance at the moment when the glass is formed. The nature of this gas is not exactly known, but it is evidently due to the action of reducing agents upon the sulphate of soda found in excess in the glass. This excess of sulphate of soda is destroyed by various methods, but chiefly by the use of sticks. At the instant when the sulphate of soda is thus submitted to the action of an organic body, the formation of sulphide is proved by the yellow coloration which the glass assumes, but which disappears afterwards from the action of oxygen. It is curious to point out here a certain analogy between refining glass and refining copper. In the former case, the excess of the sulphate of soda, which is the agent of vitrification, is destroyed by wood. In refining copper, oxygen is the agent of purification for the metal: but the excess of this gas forms protoxide of copper, which dissolves in the metal, and renders it brittle. The refining of copper, like that of glass, is therefore completed by making use of wood, which decomposes the oxide of copper, and restores to the metal all the useful properties which the oxygen had caused it to lose.

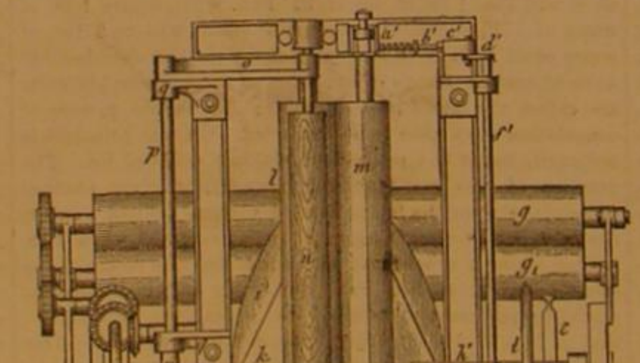
IMPROVED CLOTH-FOLDING MACHINE.

Our engravings represent a machine for folding woolen cloth and other textile fabrics longitudinally, which was recently described in the *Bulletin du Musée*. Fig. 1 shows a side elevation, and Fig. 2 an end elevation of the apparatus. The cloth to be folded is wound on a roller, the ends of the spindle of which are placed in the bearings, one of which is shown at *a*, Fig. 1. These bearings can be moved horizontally by the hand crank and screw shown in our engraving, to keep the fabric at the proper tension; and as the cloth passes from the roll and the mass becomes lighter, the weight can be moved along the notched lever to maintain the equilibrium. The fabric is kept uniform as to tension in both directions by the rollers, *b*, *c*, *d*, and *e*; and *g* and *h* are the feed rollers, which convey the cloth to the perpendicular folding wheel, *i*. The feed rollers are driven by the rotating shaft, *r*, which takes its motion immediately from the driving pulley, *x*. The wheel, *i*, is elliptical in diametrical section, with the exception that the major axis of the ellipse ends in a pointed edge, circumferential to the wheel, as shown in Fig. 2; and this edge performs the folding operation, doubling the cloth, which then passes over a perpendicular V-shaped board, *k*, which prevents sagging; and then the doubled cloth is compressed between *l* and *m*, which flatten the crease made by *i* and *k*, and is finally wound on the wooden roller, *n*, on which it is carried from the machine.

The construction and working of the apparatus is clearly and fully shown in the engraving, and the designand arrangement seem well adapted for doing the work efficiently.



CLOTH-FOLDING MACHINE.—Fig. 1.



CLOTH FOLDING MACHINE.—Fig. 2.

Currents in the Living Eyeball.

The existence of a continuous, though sluggish, current in the eye, flowing from behind forwards, has been demonstrated by Dr. Max Knies. The following was the method of investigation pursued: A minute quantity of a solution of potassic ferrocyanide was introduced into the posterior part of the vitreous humor. After the lapse of from one to four hours the animal was decapitated, and the eyeball soaked in a solution of ferric chloride; it was then hardened in alcohol, and subjected to microscopic examination. The distribution of the precipitate of Prussian blue furnished evidence of the displacement of the particles of ferrocyanide during life, and betrayed the paths along which it had traveled. The current mentioned above was found to exist in the interior of the lens as well as in the vitreous, the fluid required to nourish the former percolating through the latter, and thus following the same course as the blood in the hyaloid artery of the fœtus. The aqueous humor consists partly of a transudation from the ciliary body, partly of liquid which has made its way through the lens and vitreous. It serves to nourish the cornea. The nutrient fluid, whether in the vitreous, in the lens, or in the cornea, is conveyed along the intercellular substance; and the author is inclined to extend this proposition to all the tissues of the body, regarding the interstitial substance everywhere as the channel along which the nutrient juices are conveyed to the corpuscular elements of parenchyma or connective tissue.

The Greenhouse.

The following hints, suitable for the season, are furnished by a correspondent to the *Albany Cultivator*: If any seedlings which were sown a few weeks ago are large enough to transplant, it should be done before they get too large. At this season, unless the work is kept steadily along, and everything attended to at its proper time, some kinds of plants soon get into a condition, by growing too fast, that makes them unfit for potting or transplanting. If possible, transplant seedlings whenever the first characteristic leaves are formed, and cuttings should be potted as soon as they emit the first roots.

Plants of *callas*, *lilium longiflorum* and *candidum*, *camellia*, lily of the valley, etc., intended for Easter, should be kept free of insects, and brought into heat in time to produce their flowers at the proper season. The 16th of April being Easter this year, there is plenty of time yet to prepare for it. *Camellia candidissima* is one of the best for flowering at that season; and where many flowers are required, a good many plants of this sort should be grown. *Eucharis grandiflora*, if properly managed, can be had in flower at Easter, and is one of the best white flowers we have. Any plants which may be likely to flower too soon should be kept cool for some time.

Violets in frames should have all the air possible on clear days. A little every day is needful, but the plants must be covered well during the night. Plants in cellars should also get all the air possible, so that they may not be too tender for setting out of doors at the suitable season.

If a large number of *arunda donax versicolor* be required for bedding purposes, cut up the old plants into single crowns, and pot singly into small pots, placing them where they can get a little heat. Plants of this required for vases should be strong plants before being planted out. This an admirable plant for this purpose; in fact it should be grown in large quantities for all forms of outdoor decoration. Look after insects of all kinds, and do not by any means allow them to get ahead. "I often direct the attention of growers of plants to this particular, as upon it depends more success than many of even our best horticulturists apparently think. Thoroughly eradicate insects, and fewer sickly plants will appear in our collections of plants."

Vallota purpurea, an oldfashioned lily—generally called the Scarborough lily—is one of the finest of evergreen bulbs for flowering either in the greenhouse or parlor window. It does not require much heat, and can be easily induced to grow under very adverse circumstances, flowering for years in the same pot. Being an evergreen, it should not be dried off during its season of rest. When growing, give abundance of water; and if in the same pot for several years, an occasional watering with liquid manure will benefit it. It sends up its flower spikes from the crown of the bulb during summer and autumn, on the top of which are produced umbels of showy flowers. It is propagated from offsets which are freely produced at the base of the old bulbs.

"*Echeverria retusa floribunda* is a fine flowering plant. In Covent Garden market I observed large quantities of this plant for sale, grown mostly in six inch pots. It is very useful for the winter decoration of the greenhouse and sitting room, and is much used for this purpose around London. The flowers, which individually are very insignificant, have a very attractive appearance upon the spikes, and last for a long time in perfection if kept in a rather dry atmosphere. It is easily propagated by cuttings of the flower spikes and by seeds. If the cuttings are struck now, and grown on until June, then planted out during the summer months, and then lifted in the fall and potted in a rather sandy soil, they will flower during the winter, and greatly enhance the appearance of the greenhouse." Throughout the towns of Scotland and England the most conspicuous ornamental-leafed plant used for window decorations is *ficus elastica*; and the admirable specimens in some instances which I saw were really very creditable to the persons who bestow the suitable care upon them. The leathery texture of the large green leaves gives to the plant a bold and very attractive appearance; and grown with a single stem, having the leaves entire to the surface of the pot, it makes a fine specimen for the window. It is propagated by cuttings and eyes, and strikes very freely if put into a brisk bottom heat. In order to secure short-jointed, well foliaged plants, be careful to retain a steady moisture at the roots. Thorough dryness will cause the bottom leaves to turn yellow and drop off. Young plants are the best for most purposes, although good bushy plants can be secured by cutting the plant back to within a few eyes of the pot, and allowing several shoots to grow. Occasionel spongings of the leaves are very beneficial to their welfare.

Limits of Microscopal Observation.

The annual address delivered on February 2, to the Royal Microscopical Society, by the President, H. C. Sorby, Esq., F.R.S., was the probable limit of microscopical observation, considered in reference to the physical constitution of matter. The author omitted for the purpose of this inquiry the limitation imposed by the residual imperfections of the instruments after the best corrections have been made. Supposing the instruments perfect, light itself was, when compared with the utmost molecules of matter, too coarse a mean to enable us to see them. Referring to the researches of Helmholtz and other physicists, and comparing them with the practical results of microscopists, it appeared that the microscope enables us to obtain distinct vision of objects, such as lines 1-80000" apart, and that with photography and blue light such objects could be depicted when 1-112000" apart. Comparing these quantities with the millions of millions of molecules of albumen and other substances probably existing in a cubic 1-1000", it was shown how far microscopical investigation would be from revealing molecular structure; and as a rough illustration, the highest powers were as much behind the mark as the human eye if it attempts to read a newspaper a quarter of a mile distant. After a variety of illustrations, Mr. Sorby took up the question of Darwin's pangenesis from a microscopical point of view, and showed that, notwithstanding the minuteness of spermatozoa and the essential germinating parts of ova, there was room in them for millions upon millions of the complex molecules the theory required. A sphere of albumen 1-1000" in diameter probably contained 530 millions of millions of such molecules.—*Academy.*

Gas Lighting in New York City.

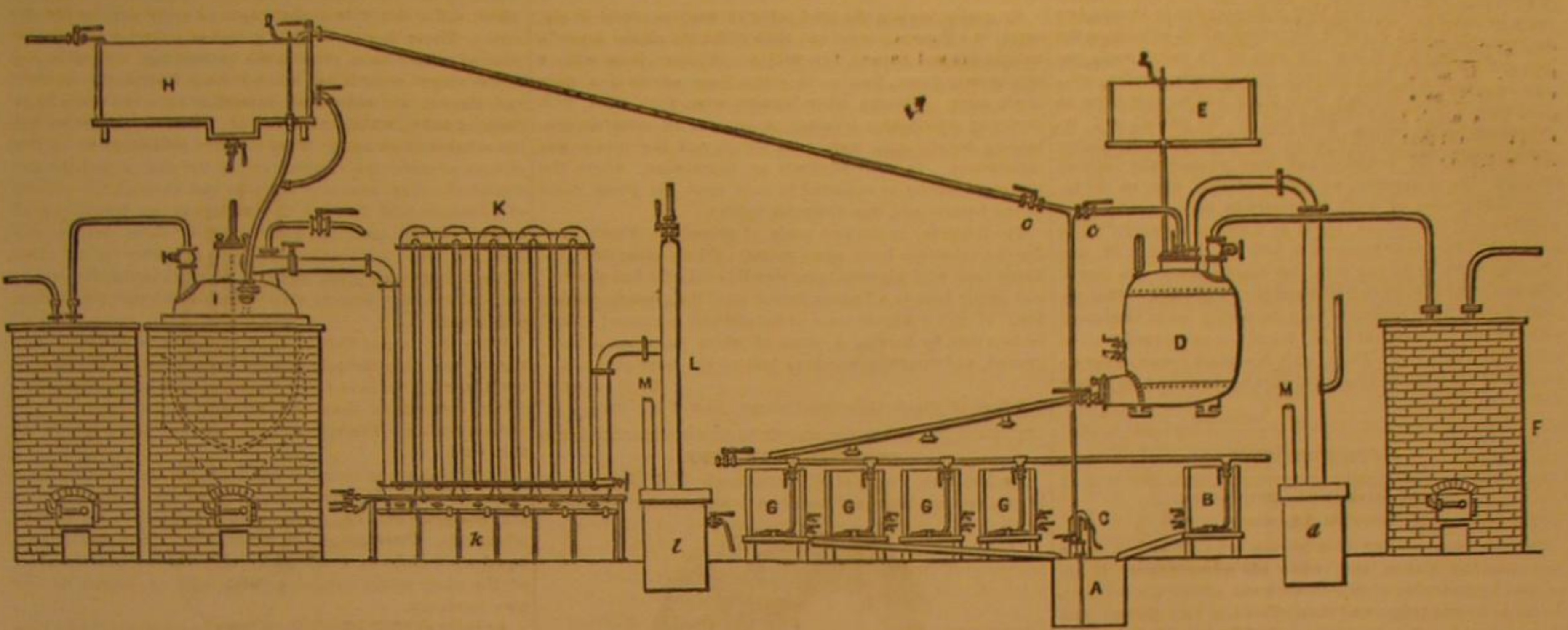
Fifty-one years ago the gas was first lighted in the house of Samuel Leggett, the then president of the New York Gas Light Company, at No. 7 Cherry street, now Franklin square. In honor of that event the company, on February 28, 1876, reduced the price of gas from $2.75 to $2.50 per 1,000 feet, which is the lowest price at which gas has ever been sold on this island. During all these years the fire that was lighted when the company started has never been allowed to expire; and when in 1874 the works were removed from Canal and Center streets, the burning coals were transported to the present location at 21st street, East river.

Treatment of Burns.

In the treatment of burns in the Charity Hospital, New York, when of a superficial character, a preparation consisting of two parts of collodion and one of olive oil has been found to be very efficacious. When the burn is of an extensive character, gasoline proves of decided benefit. The advantage of gasoline is that it is of the right consistence, and does not become rancid.

DISTILLING STEARIN.

As an appropriate supplement to our recent article on the oil resources of Africa, in which we described the immense yield of palm and other oils which might be obtained from sources on that continent now unutilized, we give herewith an engraving of a new apparatus for extracting the stearin from oil, by a new process. Stearin is now extensively used for making candles, and it is extracted from grease of all kinds. Hitherto a costly process of saponification has been employed, which the present device (for the illustration of which we are indebted to the *British Trade Journal*) obviates.



NEW STEARIN-DISTILLING APPARATUS.

The palm oil or tallow, or both combined in certain proportions, are melted in a tank, A, by means of steam; the material is then pumped into a copper vessel, B, to which is connected a steam pipe whereby it is boiled up for a certain period, the steam being superheated in the superheater, F. Sulphuric acid is then run into the acidifier, D, from E, when the process of acidification is perfected. The material is next discharged into an open vat, G, and boiled with free steam for a few hours and allowed to settle; it is then drawn off into a tank below, and pumped into a large open tank, H, lined with lead, which is placed at a sufficient elevation above the still, I, to allow it to run by gravity; this tank has a coil inside which is charged with steam in order to keep the contents in a liquid state. By means of a suitable valve, the material finds its way into the still, which is heated externally by fire to about 240° Fah., while superheated steam is let into the interior. The process of distillation now commences, the temperature being regulated according to the quality of the material that is being operated upon. The vapors pass over to the refrigerator or cooler, K, which consists of a series of vertical copper pipes connected at top and bottom with gun metal bends, the bottom bends having outlets to which are attached spiral copper coils placed in a circular tank, *k*. These tanks are fitted with pipes for the admission of steam and cold water. The product is collected in pails from the outlets or mouths of the copper coils, the greater part being fit for making candles without resorting to the process of passing it through hydraulic presses. L is the essence tank, and M a pipe for conveying gas to be burnt in the flue. That part which is not fit for making candles direct from the still is pressed and redistilled.

As the result of distilling tallow, from every 100 lbs. subjected to this process, 78 to 80 lbs. of stearin are obtained; three fourths of this, or about 60 lbs., is ready for making stearin candles without further treatment; the remaining fourth, namely, 20 lbs., after being submitted to pressing and re-distillation, yields about three fourths of stearin and one fourth of oil, the whole producing only 5 lbs. of the latter. It has been mentioned that 78 lbs. is the product by distillation, but in addition to this there is an amount of material called pitch. This is a hard black substance if it be allowed to get cold, but provision is made for passing it into an iron vessel from the still before it becomes hard. It is operated upon at a great heat in this iron vessel, and the product is similar to that from the distilling process. The pitch, after having undergone the operation in the iron vessel, is a commercial article used in many trades, and is well suited for coating iron in lieu of black japan, an article of a somewhat costly character.

IMPROVED SCROLL OR RECIPROCATING SAW.

In the accompanying engraving is represented a new scroll saw, manufactured by the well known firm of Bentel, Margedant & Co., of Hamilton, Ohio. So far as the general construction of the machine extends, beyond strength and uniform excellence of work there are no special features of novelty which would attract attention. The table and stand are very heavy and are cast in a single piece; or a wooden table may be attached, if preferred. There are the usual crank wheel, pitman, and slide to communicate motive power to the saw, the pin of the slide having a hollow chamber which carries the lubricator. The slide is of steel and the guide slides are adjustable.

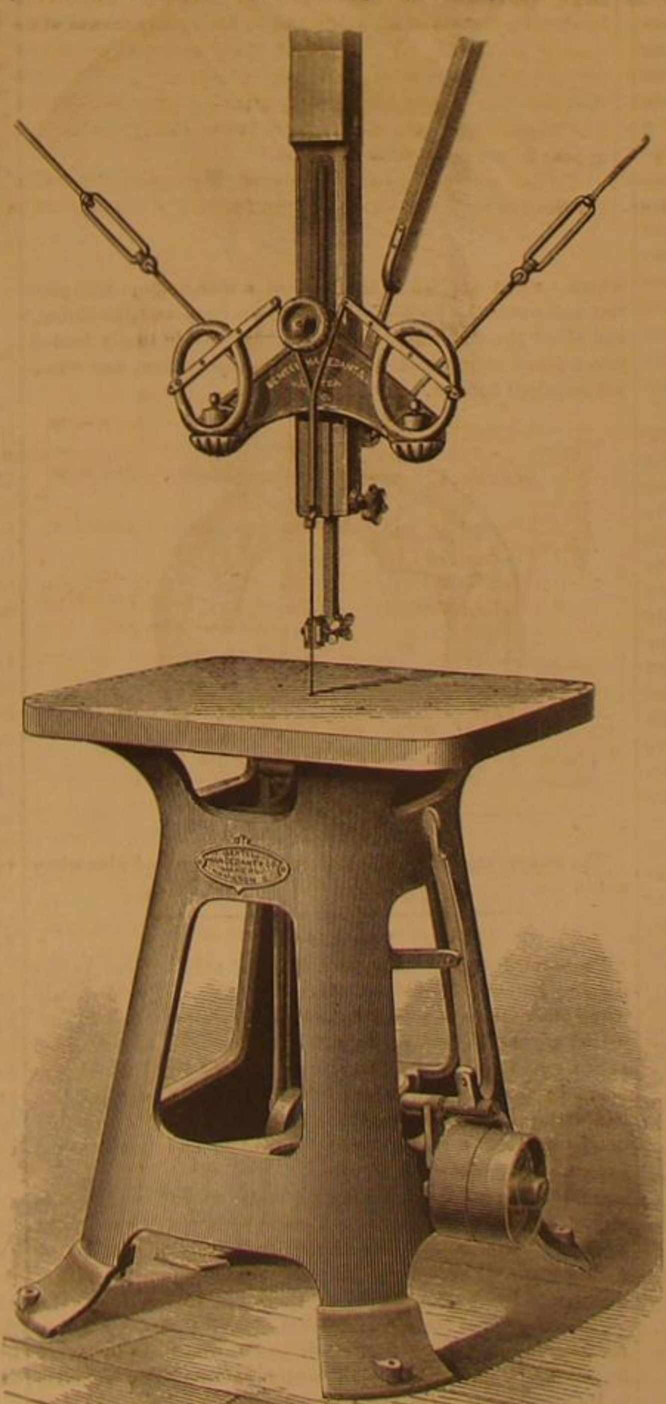
The novel and important point of the apparatus is, however, in the straining device for the saw, which is both simple and effective. It consists of two springs, two levers, and a connecting belt. The springs are each formed of a round steel bar, which is flattened on the ends and bent to an oval in such a manner that the extremities, while nearly meeting, allow a lever to be inserted between them. By depressing this lever one end of the spring acts as a movable fulcrum, while the other end presses with a force of about 820 lbs. on a point almost opposite the fulcrum. In order to compensate for the extra power which, it would appear, would be required to depress the lever to its full sweep, the leverage, or the distance between the ends of the spring, is proportionately reduced, so that the strain is thus equalized.

This device, the manufacturers state, may be adjusted so as to show an actual loss of strain; and as a matter of curiosity they inform us that they have one such apparatus in their possession that loses 3 lbs. during six inches travel or depression.

By raising or lowering the plate which carries the device, and by turning the springs toward or from the center, an increase or reduction of strain is obtained. The saw can be run at a very high speed; and as the two spring levers can be depressed 13 inches, the length of the stroke can be increased in such case to 10 inches, the saw having ordinarily 5 inches stroke.

The further advantages claimed are that the saw runs easier, with less jar, noise, and vibration than does any blade strained by springs, and that the simplicity of the device enables it to be easily manufactured, and reduces its wear and need of repairs.

Patented November 30, 1875. For further information address the manufacturers as above.



BENTEL, MARGEDANT & CO.'S SCROLL SAW.

Pneumatic Dredging.

Dredging has been a disagreeable necessity ever since docks and canals came into use, and up to quite recent times no improvement upon the ordinary elevator seems to have been thought of. Randolph, of Glasgow, tried, some years ago, to pump up mud along with water, much as M. Bazin later has done, but we have not heard that either got beyond the experimental stage. Still more recently a new dredging plant has been designed by Mr. F. E. Duckham—already well known for his hydraulic devices—for the Millwall Dock Company, who are very well satisfied with it, inasmuch as a saving is effected by its use amounting to about $10,000 a year. The working of this system of pneumatic dredging was exhibited to a party of engineers and others interested in the subject, and met with unanimous approval.

The vessel employed is a screw steamer of about 300 tuns burthen, 113 feet long, of 27 feet beam, 12 feet deep under deck, and drawing 8 feet of water when laden. She is driven by a neat compound engine of 25 nominal horse power, having 15 and 30 inch cylinders and 15 inches stroke, and 2 high pressure boilers loaded to 65 lbs. These, as well as the entire plant, reflect great credit on the makers, Messrs. Rait and Lindsay, of Glasgow. The dredger steamed round from the Clyde to the Thames, and behaved admirably. The screw is disconnecting, so that the whole power of the engines can be applied to the air pump, which forms an important part of the apparatus. This is double acting, and able to work up to a pressure of 60 lbs., though 10 lbs. is the usual working pressure. A water chamber round the cylinder, fed by a circulating pump, keeps the air cool. The dredge proper is of the usual elevator kind, fitted in a well in the center of the vessel, on the line of the keel, and adapted to traverse towards the bow, so as to excavate in advance of the vessel if needed. A couple of steam winches aid in raising and lowering the bucket ladder and varying the position of the dredger while at work.

But the distinguishing feature of this dredger is the mode of disposing of the spoil when brought up. Instead of being tipped into open barges or hoppers, it falls through a hopper on deck, into a couple of tanks, one on each side of the well, each 50 feet long by 9 feet 6 inches wide, and having a total capacity of 240 cubic yards. Iron pipes, 15 inches in diameter, one from the bottom of each tank, rise towards the deck, and unite with a breeches junction into one huge discharge pipe of 20 inches diameter, which is led to the side of the ship, and there ends in a large leather hose, with which connection may be made with a similar pipe on shore. This, at Millwall, is carried on underground—crossing roads, railways and wharfs—for 180 yards, finally coming out into a field, where the spoil is discharged. When the tanks are full, the holes on deck are closed with air tight doors, and the vessel made fast to the discharge pipe as described. Then air is pumped into the tanks from below—and, contrary to our anticipation, at no time during the discharge did the index mark more than 9 lbs. pressure—and the spoil rushes through until the tanks are empty. The tanks can be filled in from two to three hours; it rarely takes more than half an hour to empty them, and they were emptied in twenty-two minutes. Allowing 20 yards for matter which adheres to the sides of the tanks, this is at the rate of 10 cubic yards per minute. It might be supposed that stones, bricks, etc., would hardly pass through these pipes, but we saw some as large as a man's head rushing out of the outfall, and we were informed that much heavier—notably a 20-inch furnace bar, weighing 25 pounds—had been successfully carried through. As to expense, we were told that, even on the intermittent system of work necessary in docks, ten cargoes weekly could be dredged, equal to 2,200 cubic yards. The weekly bill for labor amounts to $66.75; for coal, $ 15; and allowing $100, or 10 per cent, for maintenance, the cost of this would be $184.25, or 8.04 cents per cubic yard. This, we need hardly say, contrasts very favorably with the usual price of 10d. (20 cents) or 1s. (24 cents) per cubic yard; and of itself it proves that Mr. Duckham's invention deserves the attention of all who are interested in what is at best an unprofitable labor.—*Iron.*

Correspondence.

How Strikes are Originated.

To the Editor of the Scientific American:

What is your opinion of a person who advertises for a first class tool maker, and, when his advertisement is answered by a number of skilled workmen, selects the best one, as far as he can judge, and then offers him two dollars and fifty cents a day for his services? This, as the reporters say, "is no fancy sketch," but a stern reality, and happened very recently in this city. Indeed, I learn that a certain powerful corporation, a short distance from this city, will only give this miserable pittance to the men employed in their tool room. Now a tool maker, in the correct sense, is a person who is capable of doing the very finest work, as well as the heavier kinds, in metal. Theoretically, there exists no limit, either way, to the size of tools that may be demanded for various kinds of work. They may be as large as a house or as small as a fine needle; and the skilled tool maker is able to produce either of them, each one perfect in its way, from immense templates used in drilling heavy engine parts down to the marvelous combinations of jewels and hardened steel used in watch factories. He must be able to do a job at the forge that would put many a blacksmith to the blush; he must be very familiar with the working of steel, besides being a competent worker of sheet metals, and have a thorough understanding of solders; he must be able to do a good job in pattern-making and other woodworking; he must have a correct knowledge of drawing and a decent smattering of foundery work: in fine there is nothing, I might almost say, that can be constructed from any known materials on the face of the globe but the first class tool maker is supposed to be, and in fact must be, able to construct. And all this for two dollars and fifty cents *per diem!*

"But," says the fortunate one to whom this offer is made, "I can do any kind of tool-making: I can make gages for you so perfect that the slightest variation in temperature between the parts will make a perceptible difference in their fitting. You surely cannot expect me to work for such wages as you offer!" "Well, sir, you can take my offer or not, as you see fit," answers the advertiser; "I can get plenty of tool makers at that price." This brings me to the main point, one which I have long and earnestly pondered upon. The employers say that the tendency of strikes is to compel the good workman to carry the poor workman on his shoulders; and yet, if they can hire the veriest fool that ever undertook to finish a V thread with a three cornered file (and I have seen this attempted) who chooses to call himself a tool maker, for two dollars and fifty cents a day, they will not give more to the competent workman.

I do not believe in strikes; I never was connected with any but once, and then I saved my employers and fellow workmen each a serious loss by my action in the matter; but as long as there is such a state of affairs as now exists, just so long will the strike disease be either epidemic or sporadic.

The only remedy is, in my opinion, to have the trades legally recognized so far as to have a complete and perfect registry kept of all men who pretend to be skilled workmen, with a rating placed opposite each man's name; and let each have a certificate in his possession, showing his rate in the register. A mixed board, composed of employers and employees, could from time to time fix the ratings and a schedule of wages therefor. The workman's certificate would be his recommendation, and he would get paid according to his ability and skill.

I should like to see a full and free discussion of this subject in the columns of the mechanic's friend, the SCIENTIFIC AMERICAN.

D.

Harlem, N. Y.

A New Test for Boracic Acid.

To the Editor of the Scientific American:

While working with nickel and cobalt in connection with glycerin, a very unexpected result was obtained. A borax bead containing both nickel and cobalt was immersed while hot into glycerin; the bead, then heated gently before the blowpipe, gave at first a faint green coloration, then carbonized, giving off acrolein in abundance. The experiment was repeated, using only a cobalt bead, then a nickel bead; in both cases the result was a beautiful green flame. Thinking it very singular that such difficultly reducible metals as nickel and cobalt should give a coloration, the experiment was repeated, using only a borax bead and without the aid of the blowpipe

By gently heating the bead (after it was immersed in glycerin) in a Bunsen burner and then withdrawing, the glycerin caught fire and burned, first with a faint blue, then with a strong soda flame; finally the entire flame assumed a deep green color. Various other borates were then tried, with perfectly satisfactory results. A number of minerals containing boracic acid were next tested, and the result was satisfactory. In such minerals as tourmaline, where the test could hardly be expected to hold good, the green flame of the boracic acid was distinctly visible.

The following is the best mode of procedure: Finely powder the substance in an agate mortar: fill an elongated platinum loop with glycerin, introduce this into the fine powder, and gently heat in a Bunsen burner until the glycerin catches fire. If only a minute trace of boracic acid is present, it will be best seen by holding a piece of white paper as a background, and carefully watching just as the flame goes out.

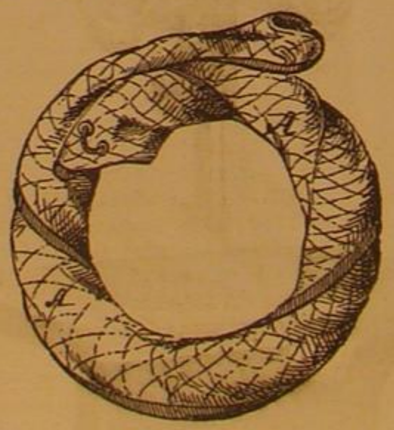
M. W. ILES.

School of Mines, Columbia College, New York city.

IMPROVED HEAD MUFF.

Mr. Heimann Fürst, of Williamsburgh, N. Y., has recently patented an improved neck, ear, and throat protector,

which, when applied to the head of a man or boy, will protect and cover the back of the neck, the ears, and the throat, and allow the free use of a hat or cap. It is easily folded into a small coil for convenience in transportation, and when not required for use.



The engravings show the article while worn and also when not in use.

The Moon.

Professor Soule recently lectured on this subject before the San Francisco School of Mechanic Arts. He said that, in using the immense telescopes of modern times, one is surprised at the exceedingly small area that can be examined at one time, and by the great diminution of light which appears to take place. A careful survey of the surface fills one with astonishment that the placid, silvery moon should be changed in a ragged, gray, wrinkled, and pockmarked heavenly body.

On turning to the brighter portions, we find everywhere mountains, volcanoes, crevasses, and precipices of vast hight or depth. It seems to be a picture of desolation, enthroned upon a pedestal of ashes. Those mountainous parts reflect a brilliant light on account of their volcanic nature, the rocks being often smooth and polished, and their jagged surfaces giving them power to catch and throw light in every direction. The southwestern portion is especially volcanic in its appearance. On close examination, however, we find long ranges of mountains exhibiting no signs of volcanic action, but in many respects similar to the Sierras, much steeper on one side than the other, and apparently formed by similar forces, though as a rule the volcanic element prevails. Many of these mountains are of immense size; thus Clavius is 120 miles in diameter, and has an area of 12,000 square miles, and turrets on its walls shooting to an altitude of 16,000 feet. We next notice the frequent occurrence of ringed mountains, not more than 10 to 15 miles in diameter, and almost perfectly circular in form. They are found alone upon the level country, or in groups, and even upon the ridges of the walled plain. There are also craters and pits, which differ chiefly from the others in their smaller dimensions. There is also another prominent feature which has puzzled astronomers, even in the present day. From many of the ringed mountains, notably from Tycho, Copernicus, and Kepler, are radiations, extending in some cases hundreds of miles, which at the full of the moon glisten with a remarkable brightness. They shine as brilliantly under the oblique as under the vertical rays of the sun—a fact yet unexplained; they pass over the tops and through the craters of volcanoes, and through the valleys in an uninterrupted course. Of the many theories concerning them, perhaps the most reasonable is that they are veins of matter ejected from below during some great volcanic or earthquake disturbances, and in many respects they resemble our own trap dykes and seines.

Since the time of Galileo, astronomers have painfully, patiently, and perseveringly mapped every detail of the moon's surface, until we have lunar topographical charts more accurately constructed than any hitherto constructed of the earth's surface. Photography has recently aided largely in this work.

By careful experiments, it has been proven that the light of the full moon is only $\frac{1}{600000}$ part of that of the sun, and that she gives only one sixth as much light as would a pure white disk; therefore she is nearer black than white. An equal sized globe of fire brick or clay thrown into the orbit of the moon would furnish us with light as bright as our own luminary.

As early as 1700, efforts were made to ascertain if any heat came from the moon, her rays being concentrated by means of a lens upon the bulb of a thermometer, with no effect, however; and other and later trials with improved apparatus gave the same result, or in some cases indicated that the moon was shedding negative heat, or cold. It was only after the invention of the thermopile that evidences of lunar heat were discovered. The amount was excessively small, however. Lord Rosse, with the aid of his three-foot reflecting telescope and Thompson's galvanometer, show that little, if any, of this heat comes from the interior of the moon, or, in other words, that the body of the luminary would be cold but from the heat absorbed from the sun. This borrowed heat has been shown to raise the exterior temperature of our satellite to at least 50° Fah. As the sun's heat and light cease to fall upon her surface and are lost for 15 days at a time; and the remaining heat being radiated into space, the alterations of temperature must be something startling, and the changes in the physical features of the body produced by the enormous expansions and contractions of her outer substance must be great and very destructive.

Intelligence and Labor.

The old delusion that education is unfavorable to labor has almost passed away. We no longer argue that the more a man thinks, the less he is inclined to work, nor fear that the material interests of our country will suffer through intellectual cultivation. We acknowledge that a well educated man may work as well as his neighbor who can hardly sign his name; and we even go a step further, and admit that a certain amount of education is necessary to secure the best kind of labor. Yet we are still far from appreciating the full effect of mental progress upon industrial employments, or estimating the vast debt which the latter owe to the former.

Intellectual culture, so far from unfitting men and women for exertion, actually excites them to it. Ignorance is the chief cause of indolence, and they are rarely separated. Savage tribes know but little of the benefits that industry can secure, and, having scarcely a motive beyond that of appeasing hunger, are proportionately idle. Educate them—show them the superiority of a house to a wigwam, and of a comfortable dress to a blanket—and the industry which can secure these benefits immediately begins to expand. Each fresh accession of civilized life demands a fresh accession of labor; and in proportion as the results of industry become more and more apparent, industry itself will more and more develop.

Education benefits industry, not alone by exciting and increasing it. It has an equally direct and powerful influence upon it in raising and improving its quality. How is the soil made most productive? Not by an unthinking routine of drudgery upon it, but rather by a knowledge of its nature and requirements; a study of the laws which govern vegetation; a thoughtful consideration of the relations which subsist between human needs and the powers of agriculture to supply them. The success of manufactures is due almost wholly to the busy thoughts that are ever planning improvements; making new inventions; constructing machinery; combining and regulating labor, and adapting all the various means within reach to the highest and most productive ends. Commerce, too, owes its very existence to the same source. The more forethought, judgment, discretion, and knowledge the merchant possesses, the more certain we may be of his ultimate success.

The same is true of those occupations which we are accustomed to consider wholly manual. The mechanic or laborer who thinks out the meaning of his work, who enters into its spirit, who devises improved plans for its execution, and sends a thought with every stroke, has tenfold the value of one who only bestows physical strength upon his work. In the province of domestic service, every housekeeper knows that the great lack is of mental, not bodily, power. There are plenty of girls who have the requisite muscle, but few who can furnish the judgment, care, forethought, and economy which are so needful in the kitchen and the nursery. Each laborer, whatever be his sphere of action, needs to understand the laws which govern his department of labor, and so to adapt his efforts as to conform with them. If he does not, his work must be to that extent unproductive and unsuccessful. These laws, however, are so entwined with those of other branches, and so dependent upon those of life in general, that a thorough education upon a broad basis is the best preparation for any kind of labor, and a continued mental discipline the best safeguard for its success. No industry can afford to slight the intellect; no man or woman who is a mere machine can ever give out his full value to the world, no nation or community can ever emerge from indolence, except in so far as they emerge from ignorance. In this country, where the opportunities of education are so numerous and so widely spread, it would hardly seem necessary to urge their acceptance; yet it is of the highest importance to our national prosperity and personal well-being that we all recognize the intimate connection between the growth of intelligence and the value of labor.—*Philadelphia Ledger.*

PRODUCTION OF LIGHT FROM MECHANICAL FORCE.

LECTURE DELIVERED AT THE STEVENS INSTITUTE OF TECHNOLOGY, BY DR. GEORGE F. BARKER, OF THE UNIVERSITY OF PENNSYLVANIA.

Proceeding on the principle that nothing should be taken for granted, the lecturer began by an explanation of the properties of magnets, dwelling particularly upon those which were necessary to a correct understanding of the subject. The name magnet is derived from the name of the ancient town Magnesia, where two important minerals were found, one, white, which is employed in medicine, and the other the black magnetic oxide of iron. This latter has the remarkable property of attracting iron: remarkable because it is not confined to the ore itself but emanates from it in all directions, thus enveloping it as it were with an atmosphere of force. This was illustrated by the familiar experiment of magnetizing a bar of soft iron by bringing the lodestone near it without touching. Upon removing the lodestone, the bar no longer attracted iron. It had lost its magnetism; a steel bar would have retained it permanently. It is of the utmost consequence to understand the manner in which the force emanates from a magnet, and it has been found that it obeys the same law as the force of gravitation, namely, that it diminishes precisely as the square of the distance from the source. If we measure this force at a certain distance from the magnet in one direction, and then find points in other directions where the force is exactly the same, we obtain what is called an equipotential surface; and by repeating this process at various distances, we map out what physicists have named the magnetic field. The direction of the lines of force was beautifully shown by means of an experiment of Professor Mayer's. Iron filings were sprinkled upon a glass plate, and this was placed upon a little bar magnet in the vertical attachment to the magic lantern represented in Fig. 1,

Fig. 1.

in which the light passing through the glass plate was reflected on the screen by a mirror. On slightly tapping the glass plate to give the particles of iron an opportunity of falling back upon the plate in obedience to the attraction of the magnet, they arranged themselves in symmetrical curves about the poles, forming an appearance designated as the magnetic spectrum. The particles in arranging themselves move at right angles to the lines of force. This was shown by means of a small needle suspended by a fine thread and introduced in the lantern. On gradually moving it around the magnet, it constantly changed its inclination so as always to preserve a position perpendicular to the lines of iron filings which represented the lines of attraction of the magnet.

As the earth itself is a great magnet, lines of force are passing out from it in every direction, and we have the means of recognizing them. A piece of soft iron held at a certain inclination, called the magnetic dip, becomes a magnet. This dip is inclined about 73° to the vertical. By placing a magnetic needle in the lantern, it was shown that a bar of soft iron, which before had no magnetic effect on the needle, began to attract it when held near it at the requisite inclination. On holding the other end of the bar up, its polarity was reversed, as its opposite effect on the needle proved.

The similarity of the action of electricity to that of magnetism was long known without suggesting the identity of the two forces to physicists. It was reserved for Professor Oersted to discover, by accident, that a wire, in which an electrical current passed, attracted the magnetic needle. Such accidents are possible only to men of profound insight, whose powers of observation have been trained by long habits of study. It required a Newton to perceive anything extraordinary in the fall of an apple. Professor Oersted's experiment was shown by placing a magnetic needle in the lantern, surrounding it by a coil of wire, and passing a current of electricity through the latter; the needle immediately began to move. On reversing the current, the needle began to swing in the opposite direction. To answer the question whether it was really magnetism which caused the deflection of the needle, and not some other force: in other words, whether the wire carrying the current had become a real magnet: the experiment with the iron filings was repeated, substituting a wire, through which a current passed, for the small bar magnet of the first experiment. The reflection of this wire on the screen was vertical; and when the plate was tapped, the iron filings arranged themselves in horizontal lines. As in the case of the magnet, therefore, they were perpendicular to the lines of force, and it was evident that the copper wire had become a magnet, having its poles along its sides. By making a coil of the wire, we multiply the effect, because we multiply the lines of force; and this is the way to obtain

Fig. 2.

the most powerful magnets. A bar of iron thrust into such a coil, as in Fig. 2, will occupy a position perpendicular to all the lines of force in it, and therefore capable of yielding the maximum effect. A diminutive piece of iron in horseshoe form surrounded by wire was then introduced in the lantern, and it attracted its armature every time a current was sent through the wire. In the next experiment the same little magnet was used with iron filings to show that the magnetic spectrum of these electro-magnets is similar to that of ordinary magnets. The immense electro-magnet of the Stevens Institute, which was mounted upon the stage, formed an amusing contrast to the little bit of iron used in the lantern.

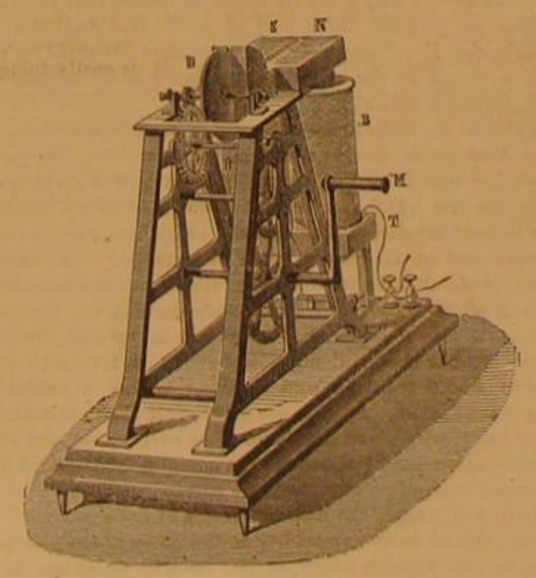
Great as was the discovery that electricity can be converted into magnetism, it must yield in importance to the one that magnetism can be converted into electricity. Arago was the first to observe that, when a copper disk is rapidly rotated under a magnetic needle, from which it is separated by a glass plate, the needle gradually begins to swing with it, following its rotation. His apparatus is represented in

Fig. 3.

Fig. 3. It was left to other physicists, and especially to Faraday, to explain the phenomenon. Their conclusions may be briefly summed up in the statement that, whenever any substance capable of conducting electricity is moved across a magnetic field, a current of electricity is generated in that substance; and this current is the more powerful, the more nearly the motion is perpendicular to the lines of magnetic force. To show this fact, the large electro-magnet of the Institute was used. A wire connected with a galvanometer in the lantern was moved up and down in front of one of the poles of the magnet, so as to cut some of the lines of force proceeding from it in every direction. The effect was that every such motion caused a deflection of the needle, showing that an electrical current was generated.

An interesting experiment to illustrate the same principle was made with the apparatus represented in Fig. 4, which

Fig. 4.



consists essentially of a copper disk rotated between the poles of an electro-magnet, and therefore fulfilling the conditions of maximum effect by cutting the lines of force perpendicularly. This apparatus turned very easily by means of the crank, M, as long as the current did not pass; but the moment the connection was made, it required all the strength of the assistant to manage it. This is explained by the fact that the copper disk is magnetized, and there is a tendency of the unlike poles of the disk and the magnet to attract each other, and hence to offer resistance to further rotation. The magnetization of the disk was shown by connecting it with the needle in the lantern by means of copper wires. If the further rotation of the disk is persisted in, it becomes hot, as was shown by connecting it with a thermo-electric pile and the galvanometer in the lantern. The resistance experienced by the copper disk was excellently shown by means of another experiment of Professor Mayer's, in which a large thin copper disk was made to swing to and fro, like a pendulum, between the two poles of the large electro-magnet. The moment the current passed around the coils of the magnet, the motion of the copper disk was arrested between the poles.

If, then, we are able to obtain an electrical current by cutting the field of a magnet, we ought to be able to do the same by cutting the lines of force of the earth This the lecturer accomplished before the audience, by moving a coil of wire, of large diameter, across the line of dip, and showing the effect on a galvanometer needle connected with the coil; every time the coil moved, an oscillation was imparted to the needle, which was distinctly visible upon the screen. The utilization of this force of the earth, like that of the sunlight for mechanical work, belongs to the future.

We have seen (in Fig. 4) the conversion of the mechanical power of the arm into heat and magnetism, and also the equivalence of magnetism and electricity. There remains the problem to turn these forces into the incomparably more subtle one of light. As in business, so in Science, it is the problem to convert raw material into high-priced products in the most economical way. A pound of cast steel of trifling value is worth thousands of dollars when converted into hair springs for watches. In the production of light, the great difficulty is to utilize our force. Even in the steam engine, only about ten per cent of the fuel is utilized as mechanical force; but when we come to light, that most imponderable of all the forces, we can scarcely utilize two per cent. When a powerful current of electricity is passed through an adequate conductor, it flows along peaceably and without unusual manifestations; but if the conductor is too thin, and it is obliged, as it were, to "crowd and elbow its way through it, it becomes red in the face, and we have the phenomenon of red heat; interrupt the conductor altogether, and make it leap over an empty space, and it becomes white in the face, emitting a brilliant light." The latter is the case in the electric lamp, Fig. 5. One of these lamps was placed upon the

Fig. 5.

stage in connection with the Gramme magneto-electric machine, in which a powerful current of electricity is generated by causing the rapid revolution of one electro-magnet between the poles of several larger ones, by means of steam power derived from an engine in the basement of the Institute. This machine will be explained in the next lecture: suffice it to say, for the present, that the light obtained was equal to about 1,600 candle power. It inundated the hall with a flood of light, and illuminated the fronts of the houses on both sides of the way.

C. F. K.

Useful Recipes for the Shop, the Household, and the Farm.

A simple way of hardening small watch drills: Heat the tools in the flame of a candle and then plunge suddenly in the candle grease. This is done on account of the drills being so small that they will not retain their heat sufficiently long to enable the operator to remove them from the source of heat to a vessel containing water used for hardening.

Jewelers will find the annexed list of silver solders of considerable practical value. Hard solder: Pure silver 16 parts, copper 3½ parts, spelter ¼ part. Medium: Fine silver 15 parts copper 4 parts, spelter 1 part. Easy solder: Fine silver 14 parts, copper 4½ parts, spelter, 1½ parts. Common hard solder: Fine silver, 12½ parts, copper 6 parts, spelter 1½ parts. Common easy solder: Fine silver 11½ parts, copper 6½ parts, spelter 2 parts. The fusing points of these solders are as follows: No. 1, 1,866° Fah; No. 2, 1,843°: No. 3, 1818°; No. 4, 1,826°; and No. 5, 1,802°.

The following is an iron cement which is unaffected by red heat; 4 parts by weight iron filings, 2 parts clay, 1 part fragments of Hessian crucible. Reduce to the size of rape seed and mix together, working the whole into a stiff paste with a saturated solution of salt. A piece of firebrick can be used instead of the Hessian crucible.

Böttger suggests the following process for dyeing cotton pure blue: Heat a mixture of 137 grains Paris blue, 137 grains tartaric acid, ½ fluid oz. ammonia water, and 2½ fluid ozs. water, and filter after cooling. Add to the deep blue filtrate a solution of caustic soda, until it is decolorised and after some time assumes a light yellow tint. Impregnate the cotton with this solution and pass it (best after allowing it to dry) through a warm, very dilute solution of sulphuric acid, and it will immediately assume a beautiful blue color and needs only to be washed in water. The sulphuric acid may be so diluted that it has scarcely a perceptibly sour taste.

The best material for hot beds is horse manure well turned and mixed with about one third its bulk of oak leaves. Another excellent mixture is the above with cotton waste, one half waste and leaves, the other half manure. The middle of March is the proper time to start the bed in northern States, and a mild day should be selected for the work. Dig a pit about 3 feet deep in front, 8 inches deeper at the back, and 6 feet wide. This affords an opportunity for adding linings if it be deemed necessary, when the heat in the bed decreases.

The Western tannin plant (*polygonum amphibium*), which grows luxuriantly in the Missouri Valley, seems destined to replace oak bark in tanning. It contains 18 per cent of tannin, while the best bark contains but 12 per cent; and large establishments employing it in Chicago find that one third more leather can be obtained with it than with a like quantity of bark. The process of tanning with it is identical with that with bark, but the leather is tougher, finer, and more durable, and receives a finer finish. The plant is an annual, and can be mowed, dried, and stacked like hay.

To prevent pumps freezing, place a small tack just under one edge of the leather valve which retains the water, sinking the tack into the leather to hold it. This will cause a small leak, and the water will not remain long enough to freeze

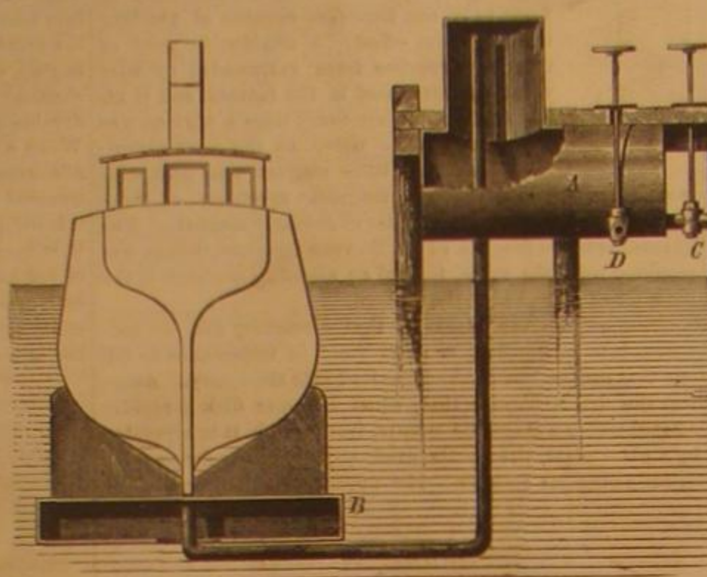
NEW MODE OF DOCKING VESSELS.

The ordinary method of raising vessels, so as to allow of repairs being made upon their bottoms, consists in floating them upon submerged docks. Out of the latter the water is then pumped, and as the dock rises the vessel is simultaneously lifted. The inventor of the new plan for accomplishing the above considers that the pumping out of the water is an expensive process, which may well be replaced by employing compressed air to enter the compartment in order to force the water therefrom, and at the same time render the dock buoyant.

This plan, it is believed, is susceptible of a variety of practical applications. As represented in the engraving, air is compressed into the tank, A, and, passing through the pipe shown, enters the dock, B. In order to effect this compression, the pressure of water in city mains might be used, or suitable storage reservoirs could be arranged to collect rain or surface water and hold it in readiness to exercise the pressure when desired. In such case the water would enter the tank, A, through the valve, C, and, rising therein, would drive the air down through the pipe. After the water had reached a certain level in the upper extension of the tank, the valve, C, would be closed, and the exit valve, D, opened. The tank being emptied would be again filled, and thus the process might continue until the desired end were accomplished.

An engine might be employed, if desired, to compress air into the tank, or any other suitable means used, which would afford a pressure sufficient of course to overcome the resistance of the column of water, depending on the depth of the dock.

The invention, which was patented September 8, 1876, is a simple one. For further particulars address the inventor, Dr. T. J. Wheeden, 107 Sands street, Brooklyn, N.Y.



WHEEDEN'S MODE OF DOCKING VESSELS.

IMPROVED APPARATUS FOR TESTING ILLUMINATING OILS.

We have so frequently called the attention of our readers to the dangers attending the use of cheap and inferior kerosene oils that to repeat the warnings is scarcely necessary here. Kerosene accidents, with their disastrous results, need not occur if the retailer or consumer of the oil who will take the trouble can, by a simple test, satisfy himself as to the safety of the same.

Any oil which will evolve inflammable vapor at so low a temperature as 100° Fah. should be as scrupulously avoided as

if it were gunpowder. That temperature may easily occur in a lamp, and the vapor therein forming, mingling with the air, may readily be ignited by a chance draft blowing down the flame above. It is a safe rule not to purchase oil which will flash under 110° Fah., and it should be further understood that the greater the heat the material will endure, above 110°, the greater the proportional increase in its safety and value.

In order to admit of the making of the test above referred to with ease and certainty, Mr. Pethuel Millspaugh, of Kent, Conn., has recently introduced a simple little apparatus which is represented in the accompanying illustration. It consists of a sheet metal chamber which receives a lamp below, and a glass vessel, A, above. The latter is formed with a contracted lower portion, so that the wider part above makes a shoulder, enabling the glass to be firmly set in the orifice over the lamp. The vessel is surmounted by a suitable cover, in which there is a filling aperture, B, and another opening, at which the test is made. To the cover is also attached a small thermometer, as shown.

The method of using the device consists in filling the glass, to the point, C, with the oil to be tested. The lamp is then ignited; and a lighted taper is from time to time applied to the cover orifice, as represented in the engraving, until a flash takes place, when it remains only to note the temperature of the oil as indicated by the thermometer. The tapers are shown in the small box beside the apparatus, and are sold with the latter.

When it is desired to determine the degree of heat at which the fluid actually takes fire and burns, which is commonly called the fire test, the apparatus may be easily adapted therefor by removing the cover (though leaving the thermometer in the fluid) and touching the surface of the oil with the taper.

These tests are very easily done, and are claimed to be accurate. Sufficient oil is held in the glass vessel for a fair and satisfactory trial; and the process of heating is slow and gradual, approximating closely to the manner in which the oil is heated when it is used for domestic purposes.

Mr. Millspaugh (who may be addressed as above for further particulars regarding the device) is also the author of an excellent little work entitled "Kerosene Accidents, and How to Prevent Them," which goes over the whole subject of these casualties in detail, giving a large number of valuable and practical suggestions. It might be read with profit by oil dealers and housekeepers generally.

A Certain Cure for Rheumatism.

Judging from his article in the *Wiener Medizinische Presse*, Dr. Franz Zeller is an enthusiast in the administration of caustic ammonia in rheumatism. For several years he had been a sufferer from severe muscular rheumatism in the right shoulder: he had taken all the anti-rheumatic remedies, with but little alleviation, when he began to reason that in rheumatism, as in gout, there may be a uric acid diathesis; he thought that *liquor ammoniæ*, on account of its rapid volatilization, would be the remedy most readily absorbed and the most prompt in action.

In almost the same moment in which he took one drop, diluted with water, he felt a complete relief from the pain, which had lasted for ten hours; he was now able to move freely the arm which, an instant before, he could scarcely bear to have touched. The remedy, he claims, has proved a positive cure in all recent cases of muscular rheumatism which have fallen under his observation; he cites numerous cases in which relief, as instantaneous as his own, was experienced. He also observed its effects in several cases of acute articular rheumatism, in two of which six drops sufficed to subdue the pain and swelling within a period of twenty-four hours. In one case of chronic rheumatism of a finger joint, which had lasted for over half a year, the simple administration of the ammonia completely dispelled the inflammation and pain in the joint within two days.

He then discusses the mode of action of his remedy. "If we consider an excessive acidity as the cause of the rheumatism, we can scarcely claim, in the cases in which one drop will instantaneously relieve the pain in recent rheumatism, that one drop was sufficient to counteract the effects of the excess of uric or (according to Fuller) lactic acid.

"Nothing remains therefore but for us to seek for the source of rheumatism in a morbid nervous activity induced by disturbances of nutrition, and to believe that the ammonia acts as a nervine directly upon the nerves."

After the cure of one attack of rheumatism, our object should be to put the patient in such a condition as to prevent their recurrence. This, the writer thinks, can be done by building up the general system, and thus diminishing the nervous excitability.—*The Clinic.*

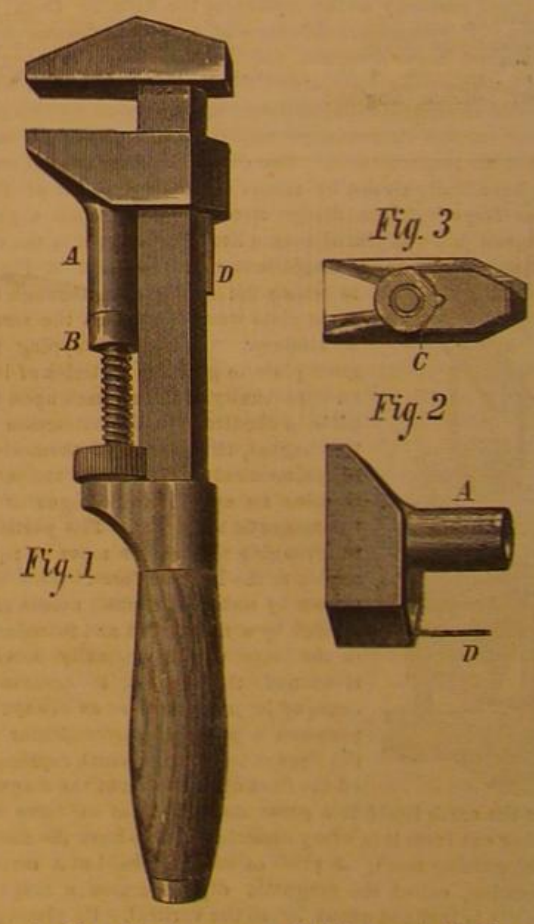
Power for Flouring Mills.

Mr. Henry Cabanes, miller and constructor, of Bordeaux, France, writes to *The Miller* as follows: "The force employed to drive a corn mill depends not only upon the quantity that is required to be ground, but also upon the nature of the wheat and the quality of grinding required; and it cannot be definitely answered without further information. I can nevertheless give you an approximate idea of what can be ground by one horse power of steam, including the necessary machinery for cleaning wheat, and dressing flour. 1. Forty-four pounds of wheat, in a good mill making flour for sale and also for baking, which in one grinding gives the largest possible quantity of fine flour, with broad and well cleaned bran, such as is done by mills around Paris and other neighborhoods, yields from 55 to 60 per cent of first flour from the first grinding; this of course varies with the nature of the wheat. 2. Fifty-five to fifty-seven pounds in mills where it is ground more round or higher, the stones being further apart, and when the millstones are not kept in condition for fine grinding, makes 45 to 55 per cent of first flour, according to quality of the wheat. 3. Sixty-six pounds in mills grinding coarser, with smaller bran more broken and not well cleaned, produces only from 40 to 50 per cent of first flour in the first grinding. Having given these particulars, supposing the grinding you require to be average quality, making fifty-five to fifty-seven lbs. of meal per horse power per hour, it is necessary to reckon 7 horse power for each pair of 4 feet stones or 4 feet 4 English. To work the three pairs with all accessories would require an engine of 21 indicated horse power. Two questions here present themselves, worth more consideration than is frequently given: Speed according to diameter (and in this case 180 revolutions appear to me excessive) and weight of the running stone, which, from all I can gather and from my own practical experience, I consider should be in proportion to the work to be done. Should this answer not be completely satisfactory, I shall be most happy to reply to you further; and perhaps I may be able to prove to you that it is easier than you think to grind 77 to 88 lbs. of meal per horse power, and obtain 55 to 60 per cent of first flour, running the stones at only 125 to 130 revolutions per minute."

BEDELL'S RAPID TRANSIT WRENCH.

An important advantage of this wrench is its capability of immediate adjustment to any size, and the consequent obviation of the slow process of working a screw to set the moving jaw as required. The inventor asserts that no pressure comes on the handle, owing to the movable jaw binding tightly (through said jaw having but one keeper), against the bar, which portion, he claims, is thus rendered about one third stronger. It is further claimed that all the parts are of nearly equal wear. The bevel on the rear portion of the head admits of the use of the wrench in close quarters, and of its turning 45° further than if it were square.

The movable jaw, A, is entirely detached from the screw, which passes loosely into it. Said jaw embraces the bar, as shown, and is provided at the rear with a spring, D, Fig. 2, for holding it against the bar. B is a carriage, screw-threaded



to receive the adjusting screw, which is operated in the usual way by a milled head. The rear portion of the carriage travels in a groove or channel in the bar, as indicated at C, in the horizontal section, Fig. 3.

In order to adjust the wrench it is only necessary to run the movable jaw up by hand until the object is embraced, when the spring holds the jaw in place until the milled screw head is turned sufficiently to bring the carriage against the base of the jaw, so securing the latter tightly.

The absence of a thread on the jaw, which is apt to wear out or bind on the screw, is a point of advantage, as is the absence of nut, ferrule, or any other device for holding the pressure bar in place. The latter receives the strain in a diagonal direction, downward and rearward, and, according to the inventor, will not spring in the back under a stress less than that previously mentioned.

Patented September 28, 1874, and January 12, 1875. Foreign patents now pending through the Scientific American Patent Agency. For information relative to sale of paten or lease on royalty, address the inventor, Otis T. Bedell, care Ely & Wray, 83 Reade street, New York city.

Killed by a Meteor.

An intelligent black boy was trudging along a highway at night in the vicinity of Palestine, Texas. There was a negro woman riding a horse in the direction in which the boy was going. The intelligent black boy re-appeared in Palestine that night out of breath and as pale as he could get. He said he saw a ball of fire come out of the sky and strike the woman and set her ablaze. The horse ran one way with the woman afire on his back, and he ran back to town to tell the people what had happened. The people went to look after further particulars of this curious incident. They found the woman lying on the ground with all her clothing burnt off, but with life enough in her to tell that she had been struck in the breast by a ball of fire. The horse was ound with his mane singed, and the woman died the next day. The people think she was hit by a meteor.—*St. Louis Republican.*

Novel Toy.

An ingenious toy, apparently of Japanese origin, has recently been introduced into London. It consists of a small picture, on paper, of an individual pointing a firearm at an object—bird, target, or second person. By the application of the hot end of a match, just blown out, to the end of the gun, the paper commences to smolder toward the object aimed at, and in no other direction. When it is reached, a report is heard, from the explosion of a small quantity of fulminating material.

THE OWL PARROT.

This singular bird, sometimes called the night parrot, belongs to New Zealand, and is called by the natives the kakapo. Dr. Gray describes it as having a high and short bill, grooved on the sides, with acute top, dentated lateral margins, and a base covered with fine, down-like feathers. The wings are short and rounded, and the fifth and sixth quills are equal and the longest; the tail is moderate in size and each feather points out, with the shaft projecting. The *tarsi* are short and robust, and covered with round scales; the claws are long, strong, and slightly curved. In general, the bird has the form of a parrot, but bears a facial aspect resembling that of an owl, of which it also has the nocturnal habits, and the almost noiseless flight. But it is not a bird of prey, as it eats corn and nuts readily when in captivity, its food in a wild state consisting of seeds, roots, and the outer covering of the stalks of New Zealand flax (*phormium tenax*). Its only vocal effort consists in a short croak; it breeds in February, laying two or three eggs; and it becomes gregarious in winter, and in the advent of spring resumes its solitary habits. The flesh is white, and is said to be good eating. The specimens herewith illustrated are domiciled in the unrivaled collection in the gardens of the Royal Zoölogical Society, London, England.

THE OPIUM POPPY.

The opium poppy is a native of Persia, and probably also of the south of Europe and Asia Minor. It is largely cultivated in those countries, and also in Egypt, Arabia, and British India, for the sake of its opium. Dr. Joseph Hooker

THE OPIUM POPPY (*papaver somniferum.*)

thus describes this process: "The capsules are sliced in February and March with a little instrument like a saw, made of three serrated plates tied together. From the incisions made by this instrument, the opium oozes out as a milky juice, which, as it dries, becomes a soft brown sticky paste; each morning this paste is scraped off by means of small shells, and collected into jars, the contents of which are afterwards made into balls of about half a pound weight; these are often coated with the seeds of some species of *rheum* or rhubarb plant. The balls are packed into chests, and exported to other countries."

Opium is produced in large quantities in India for consumption in China, on account of the great sale there, in spite of all prohibitions. Eastern nations generally are very fond of opium, which they smoke with their tobacco, or alone, and take in the form of pills. With us it is much used in medicine as an anodyne, especially in the well known preparation called laudanum; and the delusive habit of taking it to obtain a fleeting repose of the nervous system has recently grown, as our medical men can testify, to alarming proportions.

Poisoned Arrows of the Papuans.

The warlike habits of the Papuans and their implements of warfare are described in a private letter recently addressed to Dr. Hooker. The writer says that no man leaves his dwelling, for his bit of cultivation even, without his powerful bamboo bow and a few deadly poisoned arrows. These poisoned arrows are only a few among a great number not poisoned, the former being distinguished by elaborate carving and painting, probably to prevent accident among themselves. They are each pointed and barbed with human bone brought to almost needle-like sharpness, most carefully and neatly finished; they are poisoned by plunging in a human corpse for several days. Poor Commodore Goodenough and his men suffered from arrows so poisoned. It is a sort of blood poisoning that, like other kinds of inoculation, does not develop itself for several days, the slightest scratch being sufficient to render almost inevitable a horrible death. The symptoms are accompanied by violent spasms like tetanus, with consciousness until the last.—*Nature.*

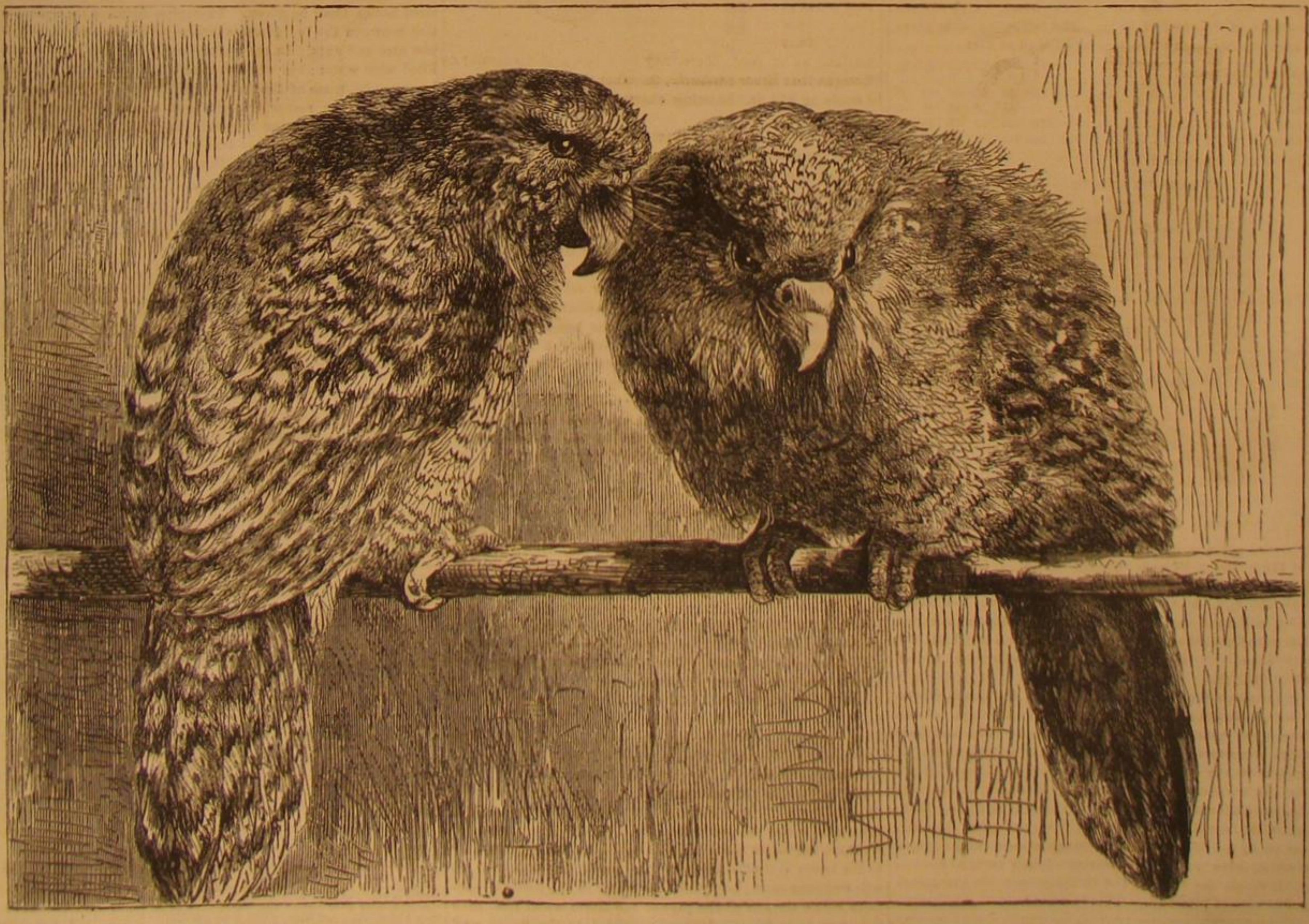
Life in Great Cities.

The relative healthfulness of some of the great cities is shown in the following table, which exhibits the annual mortality for each 1,000 inhabitants:

Madrid	65·0	Turin	24·8
Vienna	32·7	Brussels	24·8
Berlin	30·6	Paris	23·2
Rome	29·3	London	22·2
New York	27·9	Philadelphia	20·3

The above estimate for Madrid is from a recent compilation given in *La Gaceta Industrial* in that city. The capital of Spain is thus made to rank as one of the most unhealthy places in the world

A GOOD cement for covering the joints of ovens, which becomes very hard and does not crack, is made by mixing equal quantities of finely sifted wood ashes and clay. Some salt is added and then sufficient water to form a dough. The cracks should be covered while the oven is cold.



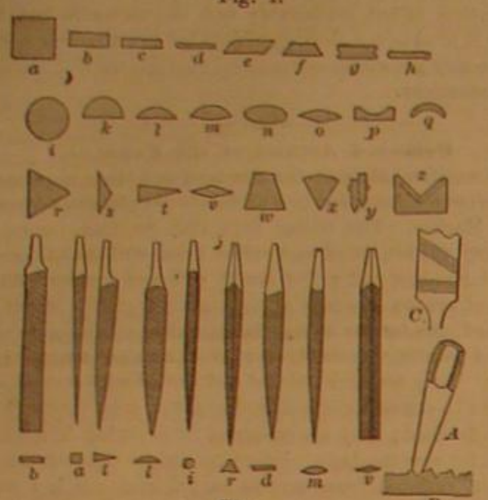
THE OWL PARROT.—(STRIGOPS HABROPTILUS.)

FILES, FUSES, AND LOW WATER ALARMS.

Our extracts from Knight's "Mechanical Dictionary,"* this week, include illustrations of all the different forms of files, of a variety of fuses, electric and otherwise, and of a number of ingenious low water alarms.

Files are graded by shape, size, and fineness of cut; and also are known by their purpose. As to shape, the series of sections given in Fig. 1 will be readily understood. *a, b, c,*

Fig. 1.



Files.

d, e, f, g, h are sections derived from the square; *i, k, l, m, n, o, p, q* are derived from the circle, and *r, s, t, v, w, x, y, z* from the triangle. The files represented in the succeeding engravings are known as follows: *a* is a square file, parallel or taper, sometimes with a safe side; *b*, when large, is a cotter file, when small, a verge or pivot file. *c* is a flat file; when small, a pottance file; when narrow, a pillar file. *d*, when parallel, is an equaling, clock pinion, or endless screw file; when taper, a slitting, entering, warding, or barrel hole file. *e f* is a French pivot or shouldering file; when parallel, a V file. *g* is a nail file for the finger nails; *h*, a pointing mill saw and round edge file; *i*, round, gulleting, or rat edge file; *k*, frame saw file; *l*, half round, nicking, piercing, or round-off file; *m*, cross file, double half-round file; *n*, oval file; *o*, balance wheel or swing wheel file, the convex side only being cut. *p* is a swaged file for finishing brass moldings; *q*, a curvilinear file; *r*, triangular, three square, or saw file: *s*, cant file, for filing inside angles of 120°; *t*, when parallel, is a banking or watch pinion file, when taper, a knife edge file. *v* is a screw head, feather edge, or slitting file; *w*, a valve file; *x*, triangular-and-half-round file; *y*, double or checkering file for gunsmiths; *z*, double or pencil-sharpening file.

As to character of teeth, the classes are: Double cut, having two sets of teeth crossing obliquely; single cut or float, having but one row of teeth; rasp, having detached teeth made by a punch instead of a chisel. At A is shown the position and action of the file chisel on the blank. C shows the appearance of the rows of teeth. The following table gives the approximate number of cuts in an inch of file:

Length of file in inches	4	6	8	12	16	20
Rough	56	52	44	40	28	21
Bastard	76	64	56	48	44	34
Smooth	112	83	72	72	64	56
Superfine	216	144	112	88	76	64

Figs. 2 and 3 represent a

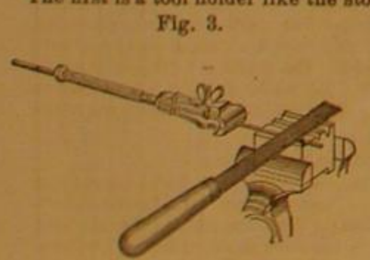
FILE CARRIER AND FILING BLOCK.

Fig. 2.

File-Carrier.

The first is a tool holder like the stock of a frame saw, and is used to mount a file in a similar manner. The file block is of suitable wood, and is gripped in the jaws of a vise. It has grooves of varying depth, in which small rods, bars, or wires may be laid, to be filed conveniently.

Fig. 3.



Filing-Block.

Fig. 4 represents different kinds of

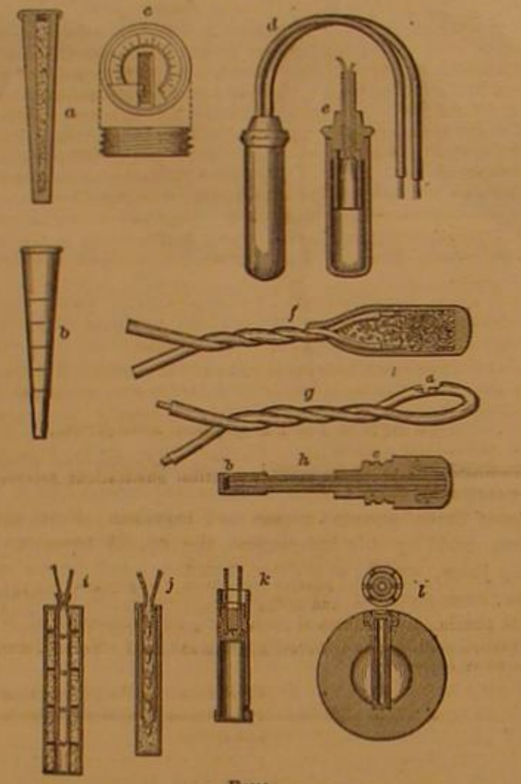
FUSES.

a b is the common wooden fuse for shells. It is filled with a slow burning composition, and for use a part is cut off at the smaller end, the amount removed regulating the length of time which the fuse burns, and consequently the duration of the period prior to the bursting of the shell to which it is attached. *c* is the Bormann fuse, which consists of a disk of an alloy of tin and lead, in which a deep channel is made to receive the composition. At the end of the channel is an aperture communicating with the exploding charge. A cap covers the disk, and is marked to indicate seconds and fractions of the same. To use the fuse, the outer covering is perforated at any desired mark, when the composition ignites by the flame from the gun passing through the aperture made, and burns until the magazine inside is reached. Bishop's electric fuse, *d, e*, comprises an inner and outer cylinder, protected by a perforated cap, through which the insulated conducting wires pass. *f* illustrates another form of electric fuse, in which the ends of the conducting wires are united by a fine wire of platinum. This last becomes highly heated when the current passes, and so ignites the powder. The operation of Statham's fuse, *g*, depends on the fact that a copper wire, covered for some time with vulcanized rubber, becomes coated with a layer of sulphide of copper, which is a moderately good electric conductor. This is utilized by twisting a piece of rubber-covered wire into a loop, when part of the covering is removed (at *a*) and the wire severed. Consequently, when a spark is passed along the wire, on reaching this spot it must follow the film of sulphide adhering to the rubber; and the resistance which it has to overcome causes the sulphide to ignite.

i j k illustrates Shaffner's blasting fuses and cartridges. *i* is a hollow cartridge provided with central and diverging spaces, occupied by a series of fuses and loose nitro-cotton, the whole covered with a waterproof casing, into which the ends of the conducting wires pass. In *j*, the main wires pass to the mine or cartridge, and are connected by smaller wires to the fuses, a number of which are placed in a single charge of explosive material. *k* is provided with a wooden head enclosed in an indented cylinder, closed by a cap; the head has a recess for the composition, and another for cement for the conducting wires. The Abel fuse, *h*, consists of a wooden head, into which the insulated conducting wires enter, and are covered with a tin foil cap containing the priming.

Powel's fuse, *l*, admits of being turned within the plug, which is screwed into the shell so as to bring corresponding apertures in the fuse and the plug into communication.

Fig. 4.



Fuses.

These are so adjusted to each other that the composition may be made to fire the bursting charge at the expiration of a given time.

LOW WATER ALARMS

may be classed under four heads, as follows:

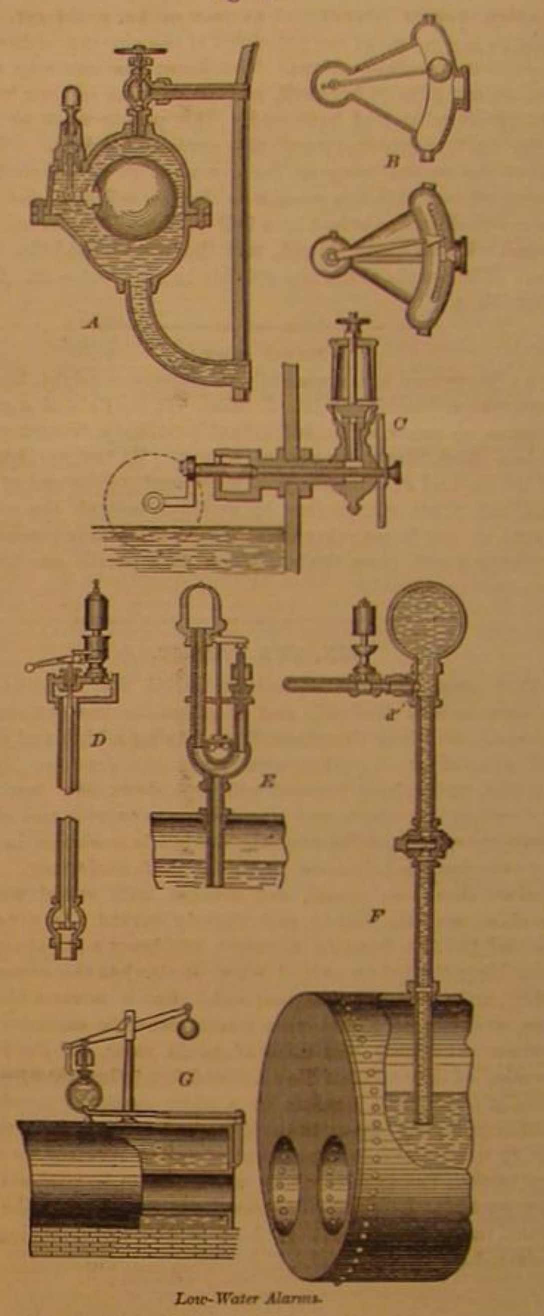
1. The float movement: A. The float is attached to an arm, and is immersed in water in the chamber which communicates by pipes with the boiler. Should the end of the lower pipe be uncovered by the subsidence of the water to that level, the water leaves the chamber and the float falls, depressing the valve and admitting steam to the whistle. When the water rises again, the upper valve is moved to allow steam to depart, and the normal condition is re-established. B. The hollow steamtight case has a central hub and a sector space, occupied by the arm of a float, which rises and falls with the changes of level of the water in the boiler. An indicator on the same axis moves with the float. C. A float is placed on the crank arm of the valve stem, and rises and falls with the changes of the water level, bringing a stud on the stem against an inclined socket, and raising the valve from its seat. This allows steam to pass to the whistle.

2. The thermostat movement: D. When the water subsides below the end of the vertical pipe, which extends downward into the boiler, the water contained therein is discharged and steam substituted. The increased heat, due to the presence of steam, elongates the thermostatic rod in the tube, and acts upon the lever to lift the valve from its seat; the steam rushes out and sounds the whistle. E This acts similarly to the foregoing, except that the effect is due to the expansion of the steampipes when the water is emptied and steam admitted. The lever has its fulcrum on a post between the pipes; the expansion of one of the latter depresses the valve stem and withdraws the valve from its seat; the expansion of the other pipe withdraws the seat from the valve. The action of the two is cumulative. The passage of steam sounds the whistle, as in other devices for the same purpose.

3. The fusible plug action. F. After the boiler has been filled to the water line and put in operation, the pressure of the steam forces the water into the pipe and air chamber, *e*. As there can be no circulation of water in the pipe as long as the lower end of it is under the water line, the disk, *d*, will continue solid; but when the water in the boiler evaporates below the end of the pipe to the alarm water line, then the water in it falls of its own weight into the boiler, and steam at once takes its place, melts the plug, and notice of low water is given by the sounding of the whistle.

4. The gravity movement: G. A vertical pipe passes into the boiler, and its open end is at the level at which it is desired notice shall be given. This pipe forms a communication between the boiler and a reservoir on the end of a hollow arm and axis. In the normal condition this reservoir is filled with water; but when the end of the pipe is uncovered by the subsidence of the water level in the boiler, the water runs out of the reservoir and steam takes its place. The change of weight in the reservoir, due to the substitution of steam for water, causes the arm to be lifted by the weighted lever, and raise the valve which admits steam to the whistle.

Fig. 5.



Low-Water Alarms.

*Published in numbers by Messrs. Hurd & Houghton, New York city.

DECISIONS OF THE COURTS.

United States Circuit Court---District of Massachusetts.

BOILER PLASTERING.—THE UNITED STATES AND FOREIGN SALAMANDER FELTING COMPANY *vs.* THE MERRIMACK MANUFACTURING COMPANY.—THE SAME *vs.* THE LAWRENCE MANUFACTURING COMPANY.

[In equity.—Before SHEPLEY, J.—Decided October, 1875.]

The first claim of plaintiffs is for a composition for coating the exterior of steam boilers, pipes, or other heated surfaces, composed of asbestos and lime putty, charcoal, and pumicestone, or their equivalents, and is infringed upon by the defendants in their use of an inner coating of a mixture of clay and asbestos, crushed or ground, with the addition of a little hair and some other fibrous substance, with a coating composed of a mixture of clay and charred fiber, or cocoanut, or cane sawdust ground, wool, or shoddy.

The second claim is for a composition, for the same purpose, of asbestos and lime putty.

This claim is infringed by defendants in their use of asbestos and whitewash (which is the same as lime putty in this composition) and clay, which is also proved in this composition of matter to be a well known equivalent for the lime putty.

SHEPLEY, J.:

These are actions at law against the defendants for alleged infringements of letters patent No. 4,134, dated September 27, 1870, reissued to the complainants as assignees of John Riley and Charles W. Bissell for an improvement in compositions for covering steam boilers, steam pipes, etc., and also for alleged infringement of letters patent No. 114,711, dated May 9, 1871, and letters patent No. 108,065, dated October 4, 1870, both to John Riley, of Troy, N. Y., assignor to the complainants, for an improvement in compositions for covering steam boilers, etc.

The reissue No. 4,134 described the essential part of the invention as consisting in the employment of lime putty, or lime mixed with water, so as to be of the consistence of glazier's putty, with some non-conducting fibrous material, such as paper pulp, and with pulverized earthy materials, which are light, porous, and are non-conductors of heat, such as plaster of Paris, water lime, cement, sand, soapstone, or black lead.

The invention described in letters patent No. 114,711 consisted in the employment of a combination of asbestos and lime putty, either with or without the other ingredients hereinafter named, as a coating for steam boilers and pipes. The other ingredients named were charcoal and pumicestone, or their equivalents.

The invention described in letters patent No. 108,065 consisted, so far as the invention related to the covering of steam boilers, in the addition of ground gypsum, or plaster, or pumicestone to the composition described in the reissued patent No. 4,134.

The defendants coat their pipes with an inner coating of a mixture of clay and asbestos, crushed or ground, with the addition of a little hair and some other fibrous substance. The next coat is a mixture of clay and charred fiber of cocoanut or cane sawdust ground, wool, or shoddy. Outside of this is a thin wash of lime with a slight mixture of hair. Outside of the second coat, in some instances, is a mass of fiber wound around the second coating. This covering of cord or fiber is covered with lime.

This coating is an infringement of the first and second claims of letters patent No. 114,711, the first claim being for a composition for coating the exterior of steam boilers, pipes, or other heated surfaces, composed of asbestos and lime putty, charcoal, and pumicestone, or their equivalents, and the second claim for a composition for the same purposes composed of asbestos and lime putty.

Defendants use the asbestos and whitewash, which is the same as lime putty in this composition, and clay, which is also proved in this composition of matter to be a well known equivalent for the lime putty. They also use the combination of asbestos, lime putty, and charcoal.

A large number of American and English patents are introduced in evidence as tending to show want of novelty. A careful examination of all these patents fails to afford any satisfactory proof that the patent No. 114,711 is void for want of novelty. The nearest approach to the composition of matter patented to the plaintiffs is to be found in the feltings or sheets of asbestos and lime, which were not plastic like the compositions of matter in the Riley patents, but were wrapped or fastened around the pipes to boilers. These, although most nearly approximating the invention of Riley, do not anticipate it.

Judgment is to be rendered for the plaintiffs against the Merrimack Manufacturing Company, for infringement of the first and second claims of patent No. 114,711, for three hundred and fifty dollars, and against the Lawrence Manufacturing Company for seventy and forty-one hundredths dollars damages, with interest from the date of the respective writs.

[*G. E. Betton*, for complainant.
G. L. Roberts, for defendant.]

United States Circuit Court---Southern District of New York.

PATENT JEWELRY.—LEWIS J. MULFORD *et al. vs.* THOMAS D. PEARCE *et al.*
[In equity.—Before SHIPMAN, J.—Decided November 3, 1875.]

The first claim to "an ornamental chain for necklaces, etc., formed of alternate closed links, A, and open spiral links, B, substantially as shown and described," is not a claim for an ornamental chain, composed of alternate closed links, without reference to the material of which the spiral link is made; but it is a claim for a chain composed of alternate closed links and open spiral links, formed of one or more coils of gold tubing, as shown and described.

The manner in which gold tubing is manufactured is well known to all persons skilled in the art, and the process thoroughly understood by the manufacturing jeweler. It would have been a waste of words to explain the method of manufacturing to a class of persons who are sufficiently informed when they are told that the link is "formed of one or more coils of tubing of the proper length, so as to form a double spring link."

SHIPMAN, J.:

This is a bill in equity, alleging an infringement by the defendants of reissued letters patent, which were issued to the complainants on February 24, 1874, for an "improvement in chains and chain links for necklaces," etc., and praying for an injunction and an account. The defendants, admitting in their answer the manufacture and sale of the patented article, deny the novelty or patentability of the alleged invention, and further insist that the patent is invalid by reason of the vagueness of the specification. The specification states that—

"The invention has for its object to furnish an improved chain for necklaces, etc., having links of peculiar construction, which enable all the links to be finished separate and then put together to form the chain. The invention consists in an ornamental chain, whereof the links are connected together by open spiral links, B, finished before being connected together, the connection being made by springing the finished links into each other in the manner described. A and B represent the links of the chain. The links A are round and closed, and are made and polished, or colored, separately from the other links. The links, B, which constitute the peculiar feature of my invention, are formed of one or more coils of tubing of the proper length, so as to form a double springlink. Into each end of the tube forming the link, B, is soldered a small shot, as shown in the drawing, which shot gives a finish to the link. The links, B, may then be colored or polished, and the chain is formed by springing the links into each other. * * * * * * * * * By this construction the links may be made and finished in quantities, and the chain formed from the finished links, by springing them into each other to produce any desired combinations of the links of the same or different kinds. Finishing the separate links in this way enables them to be more perfectly polished or colored, and with a greatly diminished expenditure of labor and time, and enables the links to be put together without injuring them in the least, however highly they may be polished or colored."

The claims of the inventor are:

1. An ornamental chain for necklaces, etc., formed of alternate closed links, A, and open spiral links, B, substantially as shown and described.
2. The open spiral links B, formed of coils of tubing, substantially as shown and described.

Ornamental gold chains, formed of alternate closed links or spiral links, or of spiral links alone, have long been known. Chains composed of split rings which are sprung into each other, or into a solid link, are familiar articles, and there can be no novelty in the mere shape or form of the chain, or of the link, which is shown in the drawings of the patent. The distinctive feature of the invention does not consist in the fact that the link is spiral, but does consist in the construction of the open spiral link from a specified material, namely, gold tubing. The article which is called tubing in the jeweler's art is made by drawing a strip of gold through a drawplate, the gold strip having been placed around a copper wire in such a manner as to incase the wire. The copper wire, with the strip of gold wire around it, is then wound upon a mandrel and cut into proper lengths. The copper is destroyed by acid, leaving a hollow spiral link which is bound with wire and annealed. The wire is then unfastened, and the link, which is thus made, possesses a peculiar elasticity not affected by the annealing, is easily separated and united to another link without any injury to itself or to the solid link into which it is sprung, and constantly preserves its elasticity and shape.

The discovery which led to the invention consisted in the discovery of the fact that links made of tubing possessed a peculiar elasticity which was unaffected by annealing. The invention was the application of this discovery to the production of a new and useful result, namely, the manufacture from tubing of ornamental chains, which possess the following elements of novelty and utility:

First, all the links can be completely finished and then put together without injury to the chain, and thereby the article can be produced at a much less expense than had previously been necessary. Gold chains which are constructed in any other manner must be finished or polished or colored after the chain is completely formed, which is a difficult and somewhat expensive part of the manufacture, while, inasmuch as these links are sufficiently elastic to be united together or sprung upon a solid link without injury to any part of the chain, the separate links can be made in quantities, and completely finished and polished before being united.

Second, the elasticity of the special links is such that the chain can easily be separated by the fingers of the owner, and united in different forms and for different purposes, and reunited in the original chain without detriment to the polish of the links, and with no loss of their elasticity. As has already been suggested, their features of novelty and utility do not result from the fact that the chain is made in part from a spiral link, but from the fact that the spiral link is manufactured from a material which possesses a peculiar quality of permanent elasticity. The invention consists in the fact that, whether the inventor was or was not the first person to discover the peculiarity, he first utilized the discovery, and applied the peculiar property of the material to a useful result in the manufacture of chains.

It being self-evident that chains composed of spiral links have been well known, it was insisted by the defendants that the chains heretofore in use possessed substantially the same qualities which are attributed to the patented article; and that the patented article had no advantage over the chains which were introduced as exhibits, and which were made of gold split rings, or split links in various forms. But it was satisfactorily proved that the split rings, which are manufactured from solid gold wire compressed in dies, and made elastic by hammering, are not sufficiently elastic to permit the chain to be joined without injury to the material into which the split link is sprung, and this injury renders necessary a repolishing or finishing of the completed article. Again, if the chain of split gold links is taken apart, this act of separation causes the coil to spring asunder, so that it loses its shape and its beauty; and if a necessity of annealing arises, the process of annealing destroys its elasticity. The difference between the patented article and a chain made of split gold rings is clearly marked. It is a difference in kind and not merely in degree.

Testimony was also offered by the defendants to prove that chains of spiral links made of tubing had been in use prior to the date of the invention, but the evidence failed to satisfy me that chains of open and unsoldered spiral links made of tubing had been manufactured prior to the date of the patent. Links have been made of tubing, which, after being united in a chain, were soldered together, and thus a chain was made which could not be taken apart, and which required finishing and polishing after it was soldered together. The testimony did not show that the plaintiff's invention of the open spiral link form tubing had been practically anticipated by others.

A large serpentine bracelet made of a coil of gold tubing, to be worn upon the fore arm, and to be kept in its place by pressure, was also introduced as an anticipating device. It manifestly is a very different article from a chain, and the fact that a gold tubing was known and used in the manufacture of jewelry was conceded by the plaintiffs.

It was also suggested by the defendants that the specification does not describe the process of manufacture of the spiral link with the exactness which is requisite. The manner in which gold tubing is manufactured is well known to all persons skilled in the art. After having been compressed around copper wire, it is wound upon a mandrel; the wire is then removed by acid, and the coil of tubing, having been secured with wire, is annealed into the proper shape. This process is thoroughly understood by the manufacturing jeweler. It would have been a waste of words to explain the method of manufacture to a class of persons who are sufficiently informed when they are told that the link is "formed of one or more coils of tubing of the proper length, so as to form a double spring link."

The first claim is not a claim for an ornamental chain composed of alternate closed links, and open spiral links, without reference to the material of which the spiral link is made, but it is a claim for a chain composed of alternate closed links and open spiral links formed of one or more coils of gold tubing, as shown and described. The finish, as given to the chain by the shot at the end of the open link, is not a material part of the invention.

There should be a decree for an injunction, and a reference to a master to take and state the account.

[*B. F. Lee* and *A. A. Alvord*, for complainants.
Jos. C. Fraley and *Henry Baldwin, Jr.*, for defendants.]

NEW BOOKS AND PUBLICATIONS.

THE INTERNATIONAL REVIEW. March—April, 1876. Published Six times a year. Subscription price, $5. New York city, Chicago, and New Orleans: A. S. Barnes & Co.

To the scientific reader, the most interesting paper in this number of the above periodical is Professor Vogel's "Chemical Action of Plants," in which the invaluable assistance of plant life to mankind, in the accomplishment of many purposes which human skill and scientific industry do not, and perhaps never will, enable us to perform, is demonstrated by a variety of illustrative instances. Professor Proctor's "Essay on the Structure of the Universe" reveals no new thought, and is characterized by the same peculiarity of that astronomer which obtrudes itself in many other of his recent productions, namely, of saying little and writing much. For a scientist whose ideas have undergone such radical changes, amounting to the abandonment of previous convictions, and whose present notions may undergo like revolution in the future, it would appear safer to speculate less, or, at least, not to extenuate his thoughts through a multiplicity of books and essays. A careful memoir of Professor Cairnes, the great English political economist, is contributed by Mr. George Walker. There is an instructive article on "Bardism," and a useful paper on "The Old and the New South," beside a valuable series of reviews of recent foreign publications.

THE NEW GUIDE TO ROSE CULTURE. Published Annually by the Dingee and Conard Company, Rose Growers, West Grove, Chester county, Pa. Price 10 cents.

The successful cultivators of roses who publish this interesting pamphlet have introduced a new system of supplying their numerous customers with rose trees. They send them by mail, and guarantee their delivery in good order. Thus amateurs of roses can obtain specimens of all the choicest varieties of this most beautiful flower, merely by sending a letter and post office order to the growers, as above. The New Guide is published to aid purchasers in making a selection; and it contains a complete list of all the roses now in demand, with detailed particulars. Illustrations and descriptions of other plants and flowering shrubs are added, together with other valuable information on floriculture. See a further announcement in our advertising pages.

THE EDEN OF LABOR, OR THE CHRISTIAN UTOPIA. By T. Wharton Collens, Author of "Humanics," etc. Price $1.25. Philadelphia, Pa.: Henry Carey Baird & Co., 810 Walnut street.

Mr. Collens announces, in his preface, that his design is to develop a practical plan for the application of the fundamental principle, "admitted by all political economists," that "labor is the real measure of the exchangeable value of all commodities and services," and to show that the principle and its application rest upon the duty of Christians towards God and each other. Such of our readers as may read the book will be surprised at many of its statements, and at the autocratic manner in which the author lays down his opinions; and the strange commingling of the holiest names and the most solemn subjects with inflation theories and the advocacy of paper as a source of wealth would be amusing but for its irreverence. We do not think that the currency question is to be settled by such publications as this.

THE TEXTILE COLORIST, a Journal of Bleaching, Printing, Dyeing, and Finishing Textile Fabrics, and the Manufacture and Application of Coloring Matters. Edited by Charles O'Neill, F.C.S., Author of "The Chemistry of Calico Printing, Bleaching, Dyeing, etc." Nos. 1 and 2. January and February, 1876. Subscription price $12 a year, payable in advance. New York city: John Wiley & Sons, 15 Astor Place.

This monthly publication gives promise of being a technical journal of the highest order. Its subject has long been the most interesting and progressive branch of industrial chemistry; and the rapidly extending use of chemical dyes gives additional value to such thoroughly digested and trustworthy information as this serial contains. The following articles are found in the pages of the first number: "Lime Juice, Argols, Citric and Tartaric Acids," "Methylaniline Purple on Cotton," "Straining Colors by Atmospheric Pressure," and "Sulphur as a Mordant for Aniline Green." Contemporary news as to new discoveries, patents, reviews, etc., is added; and an extended treatise (by the editor) on "The Practice and Principles of Calico Printing, Bleaching, Dyeing," etc., is commenced in this issue. The publication is illustrated with diagrams, etc., and each number contains 96 pages.

SPECIFICATION AND WORKING DRAWINGS OF A SWISS GOTHIC FRAME COTTAGE. By D. T. Atwood, Architect. New York city: A. J. Bicknell & Co., 27 Warren street.

This publication would be useful to many of our readers in the West and South, and to any one who desires to build a serviceable and elegant cottage without the assistance of an architect. The design of the structure is commendable, and the interior is especially arranged with a view to convenience; and the specification lays down the requirements for a well built and commodious house. Such usefully practical publications deserve the highest recommendation.

BURLEY'S UNITED STATES CENTENNIAL GAZETTEER AND GUIDE FOR 1876. Edited by Charles Holland Kidder. Philadelphia, Pa.: S. W. Burley, Proprietor and Publisher.

This handsome volume is a general cyclopædia, historical and statistic, of the United States, both now and during the past century. The information as to the Centennial Exposition is extensive, and apparently accurate; and the industrial statistics are elaborate and well arranged. The book is likely to have an extensive sale.

DESIGNING BELT GEARING. By E. J. Cowling Welch, Author of "Designing Valve Gearing," etc. Price 20 cents. New York city: E. & F. N. Spon, 446 Broome street.

This is a very elaborate treatise on a simple yet important subject, and will be useful to such of our readers as understand the higher mathematics.

THE CREED OF FREE TRADE. By David A. Wells. New York city: Hurd & Houghton, 13 Astor Place.

Mr. Wells commences his text with the indisputable axiom that the highest right of property is to *freely* exchange it for other property; and the truths that he deduces from this maxim are as self-evident as their source.

THE ECLECTIC MAGAZINE for March has a remarkably good table of contents. We can cordially recommend this magazine to our readers as one of the most instructive and useful of our monthly periodicals. It contains the best short papers which appear in the English monthlies, selected with great discrimination and judgment, beside one or two good continued serials. The present number has Mr. Gladstone's address on "Science and Art," Dr. Bastian's essay on "Why Animals have a Nervous System," "Her Dearest Foe" and "Jonathan" (continued), besides articles on "Montenegro," "Richelieu," "German Home Life," "The Unseen Universe," etc. The only objection to the magazine we can find is its embellishments. This month, there is a steel engraving of President Barnard, which, as a likeness, is almost as bad as a bust for which the learned and amiable scientist patiently sat during a recent American Institute Fair, to the delectation of a gaping crowd and to the furtherance of the reputation of the aspiring sculptress. If somebody would buy both plate and bust, and scrupulously destroy them, it would be a service both to Dr. Barnard and to posterity.

HARPER'S MAGAZINE for March contains an illustrated article on the Danube Principalities, which is of timely interest with reference to the recent Herzegovinian outbreak. Professor Samuel Lockwood contributes a paper on the "Microscope," written in plain and simple style and copiously embellished with engravings. George Eliot's "Daniel Deronda," the reigning sensation of the literary world, is continued; another instalment of the "First Century of the Republic" series treats of the progress of literature in this country; and there is the usual good selection of short stories, beside the summaries, scientific and otherwise, of recent events. Harper & Brothers, New York. $4 a year.

THE SANITARIAN for March opens with a lengthy paper, forming, as a lawyer would say, a "case" in favor of the use of salt for the removal of snow from the streets. All the evidence in the shape of professional opinions, *pro* and *con*, is adduced, and a preponderance appears to exist in favor of salt, a committee of the College of Physicians, among other authorities, certifying to its non-deleterious influence as regards public health. Dr. Bailey has a sensible article on "Ventilation of Churches," Mr. A. H. Dana tells of the "Uses and Abuses of Life Insurance" in a clear and concise essay, and there is an address, recently delivered by Dr. Doremus, on "Milk in its Medico-Legal Aspects." $3.00 a year. McDivett, Campbell & Co., Publishers, 79 Nassau street, New York.

Recent American and Foreign Patents.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED FRUIT DRYER.

Samuel W. Hope, Dover, Del.—This device includes a flue-shaped chamber having a heater at the bottom and a system of small tubes at the sides, for taking some of the air up around or by the trays, and discharging it into the drying flue again, between the trays, and also another system for drawing out the air from the spaces between the trays as it becomes charged with moisture by evaporation of the moisture of the fruit.

IMPROVED PAPER FILE FASTENER.

Charles D. Lindsey, Cincinnati, Ohio.—This fastener is made of a single piece of metal split for a certain distance at each end. The strip is then folded lengthwise. The split portion at one end has each extremity bent at right angles, while the ends of the other split part are sharpened. The latter are inserted through the paper and bent flat.

IMPROVED INVALID CHAIR.

Covedra B. Sheldon, 7 State street, New York city.—Mr. Sheldon now offers another ingenious device, in the shape of an easy chair suitable for physicians' or invalids' uses. It has an adjustable foot rest arranged to be raised upon its pivots to a horizontal position, and a back to fall down on a level with the seat, to form a bed or lounge. It also folds up for storing away compactly. There is an improved contrivance of the adjusting back support, a new arrangement of the adjusting foot support, and a cane bottom for the latter. The entire chair is of very light but strong construction. Mr. Sheldon is one of the most persistent inventors we have ever known. His patents must now number in the neighborhood of fifty; and as he is yet a young man, we have no doubt but that his "centennial" invention is a future possibility.

IMPROVED BACK STRAP BUCKLE AND TRACE CARRIER.

James W. Weed, Clarinda, Iowa.—This is a simple fastening device for the back and hip straps of harness, by which the cutting and stitching of the same is obviated, and a stronger and more durable connection of the straps obtained, while it furnishes also a hook support for the traces when the animals are detached from the vehicle. It consists of an oblong device with loops at all sides, and a central vertical pin for the fastening of the crossing straps. The side loops of the hip straps are furthermore provided with T-shaped hooks or carriers for the traces.

IMPROVED LAMP TRIMMER.

Philip Sidney Lyman, Chicago, Ill.—The invention relates to the construction of lamp trimmers, so that the wick may be cleanly cut and with perfect evenness, and consists in making it with handles angled at their ends, working upon the same fulcrum, one moving in a vertical, while the other moves in a horizontal plane, and provided with cutting blades, kept in continual close contact by guides that project from one of them.

IMPROVED TRUSSED STANDARDS FOR PIANOS.

Edwin Oakley, Lerrika, Ovalan, Fiji Islands.—The object of this invention is to provide a standard which shall counteract the overhanging strain of wires and prevent curving or bending in the back of upright pianofortes. It consists in the combination with upright pieces having obtuse angular grooves, and a tapering mortise, of trusses fitting in said grooves, and a wedge fitting in said mortise, and the whole so arranged as to form a rigid and secure brace for the standards, for the purpose of resisting the tension of the wires.

IMPROVED TOY PISTOL.

O. C. Butterweck, St. Louis, Mo.—The invention relates to a pistol whereby a marble may be ejected from the barrel with considerable striking force, by a rear-impelling spring that drives the piston rod forward as soon as the latter is lifted by the trigger. By the peculiar mode of combining the trigger and piston rod with the spring, the impulse is given with great facility, and without any liability of deranging the aim.

IMPROVED LIGHTNING ROD.

Isaac Johnson and David A. Price, Chicago, Ill.—The invention relates to that class of lightning rods made of tubular form and in several parts joined together. It consists in reinforcing and stiffening the tube sections with a metallic rod that does not fit up to the inside of the tube, but is maintained in a rigid and immovable position on the axial line of the outer cylinder by attachment at each end to a coupler; also in combining with each section a pair of peculiarly constructed couplers, one having a threaded socket and the other a screw, while each is provided with an opposite central recess for receiving the strengthening rod, and a conical cavity at the outer end of the recess for directing and guiding the end of the rod to its rest in the recess.

NEW AGRICULTURAL INVENTIONS.

IMPROVED PORTABLE FENCE.

Urias Crayton, Davidson College, N. C.—The invention relates to portable fences which may be employed for different cross lines at different times, and consists in causing a tapered edge of one panel to fit into a corresponding groove of the next adjacent one, thus preventing one panel from ever being forced past another by an ordinary pushing force or by a wind.

BAND CUTTER AND FEEDER FOR THRASHING MACHINES.

Godfrey L. Gearhart and Nicholas W. Hoffman, Lebanon, N. J.—This is an automatic feeding apparatus for thrashing machines, by which the sheaves are readily and evenly cut, spread, and conveyed to the thrasher without an attendant. The invention consists, mainly, of a reciprocating shaker with a side shelf, from which the sheaves are pushed on stationary fingers, arranged concavely with cutting knives to cut the bands. The stalks are dropped through the fingers and pushed forward by lateral strips of the shaker, to be then evenly distributed by vibrating rakes, and conveyed to the thrasher.

IMPROVED HAY STACKER.

Moses Amidon, Lathrop, Mo.—In using this device, a rake is drawn over the field by horses until loaded. The loaded rake is then drawn upon and then from the platform, leaving the rake load of hay within the hopper. As the rake passes from the platform the horses are stopped, and suitable arrangements are made whereby the hopper is caused to carry the hay over and discharge it upon the stack.

IMPROVED SWARM BOX.

Andrew Harbison, Newcastle, Pa.—The object of this invention is to catch swarms of bees as they issue from the parent hive, and keep them confined until at leisure to introduce them into new habitations, thereby saving much time of the attendant, risk of several swarms mingling together, and the consequent destruction of their queens, as well as the danger of leaving for the woods. The swarm box is constructed of thin light lumber, except the top, which is of wire cloth. The swarm is caused to pass through a tube extending inward and upward, at an angle of about 45°. The edges around this tube are armed with wire pickets, the object being to prevent the bees from again returning to the parent hive, as they cannot successfully pass over the wire pickets. On the sides, in the interior, there are shelves on each side for the swarm to cluster on, as a support is necessary when a swarm is to remain in the box for some time before hiving.

IMPROVED BUTTER PACKAGE.

Andrew J. Dibble, Franklin, assignor to himself and David G. Landon, Delhi, N. Y.—This inventor proposes a new butter form, constructed of a single block of wood, having conical cavity, in which the butter is packed. These forms may be packed together and transported. The inventor states that they will cost about one cent a piece; and after the butter is once packed in them it need not be disturbed until each reaches the consumer. Each form is made to receive a given weight of butter.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

The "Catechism of the Locomotive," 625 pages, 250 engravings. The theory, construction, and management of American Locomotives. Sent post paid, on receipt of $2. H. P. Stein, RR. Gazette, 73 Broadway, N.Y.

Wanted—Locomotive, 6 to 10 tuns, 3 ft. gauge, for wood rail. Send photo. Barner Bros., Longview, Texas.

"Wrinkles and Recipes" is the best practical Handbook for Mechanics and Engineers. Hundreds of valuable trade suggestions, prepared expressly by celebrated experts and by correspondents of the "Scientific American." 250 pages. Elegantly bound and illustrated. A splendid Christmas gift for workmen and apprentices. Mailed, post paid, for $1.50. Address H. N. Munn, Publisher, P. O. Box 772, New York city.

For Sale—An established business, manufacturing metal goods. Patented. Box 729, Providence, R. I.

For Sale—Two Valuable Patents: Automatic Grinding Machine, for grinding Planer Knives, Leather-Splitting Knives, Cloth Shears, &c. Also Friction Clutch, the best in the market. For particulars, address E. S. Fernald, Saco, Me.

Manufacturers desiring a full description and statement of the mechanical construction and working, and of the merits of the lately patented adjustable calendar and almanac, illustrated in the "Scientific American" of February 12 last, may obtain the same by addressing the Inventor and Patentee, David J. Miller, at Santa Fé, New Mexico.

Waggener's Improved Trial-Balance Book—Invaluable to Book-Keepers. Saves time: systematizes the work: prevents errors. Now in general use. 12 mo's form—No. 1, 500 acc'ts, $1.80: No. 2, 1,000 acc'ts, $2.70: No. 3, 2,000 acc'ts, $4.50. 6 mo's form—No. 4, 500 acc'ts, two periods of 6 mo's, $2.25: No. 5, 1,000 acc'ts, two periods of 6 mo's, $3.15. Sent postpaid. Catalogue free. D. B. Waggener & Co., Publishers, 420 Walnut St., Phila.

Yacht & Stationary Engines, Sizes 2, 4, 6 & 8 H.P. Best for Price. N. W. Twiss, New Haven, Conn.

Patented articles manufactured at lowest prices, by the Allen Fire Supply Co., Providence, R. I.

Wanted—Manufacturer of Iron Tools or Steam Engines, to take part of a Salesroom in this city. Address B., P. O. Box 4779, New York city.

Manufacturers of Wagon Hub Machinery, send address to P. O. Box 58, Detroit, Minn.

Round Thread Hose Couplings and "Controlling Nozzles" are the best in use. E. M. Waldron, Prov., R.I.

Inlaying and Fret Sawing in Wood, Shell, Metal, &c. See Fleetwood Scroll Saw, page 188.

File-cutting Machines. C. Vogel, Fort Lee, N. J.

Amoskeag Steam Fire Engine, first class, for Sale. Is in excellent order throughout. Has two 8x10 cylinders, rotary pump (wholly composition), steel waist boiler with copper tubes, 6 in. suction, and plays four 2¼ in. streams. Price $1,200, warranted. Address S. C. Forsaith & Co., Manchester, N. H.

Situation Wanted at Centennial, to Exhibit or Tend Machinery. F. N. B., Box 340, Flushing, L.I., N.Y.

Hearing Restored—A great invention by one who was deaf for 20 years. Send stamp for particulars to Jno. Garmore, Lock-box 80, Madison, Ind.

$1,000 for any Churn ahead of "The Prize." A. B. Cohu, 197 Water Street, New York.

A Clear Field—Small capital ensures heavy percent. Territory, etc. Liquid Vent Co., Kansas City, Mo.

For Sale—36 in.x16½ ft. Lathe, $400; 28 in.x8 ft. Lathe, $200; 18½ in.x12 ft. Lathe, $250; 15 in.x8 ft. Lathe, $175; 6 ft. Planer, $350; 3 ft. Planer, $200; 36 in. Drill, $125. Shearman, 45 Cortlandt St., New York.

Wanted—Universal Milling Machine, Brown & Sharp M'f'g Co., Providence, R. I., make preferred. Address, giving price, cash, Wm. E. Lewis, Cleveland, O.

Sash and Door Factory, Planing Mill, &c., for Sale. See advertisement on page 172.

Painters & Grainers—Send for descriptive Catalogue, & Sample of first class & quick Graining. Executed with my new perforated Metallic Graining Tools. 40,000 in daily use. J. J. Callow, Cleveland, Ohio.

Wanted—Every Machine Shop to send for one of Gardiner's pat. centering and squaring attachments for Lathes. On five days' trial, to be returned at our expense if not satisfactory. 700 one inch shafts centered and squared up per day. Price $35. R. E. State & Co., Springfield, Ohio.

Family Dish Drainer—Shop right deed and patterns, $10 per year. J. R. Abbe, Lawrence, Mass.

Yocom's Split-Collars and Split-Pulleys are same appearance, strength, and price, as Whole-Collars, and Whole-Pulleys. Shafting Works, Drinker St., below 147 North Second Street, Philadelphia, Pa.

Solid Emery Vulcanite Wheels—The Original Solid Emery Wheel—other kinds imitations and inferior. Caution—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, New York.

Steel Castings, from one lb. to five thousand lbs. Invaluable where great strength and durability are required. Send for Circular. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

$1,000 for any Hand Saw Mill equal to A. B. Cohu's, 197 Water St., New York.

A Valuable Patent for Sale to the highest bidder. Smith's Improved Awl, for sewing leather without bristles. For Cut and description, see Scientific American of July 31, 1875. Address Sylvester A. Smith, Letts, Louisa Co., Iowa.

Best Line Shaft, Pulleys, Dead Pulleys, Couplings, etc., in the country. Catalogue free. A. B. Cook & Co., Erie, Pa.

Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y., U. S. A.

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co., New Haven, Ct.

Water, Gas and Steam Goods—Send eight stamps for Catalogue, containing over 400 illustrations, to Bailey, Farrell & Co., Pittsburgh, Pa.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph &c.

Hotchkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

American Metaline Co., 61 Warren St., N.Y. City.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 470 Grand Street, New York.

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass.

For best Bolt Cutter, at greatly reduced prices, address H. B. Brown & Co., New Haven Conn.

Diamond Tools—J. Dickinson, 64 Nassau St., N.Y.

Temples and Oilcans. Draper, Hopedale, Mass.

For 6 1st class Shapers and other tools, new and 2nd hand, address E. P. Bullard, 48 Beekman St., N. Y.

Peck's Patent Drop Press. Still the best in use. Address Milo Peck, New Haven, Conn.

All Fruit-can Tools, Ferracute W'ks, Bridgeton, N.J.

Notes & Queries

A. P. will find an answer to his query as to a ball dropped through the earth, a vacuum being maintained in the hole, on pp. 138, 250, vol. 31.—D. O. F. will find the description of a method of putting a black enameled finish on cast iron on p. 238, vol. 28.—H. L. M. will find directions for polishing handles, etc., in the lathe on p. 138, vol. 24.—C. H. S. will find directions for preparing corn cobs for kindling on p. 325, vol. 26.—C. W. B. can mend his rubber boots by the method described on p. 203, vol. 30.—J. M. will find directions for making friction matches on p. 75, vol. 29.—S. T. is informed that there is no safe way of tampering with the natural change of color in the hair.—J. P. C. will find that the proper speed for a circular saw is given on p. 163, vol. 34.—C. B. R. will find directions for producing white enamel on iron on p. 382, vol. 32. This also answers H. W. P.—F. D. can remove rust from his steel tools by following the directions given on p. 56, vol. 33.—M. J. M. is informed that we cannot recommend a boiler scale preventive, as we do not know what is the injurious element in his water.—A. J. P. will find a solution of the wheel difficulty on p. 298, vol. 31.—D C. can clean his tarnished plated goods by the method described on p. 251, vol. 33.—W. A. will find directions for making corn starch on p. 154, vol. 30.—H. B. L. will find full directions for soldering cast iron on p. 251, vol. 28.—H. B. C. will find full directions for bronzing cast iron on p. 11, vol. 33.—F. H. L. will find an article on the strength of cast and wrought iron at different temperatures on p. 43, vol. 30.—W. T. R. will find directions for cleansing mercury on p. 131, vol. 30.—F. W. D. will find directions for making a silver-plating solution, for use with a battery, on p. 362, vol. 31.—I. B. & S. should apply to a toy manufacturer.—A. J. G. should read our article on the horse power of engines, published on p. 33, vol. 33.—C. D. F. is informed that we are unable to calculate the horse power of boilers from the dimensions and pressure. No trustworthy formula for such a calculation has ever been laid down.—J. McE. will find directions for building a refrigerating room on p. 251, vol. 31.—B. H. Jr. is wrong in trying to remove hair from his face.—J. V. B. will find directions for producing a green bronze on brass on p. 51, vol. 33.—J. V. B. will find directions for polishing meerschaum on p. 155, vol. 31.—H. M. H. will find directions for making rubber cement on p. 119, vol. 28. The construction of an aquarium is described on p. 80, vol 31.—F. J. will find directions for transferring engravings to wood on p. 138, vol. 30.—W. K. P. must use olive oil and white phosphorus for his phosphorus and oil lamp.—A. M. G. will find the required tables as to temperature and pressure of steam in Box's "Treatise on Heat."—W. R. M., H. G., H. H., E. H, G. A. B., W. & S., and many other correspondents who ask us to recommend books on industrial and scientific subjects should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) E. W. H. says: In a recent number of the Scientific American appears an article under the head of "The New Phase of Electric Force." I tried the experiment, using a telegraph sounder. I arranged the wires so that the armature vibrated. I now fastened a wire to the armature, but could obtain no sparks. I used three cups of Bunsen battery. What is the matter? A. Try again.

(2) C. S. says: Please give me a formula for preparing a solution to electroplate zinc with copper. I have tried the usual cyanide of copper solution, with the peculiar result of first throwing down copper, which in a few moments turns to a bright yellow, like brass. What is my trouble? A. Dissolve ¼ oz. sulphate of copper for every pint of water; add ammonia till all precipitate is re-dissolved, forming a deep blue solution, then add solution of cyanide of potassium till this color quite disappears. Add ammonia and cyanide whenever required. When these are deficient the anode becomes coated with a blue powder. About two Grove or Bunsen cells will be required.

(3) E. B. asks: Can steel knives be silver plated without putting some other metal on first? A. No, not so that the coating will adhere properly.

(4) J. G. asks: 1. What size of wire is fine enough to wrap the electro-magnet of a Morse sounder? A. No. 18 will be found a convenient size. 2. How many feet will it take? A. Use 20 or 25 feet. 3. Is it necessary to cover the silver plate of a Smee battery with platinum? A. Yes, to get the best effect. 4. How is the Léclanché battery arranged? A. Manganese and carbon in the porous cell, the latter closed with pitch, and a zinc rod in the outer cell. Use a solution of sal ammoniac for the excitant.

I made a marine telescope for use in water, but I cannot see much, as the water is muddy. Can I arrange a lamp inside it, and how? A. Some form of electric light might be used.

I made a phosphorus lamp, according to your directions, but it will not work. I boiled sweet oil, and poured it in the bottle on a small piece of white phosphorus. What was the trouble? A. Warm the bottle slightly by holding it in the hands or by placing it in a warm place, away from the fire, for a short time: then expose the oil to the air by opening the bottle.

(5) S. G. says: If oxygen and nitrogen are properly compounded, will they form an atmosphere that will sustain life? If so, why cannot they be used in sea diving? A. You propose merely to supply artificial air. There is no advantage in this, as common air may be pumped into the bell from above, or already stored there under pressure.

(6) A. S. G. says: I have observed some points in experimenting with a small induction coil which seem peculiar, and I shall be glad if you can assist me to an explanation of them. With the current from a quart Grenet, the secondary sparks will leap nearly ⅜ inch when the battery is in its best condition. Of course, sparks pass freely between wires from the secondary poles, when brought within striking distance; a point which troubles me is that sparks are freely given off from one secondary pole when no circuit is made. A. The case is one of inductive action, and is observable with all high tension electrical apparatus. 2. Another peculiar phenomenon is that the primary current gives quite severe shocks. When the circuit-breaker (magnetic) is operating (no connection between the secondary poles) upon pressing a moistened finger on the thumb screw which governs the distance of the platinum point from the vibrator, and another on either of the thumb screws of the battery, a current is felt, very similar to that from a medical coil, when the bundle of wires is pushed about half in. A. The shock is occasioned by the extra current. This is produced by the induction of the battery current upon itself, hightened, also, by the reaction of the magnetism in the core.

(7) C. I. H. asks: What is the matter with my battery? I have 4 cups (bichromate of potash) and I get a stronger shock with 2 cups than with 4. I use an induction coil; the wires are No. 36 and No. 20. Are these sizes right? A. If the wire of your primary coil were a little larger, we think you would obtain somewhat better results. It is quite likely that bad connections cause most of your troubles.

(8) D. G. asks: 1. What is meant by a drop forging? Is there any way of driving hot iron (wrought) into molds to produce given forms, such as are difficult to forge? A. Yes. Drop forgings are forgings driven into a mold or form by a drop hammer. 2. What is cast cast steel? Has it greater strength than iron, or is it simply harder? A. Cast cast steel is a casting made of cast steel. It is much stronger than wrought iron, and is soft. 3. How does it compare with cast steel? A. It is cast steel of fair quality. 3. Is malleable iron strong enough to do good service with a thread and nut, or will it pull in two too easily? A. It is strong enough if sound.

(9) N. L. C. asks: Why does cider made from sound apples in a hand press, and carefully bottled in clean botties, have, year after year, a bitter taste? A. If it is as you say, we can give no reason.

(10) L. B. says: I am framing a barn, and I want to raise it with a pair of pulley blocks with 1¼ inch Manilla rope and a gin pole. The bents will consist of one beam 36 feet long, 9 x 9 inches, 2 posts 20 feet long, 9 x 9 inches, 2 posts under the beam 16 feet long dividing the 36 feet into three equal spaces, and three girths 5 feet 6 inches in each space. 1. Will a pair of pulley blocks that will carry that size of rope be strong enough? A. Yes. 2. How large will I want the guy ropes to steady the pole, and how many are necessary? The blocks are what they call four fall. A. Provide four guy ropes, placed at equal distances around the pole, and so placed that the strain when the load is on will be borne by two at once; 1¼ inch ropes will do for these. 3. Could I raise a barn that way by using a span of horses to pull with? A. Yes; but if you are shorthanded you had better raise your frame by single stick, which is now quite frequently practised. Set up a corner post and brace it both ways in its proper position; then set up the next post and brace it, putting the girt in its place at the same time; so proceed with the third post and girt; then put in your 36 feet beam and last girt, and set the remaining corner post. You will probably find this plan attended with less labor, and with less danger from accidents, than that of raising by bents. The heavy sticks may be raised by a pole and single pulley, if required.

(11) W. H. K. asks: Can a person's beard be permanently destroyed without injury to the skin? A. Try the following: Make a strong solution of sulphuret of barium in warm water; and when required for use, mix it into a paste with powdered starch and apply immediately. In about 10 or 15 minutes, or sooner if much smarting occurs, the paste should be removed by means of warm water.

(12) S. D. asks: Please inform me what will cleanse brass shells, used in breech-loading guns. A. We suppose you refer to the blackish carbonaceous crust formed on the surface of the shells, often to a considerable thickness. Try benzine or benzole, and finish with dilute nitric acid applied with a piece of cloth.

What will clarify or bleach chicken oil? A. There is no chicken oil sold in the New York market. Send a sample of what you wish clarified or bleached.

(13) A. P. D. asks: Will hard water do to use in an aquarium? A. Yes.

(14) H. S. asks: 1. I have been trying for some time to obtain flowers of any desired color. Where can I find the explanation of the meaning of color, and the conditions under which a given color is present? A. The information asked for is to be partly found in a *resume*, published in the "Quarterly Journal of Science" (Vol. XL., 1873, p. 451), of an investigation by H. C. Sorby on this subject. He found that the most important coloring substances met with in plants are insoluble in water, but soluble in bisulphide of carbon. He also made a series of determinations of the amount of coloring substances by obtaining solutions of the same tint, but of different depth. The total number of the fundamental coloring substances of plants isolated in this manner is about 12; for their names and properties see "Proceedings of the Royal Society," Vol. XXI, p. 442. 2. If I mix two different colors or paints I get a color different from the two. Now if I, by some means, extract one of the colors, would I not get the two colors separately again? A. Yes. 3. Can I not extract something from any color so as to change the original colors? A. Yes. 4. I have the impression that black is no color and white is all colors. Is this so? A. Black is the absence of color, and white is the mixture of all the spectrum colors. 5. I have been trying to make a plant digest certain substances through the aid of a galvanic battery. Has this ever been tried? I know it to be possible, for I have obtained such results. A. What are the results spoken of?

(15) F. C. B. asks: How can I make an ink for stamping buckskin and chamois leather, that will not smear? A. From the nature of the material it is a somewhat difficult matter to get a perfectly clear and legible impression from any hand stamp of ordinary description, no matter what kind of ink is employed. If a ribbon stamp, however, be employed, and an ink of sufficient fluidity, a clear imprint may be obtained without difficulty. It is requisite that the print should not be handled until the ink has sufficient time to dry. This drying, it is hardly necessary to add, will be much accelerated by a moderate warmth.

(16) G. C. says: I tried the following for nickel plating: "Take 4 parts nitrate of nickel, 4 parts liquid ammonia, 150 parts water, and 50 parts sulphate of soda." I could not get the nitrate o nickel, but was told that sulphate of nickel was the same thing, and I used it. It quickly made a thin coating of nickel, but I could not get it any thicker, as the solution crystalized and covered the articles and the anode all over with crystals ¼ of an inch thick. The anode was granular nickel in a cotton bag. Can you tell me the reason of that? A The following is recommended highly: 2½ parts sulphate of nickel and 1 part sulphate of ammonia, dissolved in enough water to keep the solution just below the point of saturation. This will diminish the tendency to crystallize. Use two or three Bunsen cells to start with; a single Smee cell will answer for the main deposit.

(17) J. E. B. asks: What are the solvents of pure asphalt? A. Asphalt is the term given to solid bitumen. The bitumens differ in the facility with which they are attacked by solvents. Most of them are in great part dissolved by ether, mixtures of ether and alcohol, turpentine, the essential oils, benzole, naphtha, etc.

(18) C. F. L. says: Our town authorities are talking of supplying the town with water by a pump or water ram, from a stream 1,000 feet distant to a hill 115 feet high, thence from a reservoir by pipe, 800 feet, to the streets, and up and down the streets, 2,000 feet more or less. The town is from 80 to 100 feet below the hill. Will pipes from the reservoir under that head be sufficient to put out fire, or would it be better to attach a large force pump to one of the water wheels and force the water through pipes to different parts of the town? A. The town of Rahway, N. J., and several other places are provided with what is said to be a very economical and effective system of water supply. It consists of a stationary engine supplying a certain number of millions of gallons of well water per day, at a certain pressure agreed upon, and which is at all times sufficient to force the water to the upper stories of the houses in the most elevated sections of the town. This is known as the Holly system, and would probably suit you better than any other. In case of fire the pressure is maintained at its maximum by means of the control obtained through the stationary engine. Write to Holly Manufacturing Company, Lockport, N. Y.

(19) M. O. R. says: I am about to build an engine 6 x 8 inches. I intend to have the steam ports ½ inch wide and 2 inches long, and the exhaust port 2 inches wide and 2 long. Will the ports be long enough for the engine? A. Make your steam ports ⅝ wide and 3 inches long, and the exhaust port 1¼ wide by 3 inches long.

(20) J. W. Jr. says: In one of your back numbers you say that the scent of the hay flower can be made of the bark of the mario. Please give me the directions. A. The plant is one newly discovered, and we have no description of it at hand. The statement that it may be employed as a source of the perfume "new mown hay" is made by a French perfumer.

1. What preparation is put on the sensitive plate for an instantaneous photograph? A. No photograph is actually instantaneous, although the time of exposure may be reduced to a very small fraction of a second. There must be a slide attached to the camera front, so arranged as to give a very brief exposure. Use a neutral new 30 grains bath, a bromo-iodized collodion just old enough to work, a plain iron developer, and a lens giving a strong bright image. Give a very brief development and see that the image is strongly and evenly illuminated. A collodion containing 5 grains ammonium iodide and 3 grains ammonium bromide to the ounce works well. 2. What substance is put on the sensitive plate after it comes out of the came

ra to bring the picture out? A. A good developer s composed of 3 ozs. protosulphate of iron, and 4 ozs. acetic acid to 16 ozs. water.

(21) A. D. T. says: I have a porcelain slate which has become so smooth that a pencil will not make a good mark on it. What can I use to give it a good surface to mark on? A. If the slate is really porcelain, try a little dilute sulphuric acid, which allow to remain in contact with the surface a short time. Then wash carefully with clean cold water and flow over it a little strong potash lye. Allow this latter to remain in contact with the porcelain for about half an hour, and then wash clean with water.

(22) J. D. M. & Co. say: There is an article of vegetable origin used in Germany for cleaning kid gloves, and as a substitute for white of eggs in icing cakes. Can you tell us what it is? A. When the water that has been used to wash starch from wheat flour or scraped potatoes is allowed to stand until it becomes clear, and is then boiled, it assumes a turbid appearance, and deposits a flaky white substance, which has the same character as the white of egg, and is known as vegetable albumen. When dried, it forms a brittle, yellow, gummy mass, which dissolves in cold water; but when coagulated it will not dissolve in water, either hot or cold. The change of coagulation does not alter its composition. The temperature at which it takes place varies. A strong solution of the albumen in water becomes completely insoluble at 145° Fah., and separates in flakes at 167°. The more it is diluted with water, the higher the temperature of coagulation.

(23) H.O.R. says: I have a well 10 feet deep. About 3 gallons of paraffin oil has leaked through the clay floor, 12 feet from it. Can you tell me how to clean it, and destroy the oil? A. The ordinary means of destroying or absorbing the oil would not answer in this case, and we know of no means of cleaning the well better than those usually employed. If you have at hand some absorbent clay or earth, it would assist you.

(24) P. S. says: 1. I have made a Daniell's battery, and am trying to make a Neef's hammer for producing shocks. Please explain the easiest method for making it, and how to make the connections of the wires from the battery and to the handles. A. If you wish to produce shocks from a single cell in which there is an iron core, arrange the coil horizontally on a wooden base, fix a short round piece of soft iron to a spring, and fasten the latter to the base in such a position that the iron piece is within the attractive influence of the core. An upright with an adjustable screw, against which the spring rests when the battery is not in circuit, is also attached to the base back of the spring. Connect one pole of the battery to the upright carrying the adjustable screw, the other pole to one end of the coil, and the opposite end of the coil to the spring. By properly regulating the adjusting screw, the iron piece will vibrate rapidly; and if the hands grasp conductors in communication with the upright and spring respectively, more or less intense shocks will be felt. 2. What form of battery is best adapted for producing shocks? A. Two or three Grove cells will answer. 3. Will silver answer the same purpose as platinum for the connections on the spring platinum point for breaking and making the circuit? A. No.

(25) A. R. M. says: How can I make a cement for sealing glass bottles that will not soften at a temperature of less than 250° Fah.? The stopper of the bottle is made of tin. A. Cut 3 parts of good india rubber into small shreds; dissolve it by heat and agitation in 34 parts of cold naphtha. Add to this 64 parts of shellac in fine powder, and heat the whole, with constant stirring, until the shellac is dissolved. Then pour it while hot on metal plates, to form sheets. When required for use, heat to 250° Fah. and apply quickly.

(26) B. & F. say: 1. We are fitting up a line shaft to make 220 to 240 revolutions per minute. We think of putting in an engine of 10 or 12 inches bore by 24 inches stroke, running at 100 or 110 revolutions per minute, with an 8 feet fly band wheel, requiring about a 40 inch pulley on line shaft. Some of our friends say a shorter stroke engine will be more economical. If so, how much? And where is the economy? A. A shorter stroke will be more economical if you run your engine proportionally faster, so as to have the same speed of piston per minute, the economy being because the temperature of the cylinder will be maintained more equally, and nearly equal to that of the initial steam. 2. Would it be more economical to put on a smaller band wheel, with ndependent fly wheel? A. Yes, if the bearing surface of the working parts will stand the necessary increase of speed.

(27) A. B. asks: What is the property or substance in the human body that gives lead, inhaled or otherwise absorbed into the system, its remarkable noxiousness? A. The subtlety of the poison in the fluids of the body is brought about by the presence there of carbonic acid. The amount of lead which may be received into the body, and the length of time which must be consumed in its reception before symptoms of poisoning can be developed, is uncertain. These factors depend upon the peculiarities of the patient, the form under which the metal is introduced into the system, and the channel through which it makes its way. Sometimes a single dose (so to speak) will be sufficient to produce severe symptoms of poisoning, and again months and years may elapse before a man who is constantly at work will be at all affected by it. The excretion of lead after it has been received into the body is performed very slowly. In bad cases of lead poisoning, the metal can be detected in the urine a ong time after the patient has been removed from the source of contamination. Parks mentions a case where a patient was exposed for the last time to the influence of lead on December 20, 1852, and lead was found in the urine on June 16, 1853, before treatment had been commenced.

(28) C. Y. asks: In $Na_2CO_3+10H_2O$, how can I cheaply and expeditiously get rid of several equivalents of H_2O so as to get a dry, white, almost anhydrous powder? I wish to gain the same result (in large quantities) as by letting it effloresce in dry air. A. Crystallized carbonate of soda contains 62¾ per cent of water. The crystals readily effloresce in the air, and melt in their own water of crystallization. On decanting the liquid from the fused mass, it is found that one part of the salt has given up its water of crystallization to an other. By evaporation of this liquid, crystals containing one fifth less water than common carbonate of soda are obtained. These do not effloresce in air. The same result may be obtained by heating the carbonate in a current of dry air for a short time.

(29) W. T. S. asks: How can I produce a crystallized surface on tinned plate? A. Use a mixture of 1 part nitric acid, 3 parts hydrochloric acid, and 50 parts water. First clean the plate with a strong solution of potash in water. When the crystalline structure has become fully developed, remove the acid and wash in clean water.

(30) J. G. says: I have a paint mordant, which I cannot make work. This is the formula: Mix 15 gallons water, 6 ozs. borax, and 3 lbs. silicate of soda. Heat until dissolved, then add 10 lbs. rosin, boil until dissolved. To this I wish to add rubber, but cannot dissolve the kind I have with benzine. It is old billiard cushions. How can I do it, and will rubber replace linseed oil and make durable paint? A. The rubber you mention is not suitable for the purpose. Use a purer rubber, and dissolve in the benzine by heat and agitation. This solution is not miscible with the solution of borax, water glass, etc., and will not replace linseed oil. 2. Would more water glass be of use? A. No. Shellac might replace part of the rosin.

(31) A. F. O. asks: 1. What is the process for enameling on zinc in making faces for common clocks? A. The zinc disks are simply painted with white lead, containing sufficient zinc-white to maintain the requisite intensity. 2. How are the the figures put on? A. The figures are worked on with stencil plates and afterwards finished with a brush; and finally the whole is finished with a coating of good picture varnish.

(32) E. C. N. asks: Why does paint which is made of pure linseed oil and lead affect young children and even some adults? A. There is no doubt that lead finds its way into the human body, under certain conditions, and there produces a variety of morbid changes, which may in some instances terminate in death; for the metal has often been found after death in the muscles, liver, brain, and other organs. White lead paint is introduced into the body in three ways: First, by the lungs. This takes place chiefly among house painters, when the lead is mixed with turpentine in large quantities. In the evaporation of the latter, a small amount of lead is carried off, and is breathed into the lungs. Lead dust may be taken in the same way. The second way is by direct absorption through the skin. The third method is by the mouth. When the painter is careless about his personal cleanliness, and neglects to change his clothing at meal time, a considerable quantity of paint may be taken into the body with his food and drink. This is especially true of his midday meal, which in many cases is eaten on the spot where his work is going on.

(33) J. H. L. asks: In the process of making malleable cast iron, is soft or hard cast iron employed? A. A mixture of two good sorts of No. 2 pig iron and old scrap is used, the latter in the proportion of ⅓.

(34) J. S. G. says: In reply to a correspondent who asked for the method of calculating logarithms, you give the following: Let a=any number. Then $\log.\left(\frac{a}{a-1}\right)=0{\cdot}868589\times\frac{1}{2a-1}+$, etc. Why do you not tell us how you came by that number 0·868589? A. In the answer referred to, our correspondent only asked for a formula, by which he could calculate the logarithm of a number. The demonstration of the formula would require considerable analysis, quite out of place in our columns, as the matter may be found clearly treated in a number of works, among which we may mention "Rudimentary Treatise on Logarithms," Weale's series, introductory to Law's "Tables," Hutton's "Mathematical Tables," Davies' Bourdon's "Algebra," and Todhunter's "Algebra."

(35) B. & H. say: Please tell us whether there will be any difference in the drawing power of two locomotives, of equal weights, etc., one of which has drivers of a larger diameter than the other. A. The smaller the driving wheel, the greater the leverage at which the power is working to the load, and hence the greater the tractive power.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

E. M.—It is red ocher.—H. W.—No. 1 is red oxide of iron or hematite. No. 2 is iron pyrites.—J. M. M.'s specimen is under examination, but no one has been able as yet to identify it.—Specimen from Noblesville, Ind., is iron pyrites.—Specimen marked "Eberhart" is sulphide of antimony. One marked "Cannon" is green quartz marked on surface by oxide of manganese.

R. C. C. asks: What was the Egyptian mode of incubation?—F. N. asks: How can I calculate the quantity of air that and the velocity with which it will pass through a given aperture at a given pressure?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Storm and Flood Signals. By A. W.
On Cotton Factories in the South. By E. H.
On Timber Waste. By H. C. B.
On Bank Vaults. By J. K.
On a Patent Pirate. By C. F. J., Jr.
On a Mathematical Problem. By A. B.
On Boiler Explosions. By A. C.
On Centennial Circulars. By T. A. R.
On Mohair Goods. By O. C. K.

Also inquiries and answers from the following: J. G. W.—F. W.—T. D. T.—E. H.—J. S. W.—S. H. W. —J. L.—C. P.—R. F. J.—B. L.—C. K.—T. C.—J. T.— T. H.—W. E. G.—B. D.—J. H. T.—G. C.—C. J. F.— W. T.—R. H.—S. S.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Whose steam boiler is the safest? Who sells ready made iron fences, posts and all? Who sells egg-hatching machinery? Who sells bookbinders' cloth, dyed with permanent colors? Who makes machinery for cleaning moss for upholstery? Who sells the officinal preparations of boldo? Who sells penholders which teach the proper position for holding the pen?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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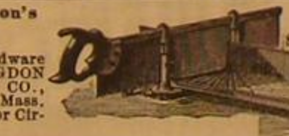

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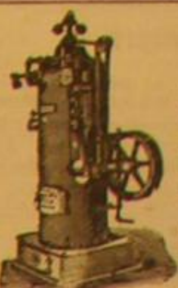

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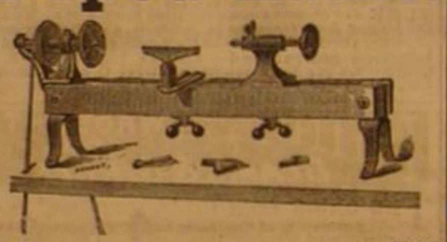

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