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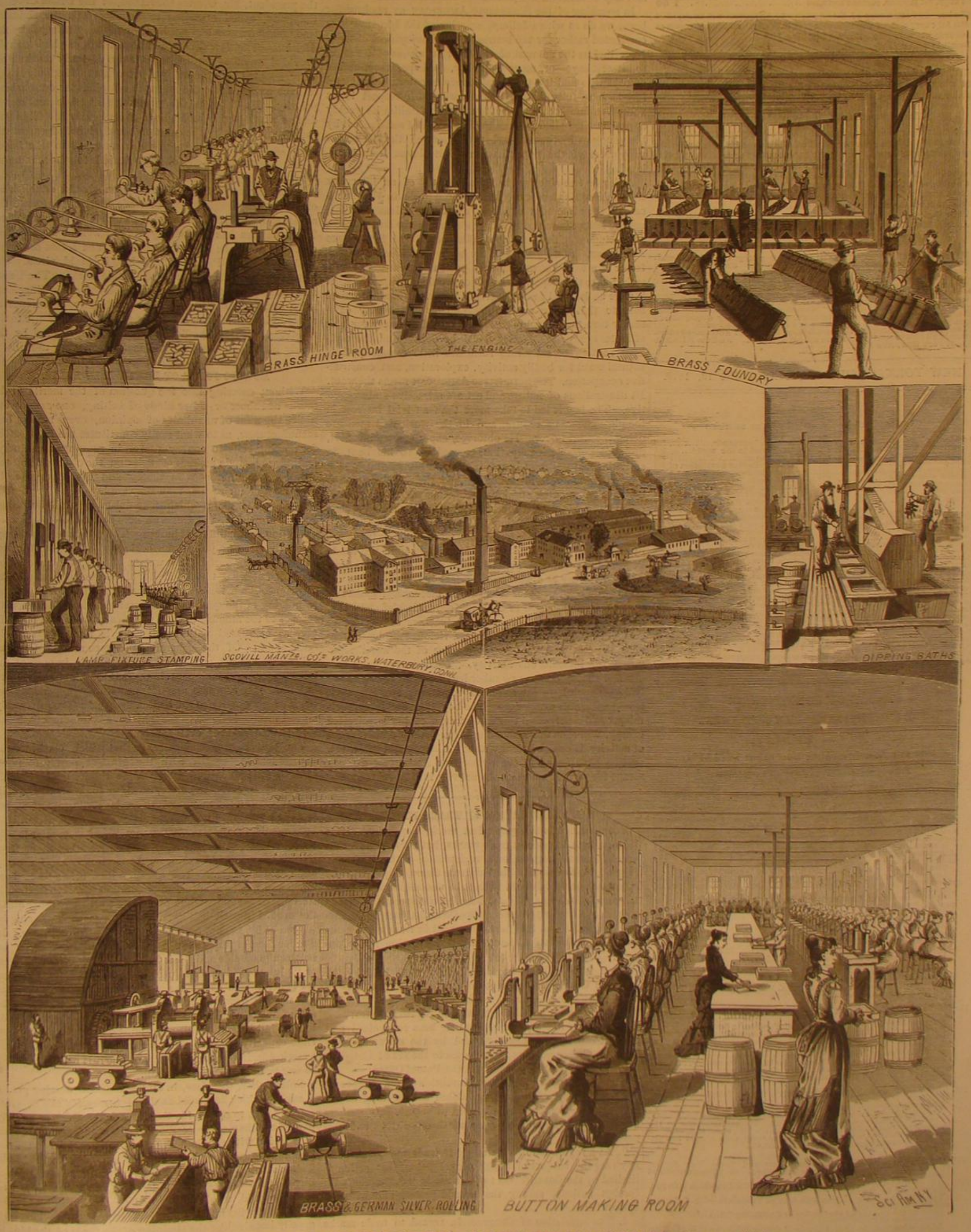

BRASS WORKS OF THE SCOVILL MANUFACTURING COMPANY.—[See page 380.]

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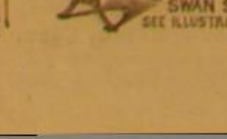

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(Signed) GEO. A. PAYNE.
State of New York, } ss.
City and County of New York, }
Sworn before me this 22d September, 1879.
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THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 50 Gold St., New York.

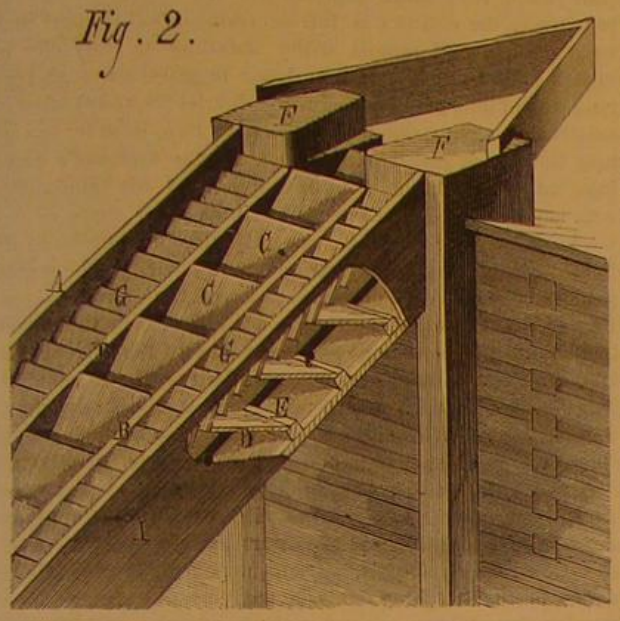
A NEW FISH WAY.

To provide a practicable passage for fish over dams or other obstructions, a current of water must be conducted from the upper level to the lower, with such velocity that fish may readily swim it, and under such conditions that they may readily find it.

Heretofore this has been accomplished in one of two ways. Either the total fall to be overcome has been broken into a succession of falls, connected by pools, as is common in the salmon ladders of Europe, or, second, the water is compelled to traverse a tortuous path down a flat incline—the tendency to increased velocity being controlled by the friction produced by the incessant changes of direction.

The greatest slope allowable for dams of any height is about one foot in twelve, and the length of the water way

Fig. 2.



McDONALD'S FISH WAY.

being about three times the length of the incline, it follows that fish, to overcome a fall of one foot, must swim a distance of thirty or forty feet, with continual changes of direction, and at every turn encountering baffling swirls or eddies.

In the fish way here illustrated and described the water is delivered down a straight sluice way having an inclination of one in three; on either side the water is banked with a slight upward and inward impulse, while down the center a current flows with uniform motion, being no faster at the foot of the way than it is at the top. The velocity of the central current may be regulated to four, three, or two miles an hour, as may be desired. The simple device by which these marvelous results are obtained will be readily understood by a careful study of the accompanying engravings.

Fig. 1 is a perspective view of the way as it appears when in operation. It is represented as built of timber, attached to a crib dam, and anchored to a rock bottom by means of iron rods. The intervening supports may be piles, as in the engravings, stone cribs, or trestles. The builder will determine the best modes of securing according to the circumstances of the particular case. At the head of the way is shown a V-shaped guard of timber, the lower edge of which is a few inches below the level of the crest of the dam. This will deflect the light floating material (sticks, leaves, etc.) and prevent any interference with the working of the way.

Fig. 2 is a perspective view of the upper portion of the way, with the side broken away to show the internal construction. Fig. 3 is a sectional view of the same.

The course of the water in the way is shown by the arrows. This fish way, when made in its simplest form, is a rectangular timber trough, two feet wide and two feet deep, inside dimensions. One end of the trough rests against the crest of the dam, the other in the pool below. The trough is firmly secured to the dam and to the bottom, and supported at intermediate points if necessary. Transverse cleats, E, three inches high, at intervals of twelve inches, are nailed to the bottom of the trough. The stringers, B, rest upon the cleats, dividing the trough into three longitudinal compartments, the middle one being twelve inches wide, the lateral compartments being five and a half inches each. The stringers are one inch boards, ten or twelve inches, set on edge. The middle section of the way is divided by the inclined portions or buckets, C, into a series of compartments, as shown in Figs. 2 and 3. The lateral sections are similarly divided by partitions or buckets, D, inclined in a reverse direction, into a series of compartments, communicating below by the openings between the cleats, E, with the corresponding middle compartments. The division of the lateral longitudinal compartments is completed by the series of directing plates, G. The water is brought into the way through a notch or sluice in the dam, two feet wide and six inches deep, and the interior hollow floor of the way is beveled off level with the bottom of the sluice way through the dam. The shoulder blocks, F, prevent the water from the dam overriding the lateral banked eddy water.

The water passing through the sluice from the dam tends to continually sink in the middle line of buckets and emerge at the sides at a lower; level the difference of head and the directing plates, G, causes it to bank up on the sides and feed back to the middle of the way. The sinking in the middle is compensated in this way, and a constant depth and constant velocity is maintained from the top to the bottom of the way.

Mr. McDonald, the patentee of this way, claims that it delivers the water down a straight sluice, and under such conditions as closely to simulate the natural flow, and that the moderate velocity of descent offers no impediment to the ascent of the most sluggish fish. It may be built on a slope of one in three, or even greater, and it need not be wider than the water way, and does not require a great amount of material in its construction. It may be adapted to any water supply, and for a given capacity secures the greatest economy in the use of water. For our small streams, to pass alewives, etc., it may be roughly built of boards, with saw and hammer, at a low cost, or it may be expanded so as to throw the entire volume of a river through it.

From its compactness and lying so close under the dam, it possesses greater immunity from freshets, and can be protected with less cost than other ways.

This fish way has been adopted by the Board of Public Works of Virginia, and its erection made obligatory on all dams in the State. Mr. Marshall McDonald, of Lexington, Va., the patentee of the way, is the Fish Commissioner for the State of Virginia.

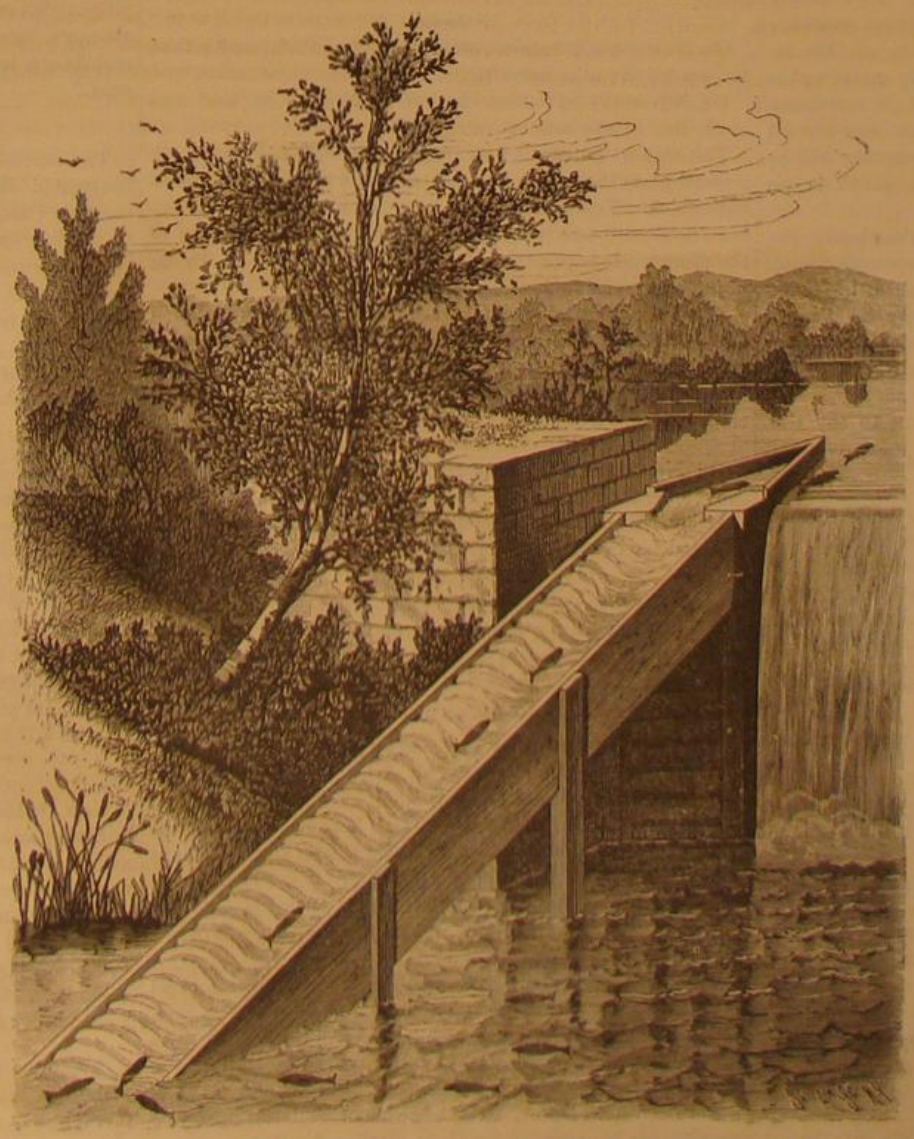


FIG. 1.—McDONALD'S FISH WAY.

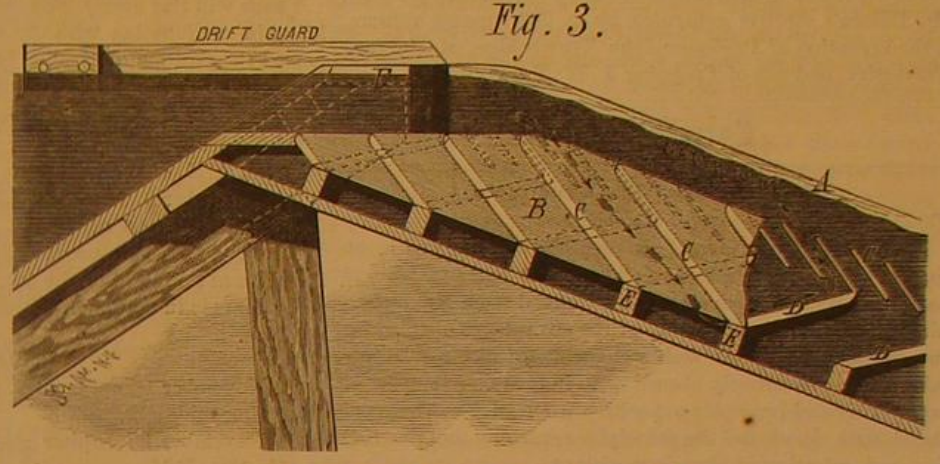
A PARIS review of the sugar trade says: "Beets are worse than was expected from the appearance of the growing crops, but the amount of the deficit cannot yet be estimated.

MISCELLANEOUS INVENTIONS.

An improved bale tie, patented by Mr. Robert G. Stewart, of Augusta, Ga., consists of a cast buckle having three openings or band slots, of which the central opening is longer than the side openings, and communicates through a tapering throat with one of the side openings, and in which also the side openings are formed in a portion of the buckle which dips downwardly at a sharp angle into a different plane from the main central portion of the buckle, the buckle being designed to be used with a band whose bent ends occupy a position around the bars of the middle section, while the free ends of the band pass above the outer sections of the buckle, so that they are held by a positive bearing surface without depending upon the expansion of the bale for holding it.

Mr. William Mather, of Salford, county of Lancaster, England, has patented an improvement in apparatus for damping woven fabrics by means of a spray or sprinkling of water upon the fabric after starching or stiffening. It

Fig. 3.



LONGITUDINAL SECTION OF FISH WAY.

consists of a damping roller made of metal, with an engraved surface. The damping roller revolves in a trough containing the water, and a doctor, of India rubber or other suitable material, is applied to the damping roller to remove the excess of moisture. The fabric or other material is pressed against the damping roller by a roller supported in a swing frame.

Mr. William P. Gilmer, of Mount Airy, N. C., has patented improvements in clamps for holding the boxes under the plunger of presses for compressing plug tobacco in the boxes. The object of the invention is to enable boxes of different sizes to be clamped and held securely under the plunger and in the proper position relative thereto.

Mr. William J. Taber, of Lookout Station, Wyoming Ter., has patented an improved trap for catching bears, wolves, and other animals. The invention consists in the combination of four curved spring bars provided with hooks and a trigger, and catches. The trap is hung upon a tree, stake, or bush, so that the bait will be within reach of the animal to be caught. Dogs, wolves, bears, and many other animals will seize a piece of flesh with their jaws and bolt it down. This operates the trigger and releases the spring hooks.

An improved combined filter and supply pipe has been patented by Mr. James Gainey, of Augusta, Ga. The invention relates to improvements in the arrangement of a filter in connection with the supply pipe of a house. It consists in combining a filter with a three-way cock by means of connecting pipes, so that filtered or unfiltered water may be drawn from the same locality and at any part of the house.

Mr. Sylvanus B. Crane, of Davenport, Iowa, has patented an improved electrical passenger recorder, designed to register all of the passengers of a railway car, whether sitting upon the seats, standing between seats, sitting on the arm rests, standing in the aisle, or standing upon the steps outside of the car, and it operates upon the general principle of closing an electric circuit by the depression of the support upon which the passenger may be sitting or standing.

Mr. James Gardiner, of Mantua, N. J., has patented an improvement in the class of portable apparatus used in scalding swine. It consists of a tub or boiler having appliances for raising and lowering the carcasses of swine, and a furnace or fire box on which the tub rests.

A paper bag machine, patented by Mr. Otis E. Davidson, of Clarksville, Tenn., is an improvement in the class of machines adapted to form satchel-bottomed bags having a single lengthwise seam or lap. The invention consists in novel mechanism for feeding and pasting, and also creasing, the continuous web of paper,

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NEW YORK, SATURDAY, DECEMBER 13, 1879.

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Prevention of Rotting of Potatoes.

Utilization of Frozen Potatoes.

THE SCIENTIFIC AMERICAN AS AN EDUCATOR OF THE YOUNG.

It is a common remark of teachers that a very brief acquaintance with the pupils of a school suffices to determine which come from reading families, which do not; and it is scarcely less easy to decide what kind of reading is current in a family. The intellectual society which young people enjoy tells upon their moral and mental character not less powerfully than do their social affiliations. The devourer of sensational stories is as little likely to excel in studies requiring patient effort and sobriety of mind, as the habitual reader of the SCIENTIFIC AMERICAN is to run away with a two-dollar pistol and a brierwood pipe, to hunt buffaloes and slay Indians on the plains.

In speaking of the SCIENTIFIC AMERICAN as reading for boys, we do so with a full appreciation of the fact that it is conducted rather for the instruction and enjoyment of men. Nevertheless the amount of matter it furnishes of a nature to interest boys—or, more explicitly, perhaps, the number of boys who find it a perennial source of entertainment and instruction—fully justifies a few words with respect to its value as a family paper. In thousands of families its weekly appearance is hailed with as lively a sense of satisfaction by the young as by the old, and very many of the stanchest supporters of the paper have read it almost from childhood.

A day or two since we had the pleasure of an interview with a New England clergyman, whose pride in the practical and scientific bent of his son's mind was pleasant to see; not the less so because the father attributed the son's success as a student chiefly to the influence of the SCIENTIFIC AMERICAN. Some years ago the boy's grandfather, a professor in a well known college, presented him with a subscription to this paper. The effect would be marvelous, if it were an isolated case, in giving a serious and practical bent to the young man's development. Boys very commonly turn their surplus energy to mischief simply for lack of better occupation. They must be doing; and the ordinary routine of schooling furnishes little to satisfy their natural want for bodily activity, exploration, and constructive occupation. The SCIENTIFIC AMERICAN meets the want. Its illustrations of nature and art are attractive and suggestive. The boy is led to take more than a trivial interest in the phenomena of nature, and in the work that men are doing the world over. He observes, experiments; in short, finds pleasurable occupation, according to his bent, in activities that tell most beneficially upon his mental habits, the general tenor of his thinking, and the advancement of his physical, mental, and moral development.

This has been the experience of multitudes of parents. And even if the education the boys receive, directly and indirectly through the information and suggestions furnished by the paper, were of no value whatever, its influence would be good in preventing activities that are harmful. So long as a boy is busy at a windmill, a telephone, a toy steam engine, a rowboat, or other scientific or mechanical undertaking, he is pretty sure to be kept from mischief, frivolity, and vice. We have been told by teachers of experience that, excepting an occasional boy of vicious taint by inheritance, the most hopeful boys were those of the worst reputation for mischievous activity. Their energy took that channel simply because no other had been furnished them. Only get such boys interested in something else and their troublesomeness disappears. The boy that is "into everything," and a perpetual torment because of his misdirected energy, will soon find something better to do if a wider range of activity is once brought within his ken. And not a few parents have found in the SCIENTIFIC AMERICAN a ready means for turning mischievous activity into useful channels.

THE REGISTRATION OF TRADE MARKS.

As announced in this paper last week, the Patent Office will continue to register trade marks, but only in favor of those who shall request such registration with full knowledge of the decision of the Supreme Court, adjudging the trade marks act of July 8, 1870, to be unconstitutional. Action on all pending applications has been suspended, to await instructions from applicants. The Commissioner of Patents also announces that fees heretofore paid in trade mark cases cannot be refunded without further legislation from Congress.

Below is the official summary of the points held by the Supreme Court with respect to the origin of property in trade marks, the nature of trade marks, and the constitutionality of congressional legislation in regard to them:

1. Property in trade marks has long been recognized and protected by the common law and by the statutes of the States, and does not owe its existence to the act of Congress providing for their registration in the Patent Office.

2. A trade mark is neither an invention nor a discovery, nor the writing of an author within the meaning of the clause of the Constitution in regard to securing to authors and inventors the exclusive use of their writings and discoveries.

3. As a regulation of commerce, if trade marks can be in any case the subject of congressional action, that action is limited by the Constitution to their use in "commerce with foreign nations, among the several States, and with the Indian tribes."

4. The legislation of Congress in regard to trade marks contains nothing in its terms, or in its essential character, which looks to a regulation thus limited, but in its language it embraces, and was intended to embrace, all commerce, including that between citizens of the same State.

5. As the statute is so framed that it is impossible to separate that which has reference to commerce within its control and that which is not, and as Congress certainly did not intend to pass the limited registration law which such a construction would imply, the whole legislation must fall, as being void for want of constitutional authority.

About a year ago the United States Trade Mark Association was founded to promote the interests of trade mark owners. At a special meeting in this city, November 24, to consider what steps should be taken in regard to the action of the Supreme Court, quite a number of prominent manufacturing firms were represented. In his opening address the president, Mr. Orestes Cleveland, of the Dixon Crucible Company, called attention to the fact that the rights of trade mark owners had not been in any way affected by the decision. The law declared unconstitutional had merely provided an office for the registration of trade marks properly adopted though not yet in market. The only value of such an office was the means it afforded for establishing priority. He thought the protection of trade marks was due as much to the public as to manufacturers. This was the ground taken by the court in the first infringement suit tried in England. Damages were awarded to the buyer of the spurious article, though denied to the manufacturer.

It was suggested that the association should establish an office for the registration of trade marks, to secure the advantages hitherto obtained through the Patent Office. The same plan has apparently worked well in France, and could no doubt be made useful here. The *Union des Fabricants*, founded in Paris, in 1877, has, it is said, already collected and classified some 30,000 trade marks. The Union also takes pains to get and keep copies of all infringement suits, besides collecting such facts of daily occurrence as relate to industrial property and promise to be of use to the members. A similar office in this city, as proposed by the Trade Mark Association, could make itself very useful.

HOW TO JUDGE OF LEATHER IN BELTS.

Without entering into the question of the merits or demerits of rubber or other kinds of belting, one cannot but notice the want of unanimity of opinion, even among belt manufacturers, as to what really constitutes the best leather for making belts to convey power in running machinery; and, if we include makers of belts on the other side of the Atlantic, the differences in theory and the divergence in practice are much wider than they are here. As a rule, too, this is a matter about which machinists generally have but little information, and are, with here and there only a rare exception, but indifferent judges. The good mechanic may know the size of a pulley or wheel required to give the necessary bearing surface, the weight of belt which should be used, and at what tension it should be run to most effectually transmit a given amount of power; but when it comes to judging of the qualities of different kinds of leather, with respect to the amount of even and steady wear that one will give as compared with another, he is almost invariably quite at sea. Of the general appearance and finish of the belting we are not now speaking; although important details render good judgment in regard to many points here quite necessary, these are not necessarily dependent on the intrinsic quality of the leather used, and it requires only a good mechanical eye to see whether a belt is smooth, solid, well-jointed, and lies even and true.

The best belt, theoretically, is that which combines the highest tensile strength with the greatest power to resist wear by attrition, being at the same time subject to little change by dryness, moisture, heat, or cold. These qualities, supposing the manufacture to be ordinarily good, are mainly dependent upon the tanning. But right here it is to be remembered that perfectly raw hide has greater tensile strength than can be possessed by any leather made from it. The raw hide, however, would never answer, for many and obvious reasons. The question then arises as to how much and what kind of tanning will best preserve the tensile strength of the hide, while imparting to it those other qualities needed in good belting, and how can such tanning be judged of by one not an expert in the leather business. In Europe there is very little difference known or acknowledged between good sole and good belting leather. The heaviest or "plumpest" leather is usually considered there the best for belts, as well as for the soles of boots and shoes. Our belt makers, however, recognize an essential difference. The sole of a boot or shoe, particularly in all heavy work, needs to have but little flexibility, but must have the greatest possible capacity to resist wear by attrition, and be, as far as practicable, impervious to water, while it is never subjected to any test of its tensile strength.

Sole leather, therefore, in all the toughest wearing grades is made as thick and solid as the tanner can make it; great care is taken to open wide the pores of the hide, in the early part of the tanning process, see that all the gelatine is saved to combine with tannin, and that the hide is left in the tan liquors long enough to take up all the tannin it will absorb. This makes the finished leather oftentimes a great deal thicker than the original hide. But such leather, it need hardly be said, would not be the best for making belts, for it has little flexibility, and its tensile strength has been greatly impaired by the straining of the fibers of the hide to take in the large amount of tannin it has received.

The tanner who would make the best belt-leather, how-

ever, although he cannot swell the fibers of the hide with tannin to the extent above noted, must produce a firm, solid article, with not a little of the elasticity and strength of steel; it must be sufficiently flexible, and yet of great power to resist wear by attrition, and to stand, with little stretching, the heaviest direct strain. These qualities are best obtained by an amount of tanning which will make the finished leather but little thicker than the raw hide of which it is made. On cutting a piece of sole or belting leather, one will notice the network of hide fibers interlacing each other, and which, before tanning, were surrounded with gelatine. These fibers give the hide its great tensile strength, and any considerable displacement of them by the transformation of the hide into leather impairs this quality. A piece of good belt leather, therefore, when freshly cut, should look bright, with the intervening spaces between the fibers fine, even, and regular. The texture should be uniform throughout, and with the utmost solidity there should be great elasticity.

No rule can be given by which the exact amount of tanning to make the best belt leather can be determined, but it is certain that to make heavy belts only the largest and heaviest hides should be used. The amount of tanning different kinds of leather receive varies widely, but there is a sort of regular gradation whereby, leaving out altogether the proportionate weight of the raw hide, sole leather receives the most tannin, with belt leather, harness, heavy upper, calf skins, and morocco following next in order, until we reach kid stock, which is generally finished with alum, and known as a tawed rather than a tanned product.

In judging as to the kind of tanning material which makes the best belt leather, there is very general unanimity in favor of oak bark. Hemlock bark is used to some extent in making belt leather of the cheaper grades, but various devices are resorted to with the design of giving the leather the appearance of oak, and thus deceiving the purchaser. The difference can, in nearly all cases, be readily detected by comparing the hemlock with the oak leather, and it is pretty well known, by all who care to be informed in the matter, just what tannages of leather the different belt makers use. In England various "mixed" tannages of leather are employed, *i. e.*, the leather is made with valonia, divi-divi, myrabolams, and gambier, instead of bark, for the tanning material; but these all make an inferior grade of leather, both for belts and for the soles of boots and shoes.

THE YEAR' PRODUCT OF GOLD AND SILVER.

The annual report of the Director of the U. S. Mint states that the production of the precious metals in the United States in 1879 was considerably less than that of the preceding year. It has resulted from the diminished yield of the mines of the Comstock lode. A depth has been reached of 1,000 feet below the bed of the Carson River, and impediments are encountered from accumulations of water and from the oppressive temperature, which discourage and have retarded vertical explorations. This has caused a falling off in the total yield of the States as officially reported, which in 1878 was $47,076,863 of both gold and silver, but which for 1879, J. F. Hollock, the State Comptroller, reports to be only $19,305,473.97 from the production of the preceding year. Although the production of Nevada will be large and continuous for many years, it does not appear probable that the mines of that State will make such enormous contributions to the mineral wealth of the country as they have in previous years. This decrease has been in part compensated by the results of the more thorough exploration of the mining regions of the Rocky Mountains, especially in Central and Southern Colorado. The production of that State was at least $6,000,000 greater in the last than in the preceding year, and will probably furnish an undiminished if not an increasing amount of silver in the future. After careful inquiry and consideration of the yield of different localities and mines in the United States, the Director estimates the total production of the precious metals in the country for the fiscal year 1879 at $79,712,000, of which $38,900,000 was gold, and $40,812,000 silver, as nearly as can be ascertained from official and other trustworthy sources.

Nearly all the gold and a large portion of the silver produced in the United States during the last year was coined at the mints or used in domestic manufactures, arts, and ornamentation. The surplus was exported to non-producing countries. From all information it is safely assumed that the annual consumption in the United States of precious metals in all forms for manufacturing purposes now averages $7,000,000 of gold and $5,000,000 of silver.

STEAM PILOTAGE.

The first effect of every new improvement in industrial means and methods is to hurt somebody. The greater the improvement the greater the hurt; and naturally also the more vigorous the protest against the change by those whose professional or financial interests are bound up with and dependent upon the old.

This universal law is aptly illustrated in the war over the new steam pilot boat lately introduced in the harbor of New York. Hitherto our pilot fleet has consisted of sailing craft only. They have been splendid boats of their kind, and admirably handled. The capital invested in them has been something like $200,000; and 117 of the 133 pilots having an interest therein protest that the introduction of steam pilot boats would tend to destroy this investment and seriously injure the service. The existing system undoubtedly possesses many admirable features; the pilots are exceptionally brave and capable navigators, who take an honest and honorable pride in their work; but there can be no question of the fact that their exclusive devotion to sails is a mistake. The adoption of steam pilot boats for inshore service cannot fail to prove advantageous to our shipping, now frequently delayed by calms, darkness, adverse winds, or ice, against which sails are unable to contend successfully. In such cases, steam pilot boats must be much more promptly serviceable; and the sailing pilots admit the fact when they protest so vigorously that steam will destroy the value of their sails. That is their misfortune; a misfortune which befalls sooner or later every vested interest in these times of progress. With all respect to the pilots who have had a practical monopoly of the trade so long, their interests are in no way commensurate with those of the shippers and ship masters of New York; and if the commerce of our city is to be benefited by the change from sails to steam the change will be made. The good of the many overrides the interest of the few, however meritorious may have been the service displaced thereby.

CHICLE.

The great interest manifested by technical men in the search for substitutes for India rubber and guttapercha has led Drs. George A. Prochozka and H. Endemann to make an examination of the Mexican product known as chicle or sapota. The latter name seems to imply that the product is derived from one of the many species of sapotaceæ, one of which is pointed out as the tree furnishing balata. With the latter product chicle shares many qualities, and possibly may differ from it only in consequence of the mode of collecting. Chicle comes from Mexico; balata from British Guiana, being the concrete juice of a tree variously called *Mimusops balata*, *Achras balata*, *Achras dissecta*, and *Sapota muelleri*. While balata is an almost pure hydrocarbon, with its various products of oxidation, Chicle contains also the various impurities of the juice from which it is derived.

The results of the examination of chicle by Drs. Prochozka and Endemann are given in the first volume of the Journal of the American Chemical Society. The material came in cakes of a chocolate or flesh color, especially on the surface. It crumbled between the fingers, yet had a certain degree of softness and tenacity, which was increased by heating. In the mouth it first crumbled, then united into a soft plastic mass—a quality which has made it a favorite material for chewing gum. On heating, a sweet caramel odor was evolved, then the peculiar smell which is generated when caoutchouc or guttapercha is heated. It disintegrates when boiled with dilute acids, the brown solution containing oxalic acid and saccharine matter. The residue boiled with dilute solutions of caustic alkalies unites again, and forms a doughy mass. Approximately its constituents were:

Chicle resin or gum, forming 75 per cent of the crude material; oxalate of lime (with small quantities of sulphate and phosphate), 9 per cent; arabin, about 10 per cent; sugar, about 5 per cent; salts, soluble in water (chloride and sulphate of magnesia, small quantity of potash salts), 0·5 per cent.

From this composition the authors hold it evident that chicle is the product of direct evaporation of the juice, without any attempt at separation, as is practiced in the case of guttapercha and India rubber; and they do not doubt that by proper treatment of the juice a product far more valuable than the chicle gum now sold would be obtained. Whether such product would be similar to guttapercha, balata, or India rubber, they are unable to say. That must be determined by an examination of the raw juice, which they had not been able to obtain.

INVENTIONS WANTED TO UTILIZE SAWDUST.

The mill owners of Minneapolis are greatly perplexed by the volume of sawdust they produce, and not a little alarmed at a threatened law forbidding the present disposition of such waste by dumping it into the river. It is calculated that the sawdust from the summer cut of logs converted into boards at that place amounts to something like 300,000 cords—enough to furnish constant work for 150 teams to cart away. The millers say they cannot afford so heavy a burden of expense, and the river communities can as ill afford to have the river spoiled by the rapidly accumulating refuse. Even the steam mills are unable to burn all their waste, and the owners of them would no doubt gladly unite with their water using neighbors in turning over the surplus sawdust gratis to whoever would agree to cart it away. Three hundred thousand cords a year of good fuel is certainly worth an effort to save, and this is the product of but one locality.

Who will invent an economical mode of making sawdust marketable? And who will devise new applications for such materials? Most likely there are hundreds of easy ways in which such materials, now a burden, could be turned to profit if our inventors would only take the trouble to think of them and work up their practical applications. Such simple devices for utilizing waste products are often the sources of large profits.

THE NEW ATLANTIC CABLE.

The laying of the sixth telegraphic cable connecting the United States with Europe, was completed November 17. It extends from Brest, France, to St. Pierre, off Newfoundland, thence to North Eastham, near Provincetown, Cape Cod, Massachusetts, where connection is made with the land lines of the American Union Telegraph Company.

The cable was constructed by Messrs. Siemens Brothers, of England, and is considerably stronger than any of the cables previously laid. The central wire of copper is surrounded by ten copper wires, twisted, insuring absolute conductivity in all weather. For insulating purposes three envelopes of gutta percha surround the wire, and outside of the gutta percha is placed a wrapping of manila hemp treated with Chatterton's compound. An armor of steel wire for protection is outside the hemp, the wires composing the armor being laid in a peculiar manner, side by side, so that fractures seem almost impossible to occur. Surrounding the armor is another covering of manila hemp saturated with an anti-corrosive compound. Not only is the insulation of this cable regarded as superior to all others, but the celerity with which it was constructed and laid is without parallel in cable history. The work was completed in exactly seven months from the day the concession to the company was granted by the French Government.

The Proposed World's Fair.

At a recent meeting of the World's Fair Committee in this city, the secretary reported that since the last meeting of the committee an extensive correspondence had been conducted with the parties who were exhibitors at the Centennial Exhibition, with a view to ascertaining, as far as possible, how they had estimated the results of that display upon their business. He said he had received a large number of replies very strongly indorsing the project of holding a similar fair in this city in 1883, and asserting that the results of the last one as manifested in their business had been eminently satisfactory. Many express themselves desirous of preparing exhibits for the projected New York fair. Various large concerns interested in the cotton industries, others in the different lines of manufacturing hardware, the iron and coal trades—all are willing to encourage the undertaking. The committee has corresponded with several eminent gentlemen in England, Spain, France, Italy, and elsewhere. These parties are willing to co-operate with the projectors of the enterprise. Among them are Señor Jordana, who was Commissioner from Spain at the Centennial Exhibition; Signor Dassi, Italian Commissioner to Philadelphia in 1876, and others.

The Chairman of the Committee on Sites reported that twelve sites had been offered, but only three were recommended from which a final selection could be made. These were Manhattan Square and adjoining property, on Eighth avenue, between Seventy-second and Ninety-second streets; the Washington Heights site, and that known on the list as the East Side Sands, of Brooklyn.

The Committee on National Legislation reported that they were prepared to present to Congress the bill which has heretofore been reported to the General Committee. A motion offered by Mr. Louis May, that a mass meeting, under the auspices of the General Committee, be held in the Cooper Institute, in December, for the purpose of giving an impetus to the World's Fair movement, was adopted.

The Audiphone.

Enough was accomplished at the public exhibition of the audiphone in this city, November 21, to show that we have in it an extremely promising aid to those afflicted with defective hearing. It is quite possible, too, that it is the leader in a line of invention which will ultimately enable the mute to speak as well as the deaf to hear.

The instrument is simply a thin plate of vulcanized rubber shaped like a Japanese fan. When in use it is curved to give it the requisite tension, by means of cords attached to the outer edge of the fan and fastened at the junction of the handle. When the top of the fan is placed against the upper teeth the impinging sound waves create a sensible vibration which is conveyed through the teeth and the bones of the face (or possibly by the dental nerves) to the auditory nerve. With a little practice the sounds thus received are interpreted the same as if they reached the nerves of hearing through the ear; and thus the deaf are made to hear more or less distinctly, provided, of course, that the auditory nerve itself is not defective. Experiments are being made with a class of deaf-mutes to determine whether such unfortunates can be taught to speak by the use of this invention, a result strongly indicated by the results thus far obtained. In any case the audiphone seems to mark a decided advance upon the old-fashioned ear-trumpet.

A Singular Accident.

Recently the SCIENTIFIC AMERICAN lost a subscriber by an accident which should furnish a lesson of carefulness to railway hands. As two trains were approaching each other on the Central Railroad of New Jersey—one an express train running at the rate of sixty miles an hour, the other a coal train—the fireman of the latter threw out a piece of slate. The stone struck some part of the express engine, and, glancing, passed through the window of the cab, giving a death-blow to the fireman of the express train.

A Fact for Advertisers.

There were printed and circulated by mail and through news agencies, of last week's issue (No. 23) of the regular edition of the SCIENTIFIC AMERICAN, more than 75,000 copies, besides the usual large edition of the SUPPLEMENT. Advertisers will bear in mind that the publishers guarantee that every week's issue shall not be less than 50,000 copies, and that it frequently exceeds that large number by several thousands, as it did last week.

MISCELLANEOUS INVENTIONS.

Charles V. Petteys, acting assistant surgeon U. S. A., stationed at Fort Robinson, Nebraska, has invented a new and improved horse litter, the object of which is to provide for army use an improved travois or horse litter, of light draught, and adapted to be folded and packed in small space, and to be readily extended when required for use; also adapted to support the sick or wounded in comfortable horizontal position, and with the least possible jar or jolt while passing over rough ground.

Mr. James W. Ripley, of Columbia, Mo., has invented a fastening for packages of letters and like mail matter in the postal service. The object of this invention is to save time and material in securely fastening such packages. It consists of a plate having hooked end and button, in combination with a cord, for securing a package.

Mr. Samuel H. Gregg, of Crawfordsville, Ind., has patented an improved barbed fence wire. The object of this invention is to make a fence wire so as to enable it to be under proper tension at all seasons of the year, so as to avoid snapping caused by the too great tension from contraction in winter; and also to avoid sagging or looseness caused by the expansion and relaxation of tension in summer.

Mr. Henry R. Gillingham, of Baltimore, Md., has patented an improvement in locking devices for demijohns, bottles, etc., designed to prevent the wasteful, injurious, or unauthorized use of wines and liquors, and to provide greater security for poisons. It consists in providing the old rotary plug valve with a peculiar locking device specially adapted to a receptable of this kind.

An improvement in egg testers has been patented by Mr. Walter S. Burnham, of Ashtabula, O. The invention consists in the combination, with a box or vessel having a mirror at the bottom, of a disk or plate provided with rim and holes.

An improved key for opening and closing the cocks of water pipes, gas pipes, etc., when placed below the surface of the ground, has been patented by Mr. Patrick H. Regan, of Nashville, Tenn. It is so constructed that it may be extended and contracted, as the depth of the pipe may require.

A radiator formed of a number of radiating sections, into which smaller tubes are inserted, so that the steam occupies the space between the inner tubes and outer sections, and the air can circulate through the inner tubes and around the outer sections, has been patented by Messrs. George P. York and William H. Wilson, of Westfield, N. Y.

Mr. Sanford L. Farrar, of Bath, Me., has invented an improved steam cooker, which consists in the arrangement of two kettles, one on top of the other, the upper one of which has a perforated movable bottom, gutter, and spout, and the lower one is provided with an escape passage, valve, perforated casing, water pipe, and studs, and contains a perforated movable kettle having a perforated removable bottom. The filling tube of the lower kettle is provided with a float and a graduated rod for indicating the quantity of water in the kettle.

An improvement in skates has been patented by Mr. John E. Parmenter, of Fort Pembina, Dakota Territory. The object of this invention is to furnish skates so constructed that they can be very easily and quickly attached to and detached from the boots, and which shall be neat, strong, and durable, and not liable to become accidentally unfastened.

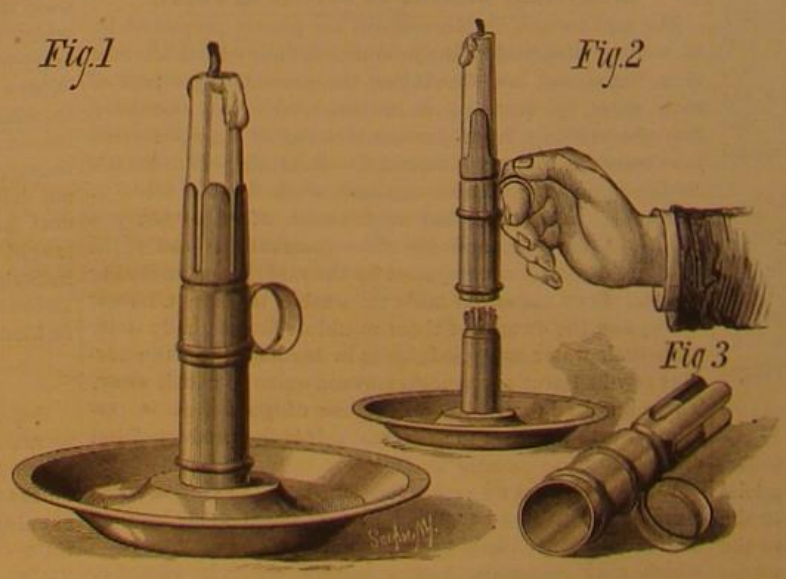
NEW CANDLESTICK.

We give herewith an engraving of a novel candlestick recently patented in this country and in Europe by Mr. A. J. Smith, of Ukiah City, Cal. The object of this invention is to provide a candlestick that will hold the candle evenly and firmly, and permit of burning the whole of it without waste.

The candlestick consists essentially of four parts—a base or bottom, a hollow standard forming a support for the upper portion of the stick, and at the same time answering the purpose of a match safe, a cap fitted to the match safe, and a sliding sleeve fitted to the cap, and having fingers for grasping the candle.

Fig. 1 shows the candlestick in actual use; in Fig. 2 the upper portion is removed, showing the match safe; and Fig. 3 is a detail view of the upper portion of the candlestick. The slide on the candlestick shown in Fig. 1 has six fingers for grasping the candle, that shown in Figs. 2 and 3 has but three fingers, and the slide is open upon one side to admit of its springing more or less to adapt itself to the part upon which it slides.

The inventor claims several important advantages for this candlestick, among which are the facility with which it may be cleaned, its economy in the use of candles, and its cheapness as an article of manufacture. It will be admitted that this is a marked improvement over the ordinary article. Any further particulars relating to this invention will be furnished by the inventor, who is willing to dispose of his American and English patents.



NOVEL CANDLESTICK.

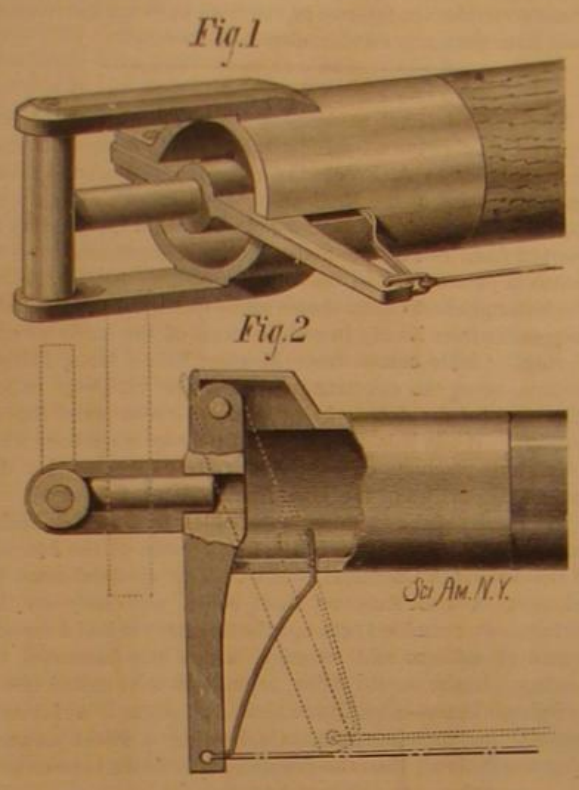
To NEUTRALIZE the sting of a gnat or mosquito, French sportsmen rub the part affected with a little *cerumen*, that is, the wax of their ear, extracted by the little finger.

NEW HORSE DETACHER.

It is estimated that the percentage of persons killed while riding after horses is fifty times greater than that of travelers killed by railway accidents. Although this statement may appear incredible, it has been carefully verified by competent persons. These accidents occur from various causes, one of the most frequent being the result of the animals becoming frightened and rushing headlong at a runaway pace.

The invention shown in the accompanying engraving is intended to prevent a large class of such accidents by permitting the horses to escape.

The "ever-ready horse detacher," as the inventor calls it, is very simple and capable of instantly detaching the horses. The device is applied to the ends of the whiffletrees, and under ordinary circumstances holds the ends of the traces or tugs in the usual way.



KITCHEN'S HORSE DETACHER.

A clear idea of the construction of the detacher will be obtained from Fig. 1, which shows a ferrule having two projecting arms, between which is pivoted a bar carrying a tongue extending through the eye of the tug and received by a socket formed in a lever pivoted in the ferrule, and pushed outward by a spring which prevents it from becoming accidentally loosened. To the free end of the lever is connected a cord running to the center of the whiffletree, through a ring thence upward to the box within easy reach of the driver. In case of accident the lever is drawn backward by the cord, as indicated in dotted lines in the sectional view, Fig. 2. This releases the tongue that holds the tugs and permits the horses to escape.

Destruction of Cast Iron Gas Mains.

A curious case of deterioration of cast iron gas pipes has recently been observed at Saarbrücken. The pipes in question had been laid for ten years, and when removed were found converted into a soft substance which could be cut with a knife, and, on analysis, was found to contain only 52 per cent of metallic iron. The pipes were laid in channels cut in soft sandstone, filled in with ashes from locomotives. The coal which produced these ashes was from the Saarbrücken basin, and was relatively rich in sulphur. The destruction of the pipes was most probably due to the action of the sulphur contained in the ashes, combined with the oxygen of the atmosphere. This view is supported by the fact that the substance into which the pipes had been changed contained one and one-third per cent of sulphuric acid. A large number of pipes were completely destroyed, and had to be renewed.

Compressed Steel.

Application was lately made before the British Judicial Committee of the Privy Council by Sir Joseph Whitworth, F.R.S., for a prolongation of the English letters patent granted to him on the 24th of November, 1865, for his invention of certain improvements in casting iron and steel, and in apparatus employed for that purpose. The invention, which is very well known, is described, technically, as "consisting in forming and employing moulds of steel, in combination with pressing plungers, in such manner that fluid steel when in such moulds is subjected to very high degrees of pressure." The term of the letters patent expires on the 24th of November The evidence of Sir Joseph Whitworth was taken before the learned Registrar—Mr. Henry Reeve, C.B.—on the 21st of July last, and was read at length to their lordships. Sir Joseph, having formally spoken as to the utility and novelty of his invention, deposed that before 1865 no such thing as compressed steel was known in the market. Before 1865 there was no getting steel that had the requisite amount of ductility and soundness. Steel of a certain amount of hardness could be got, but not of ductility. For guns, ductility was indispensable; but when ductility was required air cells were liable to be formed. He caused a large ingot of steel to be split open in order to examine the character of the metal. He found the upper part of it full of air cells, and consequently unsound. It was the best steel in the market, Bessemer steel. From these difficulties he directed his attention to improving the manufacture of steel. For many years he devoted his thoughts to it and made constant experiments. Before the letters patent were granted he had made at least 2,500 experiments.

He believed that the use of steel barrels, both for rifled small arms and for rifled guns, was attributable to his adoption of that metal for guns. He knew of no other manufacturer who had advocated the use of steel for firearms. He compared "Damascus metal," so called, with his own. The former burst with 105 grains charge; the latter did not burst at all. The fluid compressed steel was thus very much the stronger metal. His invention consisted practically in employing moulds of steel in which fluid steel was subjected to a very high pressure. Any gases retained in the fluid metal were pressed out, and the particles of the metal were thus forced into the closest possible connection. A pressure of not less than six tons on the square inch was required. The want of steel sufficiently strong to be used with this test delayed his operations for many years. The ordinary steel in the market could not stand the test. At last he made what was known as the 8,000 ton press. His invention was also applicable to cast iron, but it was more advantageous to compress steel than cast iron. Compressed steel was made down to 30 tons strength and 40 per cent ductility.

The demand for the fluid compressed steel was gradually increasing, and accidents had been materially reduced. It was not until 1863—four years after the patent was granted—that he was able to complete his works and apparatus so as to enable him to produce steel in useful quantities. The petitioner then gave intricate evidence as to the accounts kept by the firm as to the profits or losses of the invention.

In support of the petition, Sir John Hawkshaw, Mr. Barlow, C.E., Mr. Hotchkiss, of America, patentee of the revolving cannon; Mr. Wright, engineer-in-chief to the Royal Navy; Mr. Davis, works manager of the Torpedo Department at Woolwich Arsenal, and Mr. Purdey, the gunsmith, were called and gave evidence.

About the year 1863 the business of Sir Joseph Whitworth's then firm was purchased by a company in which he held by far the largest number of shares, and which company became eventually "The Whitworth Company (Limited)." The latter company carried on the business of the firm until the end of 1868, when, having the intention of eventually forming a company of another character which should afford special advantages to those of his workmen who were industrious and well conducted, he purchased all the business and again became the sole proprietor. In 1874 he formed a company called "Sir Joseph Whitworth & Co. (Limited)," of which, as before, he was by far the largest proprietor. It was so constituted that whenever any deserving workman in the employ of the company or firm desired to take shares and so invest his savings, he might do so under conditions that would be specially advantageous to him. The petitioner then described the various modes by which his invention had been brought before the public, and he contended that he had not hitherto received any adequate remuneration for the labor, time, thought, and capital he had expended. Inasmuch as the great merit of his invention and the necessity of having a metal of great strength and ductility had been demonstrated, Sir Joseph Whitworth prayed her Majesty in Council to grant him a prolongation of the terms of his letters patent.

Mr. Aston, in closing the case, contended that Sir Joseph Whitworth, the petitioner, had done as much as possible to bring his invention before the public and to give them the

benefit of it. The question, therefore, was whether Sir Joseph, as patentee or manufacturer, had been sufficiently rewarded for the invention; and he argued that looking at the expense and trouble involved, and Sir Joseph Whitworth's well-known efforts to educate and improve the workpeople in his trade, a prolongation of the patent was justified.

Mr. Gorst, on the part of the Crown, admitted the great value of Sir Joseph Whitworth's invention, and only directed their lordships' attention to the accounts submitted to them in order to guide them as to whether or not the patentee had, as yet, profited sufficiently by his invention.

Their lordships, in the result, prolonged the patent for five years, on the usual and formal understanding that the Government and its contractors might use the invention without the payment of any royalty or charge.

Fast Torpedo Boats.

Messrs. Yarrow & Co., of the Isle of Dogs, have just completed two torpedo boats for the French Government, which they lately delivered at Brest. As a record of a long run for boats of this class—by far the longest that has ever been made yet—it may be mentioned that they steamed the whole distance of slightly over 500 miles, that they were under way 34 hours, and that a mean speed was maintained of 15 miles an hour. The consumption of coal was eight tons, which amount the boats are designed to carry without requiring a fresh supply. This gives 525 lb. per hour, or 35 lb. per mile. The above data are important as showing that long distances can be accomplished by small craft of the kind, provided an excessive speed is not required. Should a speed of 23 statute miles an hour be wanted, the consumption of fuel would be at the rate of 17 cwt. per hour, or 83 lb. per mile. The vessels were subsequently tried on their arrival at Brest for three hours' continuous running at full speed, and were also tested for their turning powers, and in every respect they were found to exceed the best performances of any torpedo boat in the French navy.

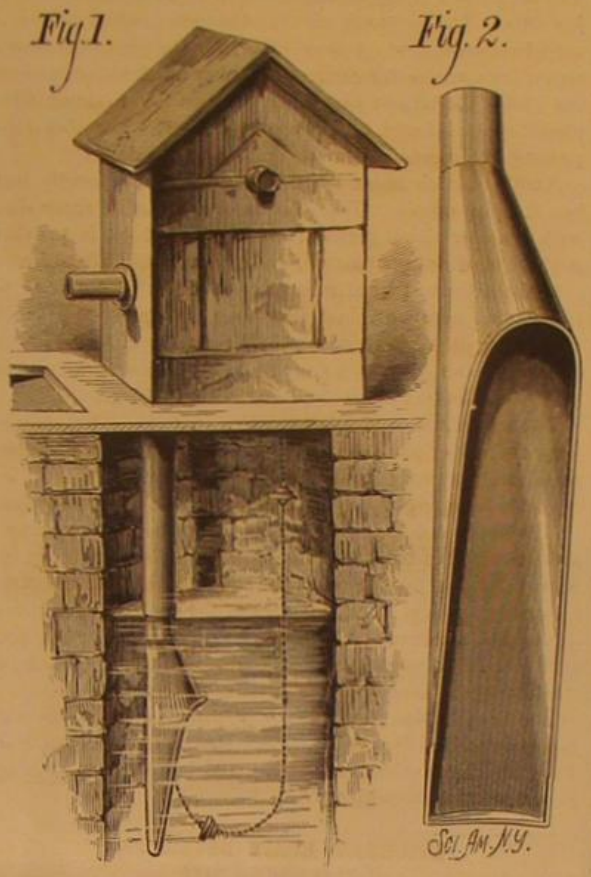
THE ST. LOUIS BRIDGE.

The great bridge over the Mississippi river at St. Louis, shown in the accompanying engraving, which is the largest arched bridge in the world, with its spans of 520 and 515 feet, was designed by Captain James B. Eads as Chief Engineer, and the superstructure was made from his designs and erected by the Keystone Bridge Company. The tubes of the arches are composed of six rolled cast steel staves forced into a cylindrical envelope of steel, the lengths of sections between the joints being about twelve feet, and the depth of the arched rib between the centers of two concentric tubes about the same. The two lines of tubes are braced together, and the ends of contiguous sections are united by couplings, made in two parts, with projections turned on the inner surface to fit into corresponding grooves on the ends of the tubes. The connecting pin for lateral struts, diagonals, and lateral bracing between the several arches is tapered and driven tightly into the joint, the whole connection being made water-tight.

The engraving of the bridge will give the reader an excellent idea of its general design and magnitude. The method of erecting the superstructure was described in this journal during the progress of the work. The arches were built outward simultaneously from the abutments and from each side of the piers, being supported by means of direct guys, composed of two lines of main cables of forty-two square inches section, passing over towers to anchorages on the shore, and by guys balanced over towers on the piers. The towers stood on hydraulic rams, which were caused by automatic gauges to rise and fall, to compensate for changes of temperature in the arches and cables.

IMPROVEMENT IN CHAIN PUMPS.

Mr. John P. Ryan, of Sardis, Miss., has recently patented an improvement in chain pumps which relates especially to the funnel connected with the lower end of the chain tube. The funnel, as will be seen by reference to Fig. 2, is of a peculiar form, well calculated to guide the buttons carried by the chain into the water tube; it has a straight wall and a flaring cut-away side, and a neck which is threaded and adapted to the lower end of the iron water tube. The straight wall of the funnel stands in the path of the chain and prevents it from swinging beyond the foot of the water tube and guides it easily and smoothly, so that little power is required to drive the pump. It is not necessary where this device is used to employ a lower chain guide wheel, as it would only add to the expense of the pump and increase friction, so that more power would be required to work it.



RYAN'S IMPROVED PUMP.

The inventor states that he uses but three buttons to twenty-five feet of chain, and that the pump will easily draw twice as much water as the ordinary chain pump.

Fireless Locomotives.

The fireless locomotives invented and used in New Orleans, La., and heretofore described by us, with engravings, are now being extensively introduced on the street railways in England and France. At a recent session of the Mechanical Engineers, London, Mr. Crampton and M. Bergeron both spoke very highly of the performance of the engines at work in and near Paris, and the opinion seemed to be general that the fireless locomotive offered an excellent solution of the problem of street tramway working. It also removes the objections to mechanical power in docks and on quays where hitherto horses have been used in deference to the laws relating to fires on such premises. Several modifications in detail were suggested, more particularly with reference to the necessity for raising the working parts of the engine as high as possible from the ground, the arrangement adopted by Mr. Brown, of Winterthur, being referred to as suitable.

There is no doubt that the principle involved is likely to become largely adopted, though the engine itself as at present designed will probably be very materially modified in this country. The advantages claimed for the engine were summed up as follows: "No danger of explosions in the street, or of accidents to the boiler; no red glimmer from the fire during the night; no burning cinders dropped on the road; no cases of fire or other accidents caused by the engine; no noise produced by the valves, blow-off cocks, or blast; no smoke, soot, or disagreeable smell of burnt gases; no stoppages resulting from the burning out of fire-bars, cracking of plates, leakage of tubes, or other causes, and to all may be added that which is the most important of all, namely, the economy which can be realized."

John Miers.

The venerable John Miers, long known as the patriarch of British botanists, died in London, on November 17th, in his 91st year. He was born in London, August 25, 1789, was educated as an engineer, and after leaving school devoted himself to the study of mineralogy and chemistry. In 1825 he published his "Travels in Chile and La Plata." Soon afterward he proceeded to Brazil, where he resided eight years, and made extensive collections of plants and insects. After his final return to England he was elected a fellow of the Linnæan Society in 1839, and of the Royal Society in 1843, acting for a time on the council of both societies. Besides many separate papers he published two large works, "Illustrations of South American Plants" and "Contributions to Botany," in which he exhibited a marked tendency to multiply genera and species. He was one of the few botanists who remained faithful to a belief in the fixity of specific type, rejecting the modern evolutionary ideas. He served on the jury of the Brazilian sections of the Universal Expositions of 1862 and 1867, and was decorated by the Emperor Dom Pedro II. with the commandership of the Order of the Rose. Mr. Miers left his botanical collections to the British Museum.

Jean Charles Chenu.

The eminent French naturalist, Dr. Jean Charles Chenu, died recently at the age of 71. His first publication was a treatise on cholera morbus (1835); his second, an essay on thermo-mineral waters (1840). He next applied himself to the preparation of his great folio work, "Conchological Illustrations, or, Description and Figures of All Known Shells, Living or Fossil, with the New Genera and the Latest Discovered Species" (1842–47). In 1852 he became librarian of the School of Military Medicine, made the campaign of the Crimea in connection with the ambulance service, and was director general of ambulances during the siege of Paris (1870–71). Besides many other works, he was author of an "Encyclopedia of Natural History" (31 vols., 1850–61), of treatises on the medical history of the Crimean and Italian wars, and elementary handbooks of ornithology, natural history (1846), and conchology and palæontology (2 vols., 1862, with 5,000 illustrations). He was made a Commander of the Legion of Honor in July, 1871.

The Navigation of the Siberian Polar Sea.

Professor Nordenskjöld's earlier conclusions with regard to the navigability of the sea north of Siberia, and the practicability of a commercial route that way, seem to have been considerably modified. His opinion now is:

1. That a voyage from the Atlantic to the Pacific Ocean,

ILLINOIS AND ST. LOUIS BRIDGE.

along the coast of Siberia, may frequently be made in a few weeks by a vessel specially adapted, and manned with experienced seamen, but that, so far as the conditions of the Siberian Polar Sea are at present known, the entire route can hardly have any practical importance for trading purposes.

2. That there are no obstacles to commercial traffic through the waters between the mouths of the Ob and the Yenisei and Europe.

3. That in all probability a sea passage between the Yenisei and Lena, and between the Lena and Europe, as a trade route, is also possible, providing the out and homeward voyages be not undertaken in one summer

4. That further researches are requisite before it can be decided whether the waters between the mouth of the Lena and the Pacific are available for mercantile navigation. The experience already collected shows, however, that steamships with heavy implements and other goods, not easily to be forwarded by land or sledges, may at any rate pass from the Pacific to the Lena.

AMERICAN INDUSTRIES.—No. 25.

BRASS MANUFACTURE.

In the city of Waterbury, Conn., long before the days of railways and steamships, the manufacture of brass was begun by Mr. Abel Porter. This was in 1802, and the business was then confined almost wholly to the manufacture of brass buttons. The industry, which was established by Mr. Porter, and for a time conducted by Abel Porter & Co., proved very satisfactory. The style of the firm passed through a succession of changes until, in 1850, Messrs. J. M. L. & W. H. Scovill, the gentlemen then composing the firm, united with other gentlemen in organizing a joint stock corporation under the name of the Scovill Manufacturing Company. Their works in Waterbury front on Mill street, and present a continuous line of nearly one thousand feet; the buildings are substantially built of brick, and for the most part are three stories high and are of neat architecture. The present officers of the company are, F. J. Kingsbury, president; C. P. Goss, treasurer; M. L. Sperry, secretary. W. I. Adams is the New York agent, E. H. Patterson at Chicago, and Allen G. Lovell at Boston. The company employ a capital of nearly $1,250,000, and have in manufactured goods, and in process of manufacture, nearly $500,000. The first forty years of this company's business career was slow, and not until the year 1850 did they realize that the turning point had been gained and they were rapidly becoming the leaders of this industry in the State, if not of the United States. One important branch of their manufacture is button making. To this one of their largest buildings is devoted; one of the lower views on the first page represents one of the button making departments.

They make a specialty of military and naval buttons, such as are worn by militia companies, firemen, railroad men, schools, colleges, and societies throughout the country. They supply to a large extent the Cuban and the Spanish American governments with buttons for their troops. They also make a great variety of buttons for liveries, from designs and dies to order. A corps of designers and die sinkers is employed on work of this sort, and in getting up new styles of buttons for ladies' wear. The company's cabinet of samples consists of many varieties of every imaginable pattern—gilt, silver-plated, nickel-plated, bronzed, enameled, oxidized, silvered, stamped, chased, or brightly burnished; also buttons of glass and metal combined, or of metal and cloth-covered buttons, lasting, worsted, and brocade for men's wear, and silks and velvets of all shades for ladies' wear.

Another department of the works, represented in one of the upper views in the engraving, is devoted to the manufacture of wrought brass—butts and hinges. The machinery for making them works automatically, and is the invention of mechanics in the employ of the company. These products vary in sizes, and the cheaper ones are used for furniture, inside blinds to houses, etc. More expensive ones, of ornamental patterns, gilt, silver-plated, and engraved, are made for use on pianofortes. Very many are for use on shipboard, where iron is objectionable from its liability to rust.

The company manufactures furniture casters, made entirely from wrought metal, by a newly invented process. The peculiar merit of the casters consists in the introduction of small iron balls, acting as friction rollers, and thus causing the caster to turn more readily than the ordinary casters. Being of wrought metal they are much stronger than the common ones of cast metal.

A large department, shown in one of the middle views, is devoted to the manufacture of kerosene oil burners, lamps, and lamp trimmings. In this department the company has had marked success, and is noted for the perfection of its work. A very large variety of burners and lamps is made there. Thimbles are made here of silver-plated brass and of German silver. The better grades are made with the same care as the best silver thimbles, and are for practical purposes equally good.

The "drawing department" is the name given to that part of the works devoted to the manufacture of brass ferrules for handles of canes, fish rods, etc. Seamless tube, solid drawn, is also made here, being drawn up from sheet metal without the use of solder.

The rolling mill, shown in one of the lower views, is a building 200 feet long by 120 feet, and the casting shop, which is shown in one of the upper views, is 100 by 75 feet. This will produce annually about 2,000,000 pounds of sheet metal, oreide, German silver, etc. It is rolled of all thicknesses, down to that of the thinnest writing paper, and made of all qualities and tempers to suit all the requirements of manufacture, some of it being made tough and ductile for spinning and stamping into irregular shapes, and some highly tempered for springs or reeds for musical instruments.

Sheet brass is made in various widths, from a mere ribbon to sheets of 20 inches or more. The alloy is melted in crucibles, cast in large ingots, and reduced in thickness between heavy rolls. The sheet is then scraped on both sides to discover imperfection and to remove any scale that may exist on the surface. It is then rolled and rerolled until it is reduced to the required thickness. During the process of rolling the sheets are occasionally annealed, less frequently, however, for spring brass than for tough soft brass.

The brass for the inside works of all American watches is made here, as is also the nickel metal for the same purpose. The oreide is a close imitation of gold, and is much used by jewelers. The German silver, otherwise called albata, is used to some extent on show cases, for the ornamentation of steam fire engines, for cornets and other musical instruments; but by far the largest part of it is used for making silver plated spoons, forks, and other table ware. For this latter purpose thousands of pounds are consumed daily.

Another article made by the company is the novelty lock-box for post-offices. These boxes are made in three sizes, with brass or nickel plated fronts. Each lock is provided with keys of unique pattern, and no two locks are alike.

In the manufacture of most of the articles the company has introduced many original processes and perfected special machinery at a great cost, which enables it to produce a grade of goods superior to any formerly imported and unsurpassed by those of other domestic manufacturers.

The manufacture of photographic materials has become very extensive, and now embraces several distinct departments in this establishment, either of which is of sufficient magnitude to require separate and individual management.

It is impossible to describe in detail the great variety of articles made in this establishment. We have already intimated that the goods made by the Scovill Manufacturing Company are sent to all quarters of the globe, and enormous quantities are consumed in this country alone. The prosperity of this company is the direct result of cheapening production while improving the quality of the articles.

The Scovill Manufacturing Company have a large warehouse located at Nos. 419 and 421 Broome street, New York. They also have salesrooms at No. 183 Lake street, Chicago, and No. 177 Devonshire street, Boston.

Correspondence.

THE EDISON ELECTRICAL GENERATOR.

To the Editor of the Scientific American:

Your issue of November 15 contains a letter from Mr. Edison accompanied by a reply to the strictures contained in mine of the 1st November.

I feel confident that so far as the opinion of thoughtful electricians is concerned I might leave the matter as it now stands without detriment to my reputation; but I am not willing the general public should suppose I acquiesce in the statements made by Mr. Upton, or that my views are, to any great degree, modified by anything he advances.

Mr. Upton says I have "confounded the obtaining of a maximum current with the obtaining of a maximum of economical efficiency." Now I submit I have done no such thing. In my letter I have assumed that in dynamo-electric machines the electromotive force is a function of the external resistance, and decreases as the external resistance increases.

The article on page 242 says nothing about the electromotive force being constant. Mr. Upton, it is true, does say that this is the case with Mr. Edison's machine, but this is a mere assertion, the truth of which I do not only not concede, but positively deny.

I do not lose sight of the statements on page 242, that "although the current from the armature may be used to excite the field magnet, Mr. Edison finds it more economical to charge the field magnet by means of a separate machine." Then follows an intimation that such is his intention in the future.

Mr. Upton says, "according to the reasoning in the letter in question," it would be "mathematically absurd to connect a battery with a resistance nine times greater than itself," and it undoubtedly would be if, as was beyond all question claimed on page 242, that *simply by so doing it necessarily rendered that battery* twice or three times as efficient as *any other* battery, or if the electromotive force of the battery was a function of the external resistance, and decreased as the external resistance increased.

I now propose to re-examine some of the statements on page 242. I quote first: "The internal resistance of the armature is only ½ ohm, and Mr. Edison claims that he realizes 90 per cent of the power applied to this machine in effective external current." Second: "Now the energy converted is distributed over the whole resistance; hence, if the resistance of the machine be represented by 1, and the exterior circuit by .9, then of the total energy converted, 0·9 will be useful, as it is outside of the machine, and 0·1 lost in the resistance of the machine." Now, Mr. Upton, claiming for Mr. Edison's machine constant electromotive force, fully indorses both of the above statements, which I again pronounce mathematically absurd, and again assert that the statement, it true, proves beyond all doubt that Mr. Edison has discovered perpetual motion. For Mr. Edison and Mr. Upton both distinctly countenance the assertion that 0·9 of the power applied is available in effective external current, and concede that 0·1 is lost in the resistance of the machine. Consequently there is no escape from the conclusion that no power is required to overcome the inertia of the mass of metal comprising the armature, nor the friction of the journals, none is lost in the production of currents which are not available in the working circuit, and none in the production of spark and heat at the commutator, etc. etc. In other words, you have only to start the machine and it will continue to revolve for ever, and perpetual motion is an accomplished fact.

Now if, as Mr. Upton leaves us to infer, the electromotive force is constant and independent of the resistance of the external circuit, there is no escaping the conclusion that power has to be applied to excite the field magnet, and in the absence of any information other than is afforded by Mr. Edison and Mr. Upton, we are obliged to assume that this power is supplied by a machine which furnishes the current for this purpose and *runs itself*. Perpetual motion is more than possible.

The question to be considered is: Is it true that a machine, in which the resistance of the armature circuit is only ½ ohm and the external resistance 4½ ohms, *necessarily* more efficient than a machine in which the resistance of the internal and external circuit must be made equal in order to obtain the maximum efficiency? I answer, no; Mr. Upton says yes, and introduces the expression $E^2 (r + R)^{-2} R$ to prove his assertion and the efficiency of Mr. Edison's machine. It proves neither.

It is true that Mr. Upton's statement differs materially from anything first stated, in that it takes into consideration the electromotive force as an element of efficiency. But what does it prove? Nothing more than was proven years ago by Joule and Favre, and the reference to a *recent* number of *La Lumière Electrique* is not the best that can be made.

There have been numerous machines built in which the resistance of the armature of the working circuit was only a fraction of that of Mr. Edison's machine, and the difference between the internal and external circuit much greater. One instance out of many may suffice.

Professor Trowbridge, of Harvard University, made tests of three well known machines, the results of which are published in the *Philosophical Magazine* for March, 1879. The results obtained are given in the following table:

WILDE MACHINE (Large Size).

Resistance of Circuit, in ohms.	Current, Webers per sec.	Speed of Mach. per min.	Metre-grammes, consumed per sec	Equiv. of Current in metre-gram's per sec	Efficiency.
0·594	62·33	548	350,658	235,480	67·1
0·733	61·76	508	392,403	285,293	72·7
0·857	43·82	532	283,107	167,907	59·4
0·907	60·25	500	453,123	335,966	74·1
1·039	39·28	520	298,356	163,682	54·9
1·120	43·44	548	343,827	215,660	62·7
1·241	50·43	504	542,685	322 047	59·3
1·453	44·94	520	553,311	309,658	56·0
1·593	47·51	536	633,765	366,910	57·9
2·305	32·86	528	643,632	253,908	39·4

GRAMME MACHINE (Large Size).

0·675	86·0	432	589.743	509,418	86·3
0·760	75·6	462	534,336	442,211	82·7
0·781	75·6	452	607,200	455,377	74·9

SIEMENS MACHINE (Large Size).

0·973	79·8	264	831,105	632,255	76·0
1·055	68·8	294·5	743,820	509,569	68·5
1·066	66·0	325	889,454	472,805	56·3

The resistance of the Gramme armature is 0·129 ohm; the resistance of the magnet, 0·212 ohm. The total resistance is therefore 0·341 ohm.

The total resistance of the Siemens machine is 0·586 ohm.

The Wilde machine differs essentially from the other two, the magnets not being included in the working circuit. The armature has two circuits, the one for exciting the magnet, and the other for working circuit. The resistance of the armature coils of the working circuit is 0·074 ohm. The resistance of the coils of the armature for exciting the magnets is 0·454 ohm. The coils of the field magnet have a resistance of 2·83 ohms.

In this machine the resistance of the coils of armature of the working circuit was about one-fifth the internal resistance of the Gramme machine, and the ratio of the resistance of the internal to the external circuit, when the maximum efficiency was obtained, was not far from that given by Mr. Edison for his generator on page 242. Yet the efficiency was much less than the Gramme, in which the internal and external resistance was about equal when the maximum efficiency was obtained. It is therefore evident that there is something more than the matter of resistance to be considered in the building of dynamo-electric machines.

Mr. Upton also gives two examples of the performance of Mr. Edison's machine, but they neither prove the efficiency of the machine as a generator nor as compared with other machines.

The only proof of the efficiency of a machine is the ratio of the work done in the external circuit to the horse power expended in driving the machine, and, *other things* being equal, it may

safely be said that that is the best machine which has the highest electromotive force and the least internal resistance.

Now for Mr. Upton's examples.

In the first case we have "$\frac{130\times130}{1\times1}\times5\times\frac{44\cdot3}{33000}=11$ H. P.," and in the second, "$\frac{130\times130}{5\times5}\times4\cdot5\times\frac{44\cdot3}{33000}=4$ H. P."

If Mr. Edison's claims were just, why did not Mr. Upton give the H. P. used in each case? Had he so done the coefficient of efficiency could at once have been obtained. But in order to state the case properly and fairly, information should also have been given as to what power was applied to excite the field magnet.

On page 265 of your issue of October 25, we do find a statement as to power used, and we assume that the machine was then working under the conditions of so-called maximum efficiency, and, conceding Mr. Upton's examples, how will the results obtained compare with the claims made on page 242?

Since, according to Ohm's law $C=\frac{E}{R}$, and Mr. Upton says the electromotive force is 130 volts, we should have in the second example $\frac{130}{5}=26$, or a current of 26 webers per second through a resistance of 5 ohms. Now, according to Joule's law, $H=C^2Rt$, this multiplied by 0·73726542 (taking 1 H. P. = 746 volt ohms) the equivalent in foot pounds of 1 weber per ohm per second, gives the number of foot pounds in the circuit (or if any one prefers he may take the equivalent in foot pounds of 1 weber per ohm per minute as 44·2359252), we shall then have $26^2\times5\times60\times\frac{\cdot73726542}{33000}=4\cdot53$, or about 4½ H.P. in the entire circuit, while in the external circuit we shall have $26^2\times4\cdot5\times60\times\frac{\cdot73726542}{33000}=4\cdot077+$, or about 4 H. P., thus indicating a loss of 20 per cent of the power applied to the machine, without taking into consideration the power applied to excite the field magnet.

I think Mr. Upton, when he wrote the letter on page 308, did not have in mind the very remarkable passage on page 242, which is as follows, viz.: "While this generator in general principle is the same as in the best of the well known forms, still there is an all important difference, which is, that it will convert and deliver for useful work, nearly double the foot pounds of energy that any other machine will under like conditions," or he would not have appealed to a general law to prove so remarkable an exception; and I would very respectfully recommend to Mr. Upton the careful study and consideration of the causes of loss in dynamo-electric machines before he again uses the calculus to support such statements as are contained in the article on page 242.

In conclusion, I think I may say that I am possessed of sufficient "sense and science" to prevent my falling into such manifest absurdities as are contained in Mr. Edison's statements on page 242, or Mr. Upton's elucidation on page 308.

EDWARD WESTON.

Newark, N. J., Nov. 15, 1879.

The Future Water Supply of Philadelphia.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of November 15 there is an article under the above title, in which the following statement occurs: "The latest project—that of Mr. James F. Smith, C.E.—contemplates a gravity supply by aqueduct, to be drawn from the upper portion of the Perkiomen Creek and its tributaries." This is not a new project, but was presented to the City Councils of Philadelphia, in 1865, by Henry P. M. Birkinbine, then Chief Engineer of the Water Department. The plan, as presented to councils in 1865, was as follows: At a point on this stream, the largest tributary of the Schuylkill, 26½ miles from Broad and Market streets, the creek passes through a narrow chasm in a ridge of trap hills. Above this point the stream falls rapidly, and drains an area of 220 square miles of hilly and rocky country, some of the hills rising one thousand feet above tide. Most of the surface is still in forest, and a very small percentage is under cultivation. Perhaps there is no section of country within so short a distance of a great city that possesses all the requisites of desirable drainage area, or from which water of such good quality for all the purposes for which it is required can be drawn. The quantity collectable would be an average of over 200,000,000 gallons per day. This water could be brought to the city and delivered into a reservoir at an altitude of 170 feet above city datum. The project as presented was to construct a large impounding reservoir at the point above designated, covering from 1,700 to 2,000 acres, and having an available storage capacity of from 5,000,000,000 to 10,000,000,000 gallons, and conveying the water to the city by aqueduct, principally of masonry. Mr. Smith, in his paper (see Journal of the Franklin Institute for October, page 248), says: "I very cheerfully resign to Mr. H. P. M. Birkinbine the credit of pointing out the stream, and for myself only claim the plan of tapping it at a higher and more favorable point, and intercepting and utilizing the headwaters of its principal branches."

Mr. Smith's suggestion is simply to take one of the principal tributaries, six miles further up stream than the original location, and by that means bring the water into the city at a greater elevation, adding other branches of the stream as the demands of the city make it necessary.

The objections to his plan are the increased length of aqueduct; complication by making it necessary to construct a number of impounding dams upon the tributaries, instead of the one large impounding reservoir suggested in the original plan; the increased expense of carrying the line of aqueduct at a great elevation; the loss of the water collected from six miles of the main stream. The greater elevation secured by Mr. Smith's plan would be of little practical value, as the pressure would be too great for the low-lying districts, and would be destruction to the entire old pipe system. The additional head secured by the new location would not increase the area which could be supplied by gravitation one per cent.

Mr. Birkinbine defended his location and plan in a paper read before the Franklin Institute at the monthly meeting on October 15.

There is no doubt but Philadelphia will at some future day draw its supply from the Perkiomen by gravitation, and were it not for the traditional slowness of the city it would have done so before this time. The improvements in the supply of New York, by the construction of large impounding reservoirs in the Croton drainage; the addition to the supply of Boston, by the construction of the Sudbury aqueduct, and in Baltimore by the introduction of the water from the Gunpowder, may induce Philadelphia to some action in the near future. At present the city has an unsatisfactory and precarious supply, both as to quantity and quality, furnished by 8 pumping stations, 8 water wheels propelling 14 pumps, 16 steam engines and 28 boilers operating 25 pumps, and 16 reservoirs at various elevations, from 94 feet to 348 feet above city datum.

HARRIS.

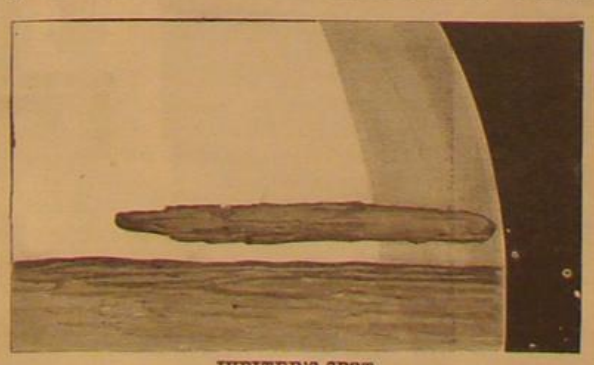
Astronomical Notes.

To the Editor of the Scientific American:

Three of the most conspicuous planets are now visible in the early evening. In the south shines the ever resplendent

MARS AS SEEN NOV. 11 1879.

Jupiter, not so bright as a month ago, but still a magnificent object to the naked eye, and in the telescope of the greatest interest to the humblest observer. The satellites, four in number, with their ever-changing positions and constantly recurring phenomena of transits, occultations, and eclipses, can be observed with quite small telescopes if properly supported and adjusted. A good 2 inch achromatic, with magnifying powers of 60 and 100 diameters, will show this phenomena with good satisfaction. To render the satellite or its shadow visible *during* a transit requires larger instruments. Let no one be deterred from astronomical study by the smallness of their instruments of observa-



JUPITER'S SPOT.

tion, for the lowest power will show much more than the unaided vision; and in the *attempt* to conquer these sublime visions with their present instruments, a taste and experience will be developed that will enable them to appreciate a larger telescope much more than they otherwise would, and at the same time have educated them, in hand and eye, to use it with greater efficiency.

The belts of Jupiter are very plainly visible this season. Also the *great red spot*, the present one first noticed in Europe about two years ago and now readily seen with moderate telescopic power. I append a sketch of it as seen a few evenings since in the 5 inch Newtonian reflector, just as it had fairly entered upon the face of the planet. In the southeast shines Saturn, not a very attractive object to the naked eye, but in the telescope the marvel of the heavens. Its stupendous multiple ring system—the despair of astronomers—may be seen with moderate telescopic aid. A 2 inch glass will show the main division of the ring, the space between the ring and planet, and one or two of the satellites. The rings will be more open next year than this. In February, 1877, they disappeared, or in the largest telescopes were seen only as a fine thread of light. Their thickness, which then only was seen, is estimated at one hundred miles. In the east sweeps up the heavens the ruddy-faced Mars in company with the gentle Pleiades. On the 12th inst. Mars was in opposition to the sun and at its brightest for this season. This planet presents to astronomers greater indications of being a habitable globe than any of the planets. It is clearly divided into two grand divisions of land and water. Some of its markings can now be seen in small telescopes, but large ones are necessary to bring out all the details. The annexed engraving shows Mars as seen on November 11, 1879, in the 5 inch reflector, at 10 P.M.

The two satellites of Mars can only be seen in the largest telescopes, and then appear as mere points of light. They were discovered by Asaph Hall with the great Washington telescope in the favorable opposition of 1877. It is reported that they were first seen this season in Europe with a three foot reflector.

WILLIAM R. BROOKS.

Red House Observatory, Phelps, N. Y., Nov. 15, 1879.

How Ice Boats Sail Faster than the Wind that Drives Them.

To the Editor of the Scientific American:

I would thank you to allow me to make a few observations on a question which you spoke of in your last number, viz., "the speed of ice yachts."

I am convinced your opinion is the true one. You base it moreover on facts; no doubt this is the best proof. But it may also, I think, be proved theoretically according to the most elementary principles of mechanics.

It is demonstrated in mechanics that when a force acts continuously on a movable body the motion of this body increases every moment. Now, in the case under consideration the force is the wind, the movable body is the ice yacht. The force is continuous (we suppose the wind continues to blow); therefore the ice yacht should go faster and faster, and if it be a sufficient time in motion, its velocity will at a given moment exceed that of the wind.

In this reasoning I suppose the friction of the yacht on the ice to be sufficiently small not to entirely destroy the increase of speed which the wind tends to communicate to the boat.

It must be observed that the velocity of the wind may vary during its action, though this by no means weakens our proof. It is sufficient that it acts continuously. If the constant force vary in intensity, the increase of speed will be less each moment, but the velocity will, notwithstanding, increase, supposing always that it is not annulled by friction.

Let us observe, in fine, that it is quite possible for a boat to go faster than the wind which drives it. For this it suffices that during the whole time of its course the boat moves through air already put in motion by the same wind.

A. O.

Montreal, November, 1879.

Energy in Foot Pounds.

To the Editor of the Scientific American:

In a communication on page 337, current volume (No. 22), Mr. Upton correctly states that: "Foot pounds are always measured by the square of the current, and the method of measuring is analogous to that employed for measuring the energy in a stream of water." His deduction is not quite right, "for if twice the amount of water flows from a given sized jet against a turbine, it will be able to do" *eight* "times the work" instead of "four" times as he has it. The reason is plain enough; for to double the velocity through the jet the pressure must be increased by four; therefore twice the quantity and four times the pressure (or head) equals eight times the power.

A. M. SWAIN.

North Chelmsford, Mass., Nov. 24, 1879.

MECHANICAL INVENTIONS.

An improved lawn-edge mower, patented by Mr. Timothy Hanley, of Boston Highlands, Mass., consists in a cutter revolving in a vertical plane against a knife whose edge lies in a vertical plane.

Mr. William L. Longley, of Cumberland Mills, Westbrook, Maine, has patented an improved revolving screen for treating paper pulp, so constructed as to screen the pulp rapidly and thoroughly, and expel it promptly from the machine. It consists in the combination, with the interior surfaces of the screen plates, of corresponding bellows plates, the latter being so arranged and operated in connection with the screen plates that when the pulp screen revolves a motion will also be given to the bellows plates, whereby the pulp will be sucked through the screen plates, and an effective pulsation thereby imparted to the pulp.

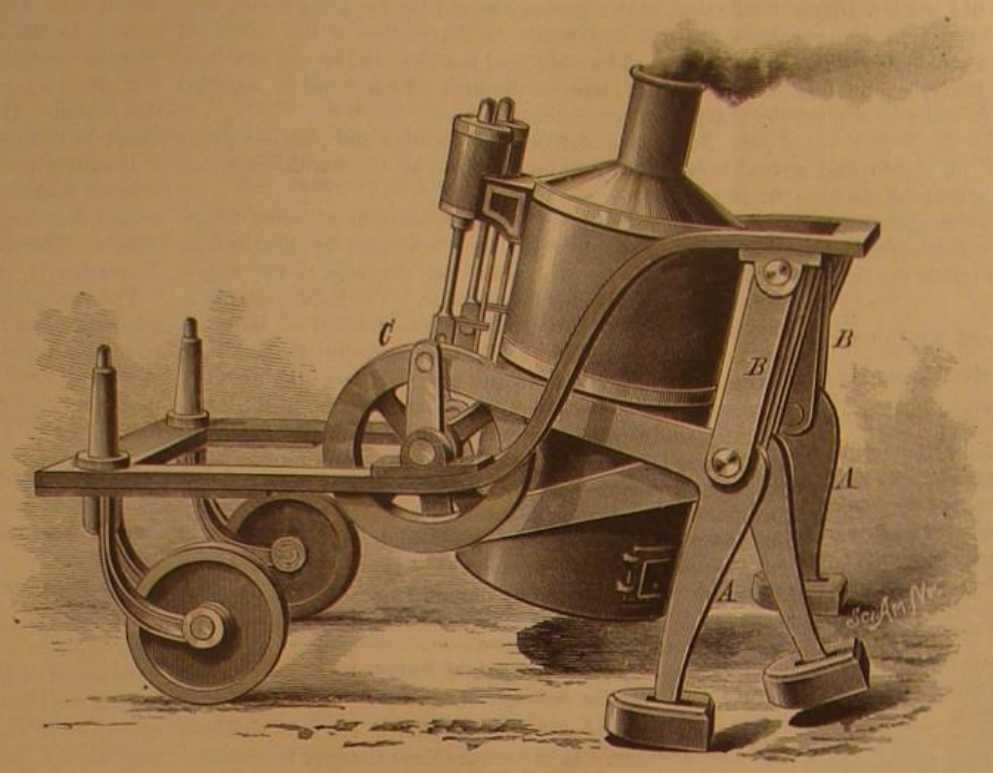
Mr. George E. Passage, of Nunda Station, N. Y., has patented an improved device for adjusting the shoe to give any desired inclination to the sieve or screen, and which shall be so constructed that the said shoe may be adjusted while the machine is in motion, so that the operator can see the effect of the change, and can thus be able to adjust it so as to give the best effects.

NOVEL TRACTION ENGINE.

The curious motor illustrated by the accompanying engraving is really a steam horse having four legs, and behaving very much like the veritable animal which it is intended to replace, in so far as the manner of its locomotion is concerned. Two right angled levers, A, are jointed to bars, B, which swing on a shaft extending across the rear end of the main frame carrying the boiler and engine. The front end of the main frame is supported upon caster wheels which are free to turn in any direction in a horizontal plane.

There are four of the jointed legs, A B, two upon each side of the boiler, and the forward ends of the right angled levers, A, are connected with cranks on the engine shafts. Each pair of legs has its separate engine, and the cranks driving each pair are oppositely disposed, so that the legs move alternately in opposite directions. Each leg is provided with a foot having an outer metal part and an inner elastic rubber portion moulded on an enlarged portion of the ends of the legs. The rubber forms a cushion which gives elasticity to the step, and prevents jarring.

The guiding of the motor is accomplished by increasing or diminishing the speed of one or the other of the engines. When walking, each pair of legs will be alternately lifted from the ground, carried forward, and placed upon the ground, there to remain while the motor is carried forward one step, when it is again lifted, and so on. The inventor of this novel machine is John E. Praul, of the U. S. Navy, stationed at Washington, D. C.



PRAUL'S TRACTION ENGINE.

IMPROVED OIL CABINET.

The engraving shows, in perspective and vertical section, an improved liquid cabinet recently patented by Mr. James M. Thayer, of Randolph, Mass. This cabinet was originally intended for the use of dealers in kerosene oil and similar liquids, but the inventor finds it admirably adapted to the use of druggists for containing spirits and other volatile or inflammable liquids; it is also suited for use in private families for holding oil or any other liquid consumed in the household, as it prevents evaporation and confines the odors, and renders explosions impossible.

The device consists of a metallic tank, A, and a measure, B, mounted in a suitable wooden case and provided with valves for controlling the escape of the liquid, and an indicator for showing the amount of liquid discharged from the measure. The case which contains the tank, A, has a lid which is raised when the tank is filled. The valve, C, at the bottom of the tank, discharges into the measure, B, and is controlled by a wire extending upward through the top of the tank and connected with a lever connected by a wire with a short arm on the spindle of the knob, D. The measure, B, contains a float, E, from which a rod extends upward through the top of the measure, and is connected with a cord that runs over a pulley and is attached to an index which is free to move up or down in front of a scale graduated to represent the gallon and its parts. This device indicates the amount of liquid admitted to the measure. In the bottom of the measure there is a valve, F, the stem of which extends through the top of the measure, and is connected with a lever which is operated by a crank at the end of the measure. The valves, F and C, are held to their seats by coiled springs, and under the valve, F, there is a drip cup for receiving any oil that may drip from the valve after it is closed. When it is desired to discharge the liquid from the measure a metallic tube is placed between the receiving vessel and the valve before the latter is opened. When the tube is not in use it is placed in a drip cup formed in the top of the measure. The cabinet may be provided with one or two tanks, and when it is used by the consumer of the oil or other liquid, the measuring device may be dispensed with.

THAYER'S OIL CABINET.

Locomotive Engine Driving.

At a recent meeting of the members of the London Association of Foremen Engineers and Draughtsmen, Mr. Michael Reynolds read a paper entitled "Practical Notes on Locomotive Engine Driving," extracts from which we take from the *Railway Review*.

He said a man might be a first class mechanic, and yet not capable of taking charge of a locomotive under steam, moving at the rate of eighty-eight feet a second. On the footplate the eye was trained to distinguish colors at a distance, and the ear learns to detect the slightest variation in the four beats of the two cylinders. It was only under steam at high speed with a train that a locomotive engineman had the advantage over a stationary engineman. On railways there were coral reefs and sand banks. There were all kinds of traps, including points, sidings, and gullets, and if the driver did not know these, he was sure to fall a victim to one of them. These trappings were sometimes of a most expensive character. The rank and value of an engineman was exactly in proportion to the labor and study he had bestowed on the subject of traps. The first class locomotive driver was always the same when at work, because he acted upon well based rules. If the locomotive driver adhered strictly to the rules laid down, there was no fear of anything going wrong, and it was necessary that he should, on entering upon duty, see what water was in the boiler. Many drivers were satisfied by looking at the gauge glass, and not by actual fact. It was only by opening the gauge cocks that a driver could be positive as to what water was in the boiler. It was necessary to see that these gauge cocks were in working order, for he knew of an instance where two experienced drivers were instantaneously killed through a gauge cock glass not working, and when the attempt was made to shut off steam, the signal being against them, it failed, and the train dashed into two horse boxes and a pen wagon. It was astonishing what little failures had done in the way of upsetting the working of a large traffic, not to mention the inconvenience suffered by passengers. The experienced engineman put his locomotive through certain trials before it left the shed, as it was better for the defect to be found out then rather than when the train was going at full speed. Unless the fire was properly constructed and well burnt through it would be found difficult to keep time, especially if the train was going against a side wind and drawing a heavy train. On some of the English express trains the average speed was fifty miles an hour, and in order to keep time the engines must run at some parts of the road seventy or eighty miles an hour. He had traveled at eighty-two miles an hour, and only arrived to time.

He then described the different kinds of coal that should be used by enginemen, and warned them of the inferior quality, which was apt to deceive the driver. He added that broken firebrick should also be put into the fire box, as it prevented coal from falling out, and excluded the cold air. The oiling was generally done by the driver on the inside of the engine, and the fireman did what was necessary underneath. The history of locomotive failures showed that at least two thirds of these occurred through preventable causes, and which would have been avoided had the engineman systematically examined the locomotive. Every engine failure was the result of one of two things. It was either a deviation from what the builder intended, or a deviation from perfect engine driving. It was always the case that a first class driver was a man of taste and judgment. After the engine had arrived at the end of its trip, it should be immediately examined, because if left till it reached the shed, which might be an hour or two later, then what was formerly hot would be comparatively cold, thereby deceiving the engineer. From the start to the finish of a journey everything demanded close attention, and there was not a body of men in England who tried to give satisfaction like the brave enginemen of the iron horse.

After some discussion on the advantage or otherwise of making drivers practical mechanics and scientific men, the chairman said the question was fully discussed before a committee of the House of Commons about thirty years ago, when Mr. Brunel stated that locomotive enginemen ought not to be able to either read or write, and the more ignorant they were the better, for they would make themselves part and parcel of the engine. That opinion, however, was not agreed to by the committee, and Mr. Brunel found himself in a miserable minority, as it was the general opinion of the members that drivers ought to be thoughtful and trustworthy mechanics—such was his own opinion also.

Steam Jet Signals.

It is curious that no use has been made of the fact that when a strong ray of light is thrown upon a jet of steam issuing forth into darkness the steam becomes brilliantly illuminated, and the light thus transmitted is visible from long distances. The example of this, frequently seen in the steam issuing from a locomotive engine at night, when the driver opens his fire door, has not been lost, for, taking advantage of this principle, M. Carl Otto Ramstedt, late of the Russian Navy, has devised a system of night signaling on board ship, with which some experiments have recently been made by the Trinity Board. The apparatus consists of a dished chamber, in which the inventor burns strontium or other substances so as to produce a variety of colors if desired. At the back of the chamber is a reflector, by means of which the light is thrown on the steam either steadily or in flashes at will. The steam thus becomes a luminous mass, varying in color with the substances used in combustion. The result of the experiments recently made showed it to be very effective and applicable to its intended purpose, and there appears to be little doubt that it will prove of value as a means of signaling at sea.

To Solder Tortoise Shell.—Bring the edges of the pieces of shell to fit each other, observing to give the same inclination of grain to each; then secure them in a piece of paper, and place them between hot irons or pincers; apply pressure, and let them cool. The heat must not be so great as to burn the shell; therefore try it first on a white piece of paper.

A SINGULAR HABIT OF THE WOODCOCK.

Among several curious habits of the woodcock, described by the editor of the *Zoologist*, its practice of carrying its young is perhaps the most interesting. The testimony of many competent witnesses is cited to corroborate the statement. The late L. Lloyd, in his "Scandinavian Adventures," wrote: "If, in shooting, you meet with a brood of woodcocks, and the young ones cannot fly, the old bird takes them separately between her feet, and flies from the dogs with a moaning cry."

The same author makes a similar statement in another work, this habit of the woodcock having been observed by a friend.

One of the brothers Stuart gives, in "Lays of the Deer Forest," a graphic account of the performance. He says: "As the nests are laid on dry ground, and often at a distance from moisture, in the latter case, as soon as the young are hatched, the old bird will sometimes carry them in her claws to the nearest spring or green stripe. In the same manner, when in danger, she will rescue those which she can lift; of this we have frequent opportunities for observation in Tarnaway. Various times when the hounds, in beating the ground, have come upon a brood, we have seen the old bird rise with the young one in her claws and carry it fifty or a hundred yards away; and if followed to the place where she pitched, she has repeated the transportation until too much harassed. In any sudden alarm she will act in the same way." Another method of transportation has been observed by Mr. Charles St. John, and described in his "Natural History and Sport in Moray." He says: "I found out that the old woodcock carries her young even when larger than a snipe, not in her claws, which seem quite incapable of holding up any weight, but by clasping the little bird tightly between her thighs, and so holding it tightly against her own body."

This narrator doubts the feasibility of any other mode of transport, and notwithstanding the confirmation of his report by other observers, it is probable that the method shown in the engraving is the one most commonly employed.

WOODCOCK CARRYING ITS YOUNG.

The Cultivation of Carp.

The Fish Commission have been distributing German carp throughout Kentucky, Missouri, and other Southern States. Professor Baird says that this fish bears about the same relation to the ordinary English carp that a North Carolina "pine woods" pig does to one of the Berkshire breed. In Germany the carp is esteemed as highly as the trout and sells for the same price in the market. The first successful introduction of these fish into the United States took place about three years ago. The experiment of breeding and raising them in the pond where they were then placed has been perfectly successful, the fecundity and rapid growth of the fish having been quite remarkable. Specimens hatched this year have already attained a length of seven inches. The carp lives on vegetable food, and thrives best in warm water; facts which make it peculiarly suitable for the South, and its qualities as a food fish will give it a high value in that section.

Sponge Gathering around Key West.

A Florida correspondent of the *Farmer and Fruit Grower* tells how sponges are gathered off Key West, in which waters, and along the Gulf coast of Florida, are the principal sponging grounds of the United States. The sponge schooners have two places for cleaning sponges, namely, Anclote Keys and Rock Island. The several varieties of sponges are classed according to their marketable value as "sheep wool," "yellow," "fox glove," "grass," etc., besides one class, the "loggerhead," which has no value, and is not thought worth picking up. The first named is the variety most sought, as it bears the best price. The most of the vessels engaged in the sponge trade are owned and fitted out at Key West. The outfit of a sponge schooner consists of a number of long poles with hooks fastened on the end for gathering; from three to seven small boats called "dingies;" from seven to fifteen men—according to the number of boats—with provisions for from eight to twelve weeks; water-glasses, etc.

In sponging each dingy carries two men, with water-glasses, sponge hooks, and other necessities. While one man sculls the boat about, the other, lying across the boat's thwart with his head in the water-glass, scans the bottom for sponges. The water-glass is nothing but a common deep wooden pail, with a circular pane of glass for a bottom. Placing this upright in the water, and putting the head in far enough to exclude most of the light, one can easily see an object on the bottom in six or seven fathoms of water. The sponger directs the sculler how to go by waving his hand, and when in a desirable position he thrusts his long pole down and hooks his sponge.

The vessels usually remain out upon the bars from Monday until Friday evening of each week, coming into the Keys Friday night in order to clean the sponges gathered the week previous, put those gathered the current week into the crawls, put their wood and water on board, and prepare for the next week. The freshly gathered sponges are put into crawls or pens, made by driving posts in the sand, where, at low water, they will be quite or almost dry. Here they are left until the next Saturday, to be washed by the tides. On the following Saturday they are cleansed by striking them one or two light blows with a paddle.

NATURAL HISTORY NOTES.

A Single-toed Deer.—The curious case of a breed of one-toed hogs brought to the notice of scientists some time ago by Dr. Elliott Coues, is paralleled, at least in an individual instance, by that of a one-toed deer, the four feet of which were recently presented to the California Academy of Science. Unfortunately the only parts sent were the metatarsals and toes, so that it would be difficult to be certain of the species, further than that it was a *Cariacus*. The deer was killed in Mendocino County, Cal., but no information as to the existence or non-existence of others resembling it has yet been obtained. In all cases the third toe was the only one utilized for progression, but the extent of the development of the fourth toe differed in the respective feet.

A Luminous Moss.—Mr. J. Poisson gives in *La Nature* the following account of a moss which is met with quite frequently in the Pyrenees, and which is very puzzling to persons who are ignorant of natural history. The *Schistostega osmundacea* is a small moss with distichous and elegant foliage forming the type of a genus erected by Mohr at the beginning of the present century. Its botanical name is derived from two Greek words signifying "ruptured covering," in allusion to the fact that the operculum or lid which covers the urn or spore case tears instead of falling off in one entire piece. This humble plant has for a long time attracted the attention of botanists, and been a source of curiosity to tourists who frequent the Alps, the Pyrenees, etc., where are found many caves into which but little light penetrates, and in which the *Schistostega* finds congenial surroundings for its growth and development. In the very feeble light of these caves greenish-tinted luminous effects are observed which have been aptly likened to the sparklings of the emerald. It was at first thought that these were due to a phosphorescence emitted by the moss, but when Bridel published his "Bryologia Universa," in 1825, this theory had to be abandoned; for this distinguished student of moss es remarked that when the light was entirely shut off at the mouth of the cave in which the *Schistostega* grew the luminous effects disappeared. As a result of this observation it became evident that the phenomenon was due to reflection of light from the delicate cells filled with chlorophyl, composing the filaments that are seen at the base and in the vicinity of the little moss.

At the epoch in which Bridel wrote botany had not made that advance that it since has done, and so the distinguished bryologist naturally took these filaments which had the property of reflecting light for a new species of alga, and called it *Catopridium smaragdinum*. These filaments, however, were nothing else than the vegetative state of the moss itself—a state called by botanists the "protonema" or "prothallus." When the spores of a moss germinate (if a thing can be said to "germinate" that contains no germ) they throw out a filament containing grains of green chlorophyl; then the filament divides into cells and gradually ramifies, and, after a certain length of time, varying with the species, this prothallus gives rise to buds, which take root, form stem and leaves, and become new moss plants. The latter state is the adult and perfect form of the plants. So, then, the moss called *Schistostega osmundacea* owes its luminous properties to the prothallus—its first vegetative stage. This prothallus is composed of septate filaments, which, by means of their anatomical arrangement, store up the light that reaches them and reflect it again, just as a brilliant cut in facets reflects back in sparkling rays the light it receives, these rays being so much the more brilliant in a comparatively dark place.

The Lowest Forms of Life.—At a recent meeting of the Philadelphia Academy of Natural Sciences Dr. Leidy referred to the structure of the low forms of infusorial life known as the *Amœba*, upon a study of which, and allied creatures, he had been engaged for some time past. He said that the species of the true genus *Amœba* all possess a nucleus and contractile vesicle. He believed that the latter organ, if it may be so called, performed the function of a combined heart and lung, as currents of liquid were probably received and expelled by it. It would be remembered that a form of life still lower than the *Amœba* (inasmuch as it is devoid of a nucleus) had been described by Haeckel under the name of *Protamœba*. Recently Prof. Butschli had described an interesting species which he had found parasitic in the intestinal canal of the common cockroach. Dr. Leidy was glad to be able to confirm all of Butschli's statements concerning this curious little creature, which he had observed in the situation indicated. He believed, however, that it should be placed in a genus distinct from the *Amœba*, as it possessed permanent characters which placed it between that genus and the *Protamœba*. A distinct nucleus and nucleolus can be readily seen, but no trace of a contractile vesicle has, as yet, been discovered in it. In the typical *Amœba*, the protoplasm of which the animal is composed, divides itself into two portions—a clear outer film and granular contents. In the new form no such division of substance can be seen during life, although the two portions separate after death. These characters seemed sufficient to distinguish the creatures generically from those heretofore described, and Dr. Leidy therefore proposed for it the name of *Endamœba*, retaining the specific name *Blattæ* proposed by Butschli. This rhizopod is of interest to the student of microscopic life, because of the ease with which it can always be obtained for examination, and because it forms probably the simplest and yet the most complete example of a living organic cell—a particle of protoplasm containing a nucleus and nucleolus and nothing else. In answer to a question, Dr. Leidy stated that it was commonly believed by those who studied infusorial life that all the forms containing chlorophyl gave off oxygen after the manner of plants. The belief was not founded merely upon the green color of the contents, but upon experiment. He did not think that this liberation of oxygen by animal matter was necessarily contrary to the logic of nature, because we have not been able to positively distinguish animal from vegetable life.

The Jelly Glands of the Water Shield.—Dr. J. Gibbons Hunt, in a paper read recently before the Philadelphia Academy of Natural Sciences, has described the apparatus which in the water shield (*Brasenia peltata*) excrete the jelly which covers the submerged parts of the plant. These consist of special jelly glands covering all the submerged portions, and are not mentioned anywhere in the books. They are cylindrical in form, about 180th of an inch in length, growing out from and connected with special epidermal cells of oval form, which differ in contents and formation from the ordinary contiguous cells. These cells are filled with a dense and nearly transparent protoplasm, which throws out the jelly, apparently through the thin walls of the glands. The jelly from one gland touches and unites with that next it until the entire submerged parts become incased in a gelatinous garment. Dr. Hunt does not venture upon any theory as to the uses of this jelly in the economy of the plant—a subject that has puzzled botanists generally.

The Wapiti.

In his recent lecture before the Geographical Society, on Field Sports in America, Lord Dunraven pronounces the wapiti the handsomest by far of all the deer tribe. He says: He is called an elk in the States; why, I do not know, for the European elk is identical with the American moose, and a moose and a wapiti are not the least alike. But I presume the wapiti is called an elk for the same reason that thrushes are called robins and grouse partridges. The reason, I dare say, is a good one, but I do not know what it is. The wapiti enjoys a range extending from the Pacific seaboard to the Mississippi, and from the Northwest territory in British possessions down to Texas, and he formerly was found all the way across the continent and in the Eastern States. He is exactly like the European red deer, only about twice as large, carries magnificent antlers, and is altogether a glorious animal. Wapiti are to be met with in forests of timber, among the mountains, and on the treeless prairie. They are, I think, most numerous on the plains, but the finest specimens are found in timbered districts. One might suppose that branching antlers would cause inconvenience to an animal running through the tangle of a primeval forest, but the contrary appears to be the case, for in all countries the woodland deer carry far finer heads than the stags of the same species that range in open country

Wapiti are very shy. They require quiet, and large, undisturbed pastures, and they are hunted with a thoughtless brutality that must shortly lead to their extermination in civilized districts.

Shad and Striped Bass in Lake Ontario.

Over five hundred shad, weighing from two to four pounds each, were taken during the past summer in white fish nets set in deep water off Sackett's Harbor, Lake Ontario. Seth Green, New York Superintendent of Fisheries, says that their stomachs were full of the common food of the lake, showing that they feed there. He has opened thousands of shad in the Hudson, Connecticut, and Potomac rivers, rarely finding anything in their stomachs. He thinks it probable that the Ontario shad have never been to salt water, that they have become land-locked, and will make the lake their home.

It is probable that another valuable salt water fish has also been able to thrive in Lake Ontario, namely the striped bass. About a year and a half ago Mr. Green placed a number of young bass in the Genesee river; and lately a female striped bass, thought to be one of the same lot, was taken in the Niagara river near Lewiston, the first ever taken in the tributaries of the Lake. The fish was well fed, weighed two pounds, and measured sixteen inches in length by nine in girth. Whether the fish will breed in the lake remains to be seen.

Sea Weeds as Food.

In a recent speech on the trade between Japan and Hong Kong, the English Governor of the latter port made some statements with regard to the use of sea weeds in China, which suggest the possibility of our neglecting a valuable source of food supply along our Atlantic coast. The profitable crop of "Irish" moss gathered annually from the rocks off Scituate, Massachusetts, may be but a small part of our resources in this direction. Governor Hennessey said: "I have been examining them (Japanese seaweeds) in the museums of the Kaitakushi both here and at Tokio, and it seemed as if I recognized familiar friends, for in the busiest streets of Hong Kong similar products are to be seen in bales and bundles with Japanese trade marks upon them. Your seaweeds have a high reputation in China for their succulence and nourishing qualities. From the statistical tables placed at my disposal by the Government, I find that in the year ended June 30, 1878, the quantity of Japanese seaweeds received in China through Hong Kong, and otherwise, amounted to 20,565,479 catties, valued at $456,366. Looking to the way that this article of food is produced and put upon the China market, and to the extraordinary demand for it in that empire of 400,000,000 of food consumers, it is not too much to say that its production and sale will be in almost direct proportion to the labor you can give it. Increase that labor fivefold, and the consumption of Japanese seaweeds in China will probably be increased fivefold. The night before last I experienced a new and not unpleasant sensation in eating some of your well-cooked seaweeds, and I am not surprised at the estimation in which the Chinese, a nation of cooks and gourmands, hold them."

The Salt Product of New York.

During 1878, the Onondaga Salt Works produced, in the aggregate, 7,126,197 bushels. Up to the middle of November this year, the yield was 7,276,062 bushels, and there is no doubt that the production of the entire year will be very near 9,000,000 bushels, an increase of almost 2,000,000 over last year, and nearly equal to the largest yield in the history of the trade. This year Onondaga salt brings $1 a barrel of five bushels in the West, against 70 to 80 cents last year, affording the manufacturer a fair but by no means large profit. There is a growing demand for salt for agricultural purposes, farmers having become convinced that as a fertilizer it is of great merit. In order to increase this demand, and to place the article in a position where it can compete with other composts, it has been suggested that the duty on this grade of salt, which is 35 cents per ton, be taken off. It is thought that if this were done an immense trade in this branch of the business would result.

During recent years the cost of producing salt has been materially reduced by burning pea or dust coal instead of ordinary lump coal. The coal dust is obtained at the mines comparatively free of cost, for it is mere refuse, and the larger share of the expense to the manufacturer is the transportation from the mines to the works. This coal dust is burned under a strong artificial draught furnished by blowers worked by small steam engines. It is now clearly demonstrated that salt can be produced at these works at so low a cost as successfully to meet home competition. No ingenuity, it is claimed, can reduce the cost of production low enough to compete with foreign manufacturers as long as the article comes over as ballast, almost duty free.

The Wheat Crop of 1879.

E. H. Walker, statistician of the New York Produce Exchange, after a careful estimate from authoritative reports, places the wheat crop of the United States for 1879 at about 425,000,000 bushels. The spring wheat crop will not be so large as was at first expected, that of Minnesota being no more than 28,000,000 bushels, instead of 40,000,000 as estimated early in the season. The amount consumed by 48,000,000 persons, plus the amount required for seed and other purposes, is placed at 250,000,000 bushels, leaving 175,000,000 bushels for export, 160,000,000 bushels for Europe, and 15,000,000 for other ports. The deficient wheat crop in Europe this year makes the demand there—provided the people are able to pay for so much—above 300,000,000 bushels, two-thirds of which will be required in France and the United Kingdom.

RECENT DECISIONS RELATING TO PATENTS, TRADE MARKS, ETC.

By the U. S. Circuit Court.

PAPER CAR WHEELS.

A case which promised to be of some importance as affording the means of a full discussion of the comparative merits of paper and iron car wheels, has just been decided in the United States Circuit Court at Philadelphia, by Judges McKennan and Butler. It appears that on November 1, 1876, Holloway, a brakeman of the North Pennsylvania Railroad, was killed in an accident caused by the tire coming off a paper car wheel under a Pullman palace car. The father of the deceased sued the Pullman Palace Car Company for damages, and it is this case which has just been decided by the court in favor of the defendant. The plaintiff contended that the paper wheels were unfit for use, and not as good as first class chilled iron wheels, and that the use of such paper wheels showed such gross negligence on the part of the Pullman Palace Company as made the latter liable for damages, though it was admitted that the paper wheels as now made by the Hudson Paper Car Wheel Company are safe.

After the plaintiff had rested the defendant asked for a non-suit, on the ground that the plaintiff had failed to make out a case, and that the testimony did not show any liability on the part of the Pullman Palace Car Company. The Court granted the non-suit, so that there was no argument on the comparative merits of paper and iron car wheels beyond that made by the counsel for the plaintiff in his opening. A motion was afterwards made to set aside the non-suit, on the ground that the car wheel company is also liable for injuries that might result from the negligent and defective construction of the car wheel, but the judges reiterated their decision, and a verdict in favor of the defendant was recorded.

R. N. Allen, Superintendent of the Hudson Paper Car Wheel Company, says that the wheel, the breakage of which caused the accident—the only one which has been traceable to such a cause—was manufactured twelve years ago by processes which have been greatly improved upon in the interval. The broken wheel had made a mileage of 200,000, and had not been properly inspected. Wheels of the same kind, made at the same time, have been in continual use since the accident, and are, after having made 350,000 miles, still in good condition.

By the U. S. Circuit Court—Eastern District of Wisconsin.

PLASTERERS' HAIR.—KING *vs.* TROSTEL *et al.*

The device covered by the following claim—"As an article of manufacture, the bale, B, of plasterers' hair, consisting of several bundles, A, containing a bushel each, by weight, inclosed or incased in paper bags or similar material, united, compressed, and secured to form a package, substantially as specified"—does not involve invention and is not patentable. Letters Patent No. 152,560, granted June 30, 1874, to Wendell R. King, are void.

DRUMMOND, *J.:*

This is a bill filed by the plaintiff against the defendants to restrain them from manufacturing and selling a kind of bale called "Plastering-hair Bale," which the plaintiff claims to belong to him by virtue of letters patent issued to him on the 30th day of June, 1874. The plaintiff invented, as he alleges, a peculiar method of putting up plastering hair in bales so as to constitute it an article of manufacture protected by the patent issued to him. He says in his specification that

"Heretofore plastering hair has been packed in a mass, or a certain number of bushels baled together, varying in amount as to the order required, so that when received the retail dealer was compelled to parcel out the same and weigh it to suit his customers."

Hair had been previously put up in large bags, barrels, or boxes, so that when it was called for by a customer, it had to be taken out of this large package, and, generally being more or less dirty, it was disagreeable to separate one part of the hair from another, and the plaintiff claims that he supplied a desideratum in the trade by putting it up in small parcels and tying or fastening them together so as to constitute what he termes a "bale." It is assumed that the hair is in a proper condition to be packed, and that being so, he describes his mode of packing. He says:

"I first place a bushel of hair in a paper sack, loosely, or only so far packed as may be readily done by hand. Several of these one bushel packages are then placed side by side in a baling press. I use for this purpose the baling press heretofore patented to me. They are thus compressed forcibly together, so that the bale produced will be a compact, firm bale, occupying only about one-fifth of the original bulk. The paper bags, which still envelop the individual bushels of the bale, keep said bushels separate, and serve at the same time to protect the hair."

He claims that when the hair is thus put up in bushels and fastened together in the mode designated, so as to form a bale, it constitutes an article of manufacture, the subject of a patent, and that it is a very convenient mode in which hair can be sold in small parcels, so as to meet a common demand upon dealers.

The claim at the end of the specifications is as follows:

"As an article of manufacture, the bale, B, of plasterers' hair, consisting of several bundles, A, containing a bushel each, by weight, inclosed or incased in paper bags or similar material, united, compressed, and secured to form a package, substantially as specified."

And the question is whether the plaintiff is entitled to a patent for putting plasterers' hair in packages and fastening them together in the manner described so as to constitute a bale. I am of the opinion that he is not. It is not necessary to decide in this case whether, taking the whole package together, compressed in a baling press which has been patented to him, as he states, it is such an article as the patent law protects, because I do not understand that the bale of the defendants, which is claimed to be an infringement of the plaintiff's patent, has been compressed in the same manner as the bale of the plaintiff, and therefore, strictly speaking, it is not the bale described by the plaintiff. If the plaintiff's patent is construed so as to include any mode of pressure by which the bale is formed out of small packages of plasterers' hair, as his counsel seems to claim, then I think the patent cannot be sustained; because a person can put most articles of merchandise in distinct and separate packages and then compress them together, and that would infringe the patent of the plaintiff, if the construction be as broad as has been intimated.

It may be true that this mode of putting up plasterers' hair has met a want in the trade, but, after all, independent of the particular mode of compression by the apparatus which the plaintiff speaks of in his specifications, it was nothing more than a method which any person might adopt, and which did not require any inventive skill. It is something which might occur to any person, to take almost any article of merchandise, put it in separate parcels, and bind them together. It is an exercise of the ordinary skill possessed by any person.

I had occasion some years ago to examine the principle involved in this case very fully in a bill filed to protect a package which was claimed to be a new article of manufacture for inclosing lard. There were many claims to that patent. All of the claims were rejected except one, which was sustained as a new article of manufacture. It appeared in that case that the article produced a revolution in the trade in lard, which was put up in such a way as to stand all climates, and so as it could be transported any distance without injury. With a good deal of hesitation and doubt as to the correctness of the ruling of the court in that case, one claim of the plaintiff's patent was sustained. The case never went to the Supreme Court, the parties having acquiesced in the decision of the court and settled their controversy.

I am not willing to go beyond that case, nor to encourage patents for such things as this, and to hold that nobody else can take plasterers' hair and make it up into small parcels and bind them together no matter how, and to say that any one who does this infringes the patent of the plaintiff.

By the Acting Commissioner of Patents.

ANTI-CHINESE TRADE MARK.—CIGAR MAKERS' ASSOCIATION OF THE PACIFIC COAST.

1. Where the purpose of an alleged trade mark is that of a symbol only, indicating the fact alone that those who employ it are members of a certain association, it is not a mark of trade such as is contemplated by the statute as proper matter for registration.

2. The avowed object of an association in the use of an alleged trade mark being to discourage the Chinese from manufacturing cigars, it has in view the restraint of trade, and is opposed to public policy, and the trade mark is, therefore, an unlawful one, which the Commissioner of Patents is expressly prohibited by statute from receiving and recording.

APPEAL FROM THE EXAMINER OF TRADE MARKS.—TRADE MARK.

DOOLITTLE, *Acting Commissioner:*

The applicants in this case consist of an association of individuals incorporated in the State of California, and engaged in the manufacture of cigars. They desire to register a trade mark which may be used by different members of the association. It consists of "a figure of a man in a sitting posture in front of a table covered with cigars and the implements of the cigar makers' trade."

The purpose of a trade mark is to distinguish the goods of one manufacturer from the same character of goods made by another; and if this trade mark were registered it would not have this effect, as it does not appear that the members of the association all manufacture the same goods, or propose to apply the mark to any particular kind. The purpose of the alleged trade mark appears to be that of a symbol only, indicating the fact *alone* that those who employ it are members of a certain association. It is, therefore, not a mark of trade, such as is contemplated by the statute as proper matter for registration.

Another objection to this proposed registration is, that it is not a lawful trademark, as it appears from the papers in the case that the avowed object of this association is to discourage the Chinese from manufacturing cigars. Such an object has in view the restraint of trade, and is opposed to public policy. The Commissioner of Patents is expressly prohibited by statute from receiving and recording "any proposed trade mark which is not and cannot become a lawful trade mark." (Section 4939 Revised Statutes.)

The decision of the Examiner of Trade Marks is affirmed.

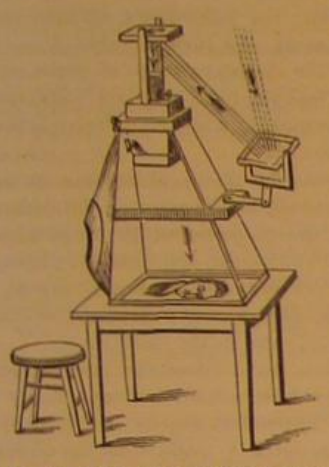
PLATT'S TRACING APPARATUS.

The tracing apparatus shown in the accompanying cut is thus described by Mr. S. L. Platt in the Philadelphia *Photographer:*

A great many photographers cannot afford a solar camera, and an apparatus that would enable them to have some of its advantages will doubtless be of service to them.

The first step is to procure the enlarged sketches of the picture you propose to make. This I do by means of the apparatus which I shall describe below.

As I have said, my invention is for tracing or sketching for crayon or other portraits. It can be used by any one, and for enlarging any object that can be attached to the top, which is to contain the picture, face down. It can be made of any size, from eight by ten to life-size. The lens, the movable front for focusing, clamps for holding the movable top, which is adjusted from inside, and governs the size of the object, and the reflector to throw strong sunlight on the object, will all be seen in the diagram; also the table or stand upon which the paper, or material upon which to draw the image as it is reflected down, is placed. This is a very useful instrument for any gallery, as any card can be enlarged to a perfect eight by ten, or larger, to show the customer how he would appear in a large portrait, which might induce him to have one made. The one I have is intended for a ten inch head, or from that down to eight by ten. It is two feet square at the base, four feet high, fifteen inches wide at the center, with a twelve inch arm to the reflector. The reflector has three movements, or six, counting the backward movements.



PLATT'S TRACING APPARATUS.

The movable box has only two movements, up and down, for governing the size of the reflection. The box is nine inches square, one inside of the other, fastened with a thumbscrew inside of the front curtain. The movable top is raised and lowered from the inside, and fastened by a clamp with a thumb screw in front. The thumb screw is ten inches long, to reach clear across the front. The strip across the center, holding the reflector, is eighteen inches long. The box or framework is covered with soft flannel, and lined with thick yellow paper, so no light gets in save the reflected light. It will be observed that the image is very strong, and has the appearance of a finished picture. The rays falling in at the top make it a very pleasant light to work in, just right for comfort, something like twilight. It takes one to trace by measure, as all portraits do on canvas or cardboard, from two to four hours.

An artist rarely crayons two heads alike from the same picture, and do his best. I can with this make eight sketches with ten inch head in less than an hour, and have them alike every time, for I will not change the focus, and pin the paper each time at the same place. Changing the position of the reflector does not change the reflection, as it leaves the picture every time alike. This is not usually the case with a solar printer. I am a great friend to the solar camera, but I can, by using a condenser, do the same work by this.

Silvering Mirrors.

Some time since the Académie des Sciences offered a prize of 2,500f. for a method of satisfactorily and permanently silvering mirrors, and which should save the workmen the danger of exposure to the effect of mercurial vapors. The prize has been awarded to M. Lenoir, whose process is substantially as follows: The glass is first silvered by means of tartaric acid and ammoniacal nitrate of silver, and then exposed to the action of a weak solution of double cyanide of mercury and potassium. When the mercurial solution has spread uniformly over the surface, fine zinc dust is powdered over it, which promptly reduces the quicksilver and permits it to form a white and brilliant silver amalgam, adhering strongly to the glass, and which is affirmed to be free from the yellowish tint of ordinary silvered glass, and not easily affected by sulphurous emanations.

Sugar from Sorghum.

Dr. Collyer, chemist of the Agricultural Department, is confident that one-tenth of the corn acreage of Illinois would suffice to raise all the sugar used in the United States, if devoted to sorghum of the variety best suited to the latitude; this allowing practical results to reach only 50 per cent of those obtained in his most favorable experiments. The cost of the raw sugar, he thinks, should not exceed three cents a pound. The early amber cane is the species best suited to Illinois. Commissioner Le Duc, who has just returned from a tour of inspection in the West, reports that the most promising results have already been obtained. He visited one manufactory in Illinois, where 43,000 pounds of sorghum sugar have been made this season, equal in every respect to the best product of the sugar cane; and this enterprise has been carried on under exceptional difficulties. He visited, or received reports from many other localities to which he had sent sorghum seeds, all speaking in the most favorable terms of the prospects.

ANCIENT GLASSWARE.

Ancient Venetian glassware was of rare beauty, excelling everything ever made previously by any nation. Domenico Anzolo introduced the art of cutting, grinding, and polishing glass. Venetian mirrors especially, although they cannot be compared with the productions of modern times, were highly valued, and for several centuries Venice had a

VENETIAN GLASSWARE.

monoply of them. Imitations of precious stones were made in large quantities, also beads and imitation mother-of-pearl. Necklaces and cameos of the saints were exported in large quantities to Palestine, where they were sold to the pilgrims as amulets for fabulous prices.

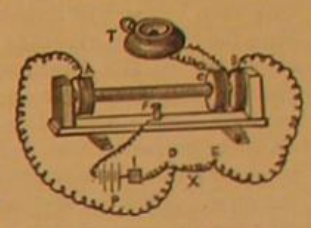
The most celebrated Venetian mirrors that have been preserved are those presented by the republic to the kings Henry III. and Francis I. of France. They are slightly convex, very thick, and set in frames of solid silver, gold, and damascened steel, about 30 inches high, 25 inches wide, and decorated with lilies and palm leaves formed of precious stones and gold. They were regarded as masterpieces of art at their time.

GERMAN GLASSWARE—16TH CENTURY.

Venetian glass was exported to all parts of the world, as far as known at that time. Enterprising merchants even established a regular trade with China, having been encouraged in this business by the celebrated traveler Marco Polo. In consequence, an immense wealth was accumulated, and the fortunes of common workmen in the glass houses were immense. Nevertheless many of them became tired of their golden cage, especially as many enticing offers were made to them by foreign princes. In spite of the rigid enforcement of the laws and the close surveillance under which they were placed, many of them escaped and were gladly welcomed and protected by the governments of the other European nations. Thus we find many Venetian glass makers in Germany toward the end of the 15th century, and from them the Germans learned a great many secrets in regard to the ornamentation and coloring of glass. German glassware, however, kept for a long time an eminently national character. The ornamentation consisted of banners, coats of arms, patriotic devices, and representations of important historical events, engraved with great skill. The principal seat of German glass industry was, and is yet, in Bohemia. In the 17th century the taste changed somewhat, and enameled cut glass came into fashion. Bohemian glass was very clear and colorless, and found a ready market.

MEASURING RESISTANCES.

M. Hospitaliar describes in the *Electrician* a method of measuring resistances, in which he uses a modified form of Hughes' audiometer. Two similar coils, A and B, are connected in a devised circuit with the battery the current of which passes through a vibrating contact. A coil of fine wire, C, is placed between the coils, A and B, and connected to the telephone. This coil slides along a graduated bar, so that its exact position may be easily determined. If, on introducing an inappreciable resistance between the binding screws, D and E, the current in A has the same intensity as in B, the actions of A and B upon C are equal and contrary, so that no sound is heard in the telephone. If a resistance be introduced between A and D, say one ohm, then the actions of A and B upon C are no longer equal, and a sound is heard in the telephone. The movable coil, B, is now adjusted till no sound is heard, and on the graduated scale a mark, 1, is made, indicating that the resistance between D and E is one ohm. Other known resistances are successively introduced and the scale completed, and then the unknown resistance inserted may at once be obtained by reading the scale at the point where sound in the telephone ceases. It is necessary that the battery used should be powerful enough to enable the feeblest sound in the telephone to be heard. The author of this method believes that it will be of great service for measuring the resistances of conductors, of electro-magnets, and telephone coils, because of its extreme simplicity.



The Largest Organ in the World.

The organ for the cathedral at Garden City, Long Island, now under construction by Mr. Hilborne L. Roosevelt, is described by the *Evening Post* as the largest and in several respects one of the most remarkable in the world. It will cost about $40,000, and will be put in place next spring. The main body of the instrument will stand in the chancel, and the organist will sit there. At the west end of the building, in a tower directly behind a large stained glass window, is a room in which a part of the organ will be placed and connected with the chancel by electricity, like the organ built by Mr. Roosevelt in Grace Church, New York. The window will be opened and closed by electricity, controlled by the organist from the chancel, thereby making fine crescendo and diminuendo effects with the organ in the tower. Over the ceiling, about the center of the building, will be placed another part of the instrument called the echo organ, which is to be played from the chancel by electricity. Underneath the chancel, in the chapel situated there, is a part of the organ, which is arranged so that it can be played in the chapel as well as from the chancel. Lastly, the large chimes which hang in the tower will be connected with the chancel by electricity, so that the organist can play them from the keys of the organ. The bellows will be operated by hydraulic engines, and the organist can, by simply turning on the water, have the whole instrument, including the chimes, at his command. Though this will be a mammoth instrument, and notwithstanding the great distance between many of its parts, the pressure necessary to play on the keys will be no greater than is used in playing upon a piano. This is due to the use of electricity, pneumatics, and hydraulics, which combined render it possible and practicable to construct such an instrument.

There will be four vox humanas (similar in construction to the celebrated one in Freiburg); one of these will be in the chancel, one in the tower, another over the ceiling, and a fourth one in the chapel beneath the chancel. All of these will be under the control of the organist in the chancel, and will be capable of crescendo and diminuendo effects. Certainly some beautiful and extraordinary combinations can be produced with their aid. In all there will be one hundred or one hundred and twenty speaking stops, the exact number not yet having been determined upon. The Boston Music Hall organ has eighty-four stops, the Cincinnati organ ninety six, and the largest organ in the world, that in Albert Hall, London, one hundred and eleven. Five hydraulic engines will be needed. Quite a small Gramme magneto machine will furnish all the electricity needed. Where mechanical force is required, as in ringing bells or opening windows, compressed air will be used in an ingenious manner devised by Mr. Roosevelt.

How Sugar is Refined.

A detailed account of the processes by which the pure white granulated and cube sugars of our best refineries have been produced from the coarse sugars of the plantations, may be of interest, says the *American Manufacturer and Exporter*, to those not familiar with the methods now employed in Boston refineries, so favorably known by their products wherever shipped, and so remunerative to their owners.

The melting process, which is the first in order for refining sugar, is carried on in a melting room, so called, now mostly separate from the main establishment, in a building by itself, on account of the uncleanliness of the process. Here the hogsheads and other packages are broken open and emptied by machinery into a melting pan, together with the sugary water obtained by cleansing the empty hogsheads by steam. This melting pan contains from four to six hogsheads of sugar, and has connected with it a revolving horizontal or vertical shaft with stirrer knives for breaking up the lumps of sugar. Here, with water and steam, the sugar, which varies in quality, is melted to a consistency of about 30° Baumé, and drawn off through a sieve till all coarse impurities, such as nails, chips, etc., are removed. It is then raised by means of a large pump to the upper floor of the clarifying house, where it is received into the clarifiers or "blow ups."

The clarifying process is now entered upon, the clarifiers or "blow ups" being large shallow pans about ten feet in diameter and six feet high, having at the bottom a three or four inch copper coil through which the steam circulates. Here the liquor is gradually heated up to a temperature of about 180° to 210° Fahr., and to a density of 20° to 30° Baumé. All moist sugars contain more or less acidity, and on these lime is used. Dry sugars, especially Manilas and all lower grades of East India sugars, containing too much lime, are treated with sulphurous gas or an acid to neutralize the same. Alum is sometimes used to good advantage. In all cases the liquor, before it is filtered, should have an excess of lime in it to prevent it from fermenting. On the lower grades of sugar, bullocks' blood, either fresh or dried, is used. The albumen of the blood begins to coagulate at about 140° Fahr., forming a net throughout the liquid, which gradually rises, as the heat increases, to the surface, carrying with it all the lighter impurities, and leaving all the heavier ones at the bottom. Between the thick scum on the top of the liquid and the impurities at the bottom of the "blow up" a clear liquid will be seen, which is drawn off and finds its way to the bag filters, on the next floor below.

The filtering process now begins. The liquid from the clarifier or "blow up" passes through bag filters, which arrest all floating impurities in the liquid. These filters differ in size in different establishments, but where ten years ago about a hundred bags were put into a single filter, they now put from four to eight hundred. The filters are constructed as follows: At the top is a large tank for receiving the liquid from the clarifier above, the bottom of which is perforated with a multitude of holes, to which as many bags are attached beneath, to receive the liquid from the tank, and are double, that is to say, a bag made of cotton cloth, five feet long and about two feet wide, is introduced into a strong bag made of flax, six feet long and only six inches wide, and a brass bell-shaped thimble, larger end downward, is inserted into the neck of the inner bag, and both inner and outer bags are tied to it, both constituting one bag. These double bags are fastened to the bottom of the tank by means of a screw in the smaller end of the thimble of each. The tank holding all the bags on the bottom stands over another tank, which surrounds the bags and receives the liquor at its base as it percolates through the bags. This combination of filtering bags with upper and lower tanks constitutes the "bag filter," as it is named, and by means of it a large amount of filtering surface is obtained in a small space. The filtration is rapid, if the preceding clarifying process has been perfect.

From the bag filters the liquid runs into the receiving tanks on the floor below, and consists of the raw sugar in a liquid state freed of its coarse impurities, yet still retaining many objectionable ingredients which will prevent the crystallization of the sugar, and others which will impair the quality of the refined product. These impurities are gum, lime, salts, mineral substances, and coloring matter, which have to be removed by means of charcoal filters.

Charcoal has the power to abstract and retain the organic coloring matter and impurities of the liquor, and thus to assist the granulation of crystals, increase the amount of sugar, and improve its quality. Charcoal filters are now mostly built ten feet in diameter by twenty feet in height, each to hold about 90,000 pounds of charcoal (burnt bones). They are constructed with a perforated bottom, composed of separate pieces, so as to be removed and cleansed occasionally, and made to rest on wooden blocks so as to leave a space six inches in depth between the perforated or false bottom and the lower bottom of the filter. A filtering cloth or blanket is spread over the perforated bottom to prevent the filtered juice, in running through, from carrying any of the bone black of the charcoal with it. The filters now used have mostly closed tops and man holes on the side, at the bottom, and on the top, for the purpose of filling and emptying them when necessary. To secure a good filtration care must be taken to pack the charcoal uniformly throughout the filter, otherwise channels will be formed through which the liquor will find its way easily, overtaxing a part of the charcoal and leaving other portions unused. The object of these filters is to remove the vegetable coloring matter from the sugar liquor and any excess of lime which may have been supplied it during clarification, also all mineral salts originally existing in the cane or added to the liquor on its way from the clarifiers to the charcoal filters. It will be readily seen that this process is of the greatest importance to the sugar refiner, as almost all impurities, especially gummy substances, in the sugar liquor will hinder the granulation of the crystallizable sugar in the next process. The charcoal is therefore called the "soul of the sugar refinery," and the success of the business in reality depends on it alone. Some of our large refineries have from three to four million pounds of it in constant use. The charcoal which has been used to the extent of rendering it useless for further filtration, is made as good as new or better by a process known in refining parlance as revivification, and is made to do duty over and over again. In the year 1811, it was discovered that animal charcoal possessed the same power of retaining coloring substances, etc., and abstracting them from sirups, that vegetable charcoal or burnt bullocks' blood had. The charcoal filter was first introduced by Mr. Dumont, in the beet sugar factories of France. The liquor from the base of the charcoal filters forces its way by natural pressure through connecting pipes downward and upward into receiving tanks above, and is drawn from thence through other connecting pipes into vacuum pans still higher up. The liquor is now ready for the

Concentrating and crystallizing process, or what the refiners designate as the "boiling process," which requires large experience, skill, and ability to conduct properly. The vacuum pans are most of them made of cast iron, and two of the largest ones ever built reach the enormous dimensions of eighteen feet diameter. Smaller ones, seven feet in diameter, are often made of copper. Large pans yield larger crystals and a larger amount of sugar, and proportionally less sirup, than smaller ones, and are best adapted to a centrifugal house. Small pans are mostly used in mould houses.

In the commencement of the "boiling process" the liquor should be run in as quickly as possible into the vacuum pans till the whole heating surface is covered, then the steam turned on, and the evaporation conducted at a temperature of from 140° to 150° Fahr.; as soon as the liquor begins to granulate or form crystals the temperature is reduced to 125° Fahr., and finally, just before the evaporation is completed and the sugar is ready to be let down into the heater, it is further reduced to 110° Fahr. When the sugar boiler ascertains, by withdrawing a sample of the liquor with the proof stick, and drawing it out against the light between his finger and thumb, that the crystals are in a sufficiently forward state for his purpose, he adds some more of the thin liquor to that already in the pan and continues the boiling operation as before. When this last charge is brought into the same state as the former one, he adds another quantity of the thin liquor, and so repeats the process till the vacuum pan is full. At each successive charge the crystals continue increasing in size to the end of the operation, those first formed serving as *nuclei* for those that follow. If a fine grained sugar is required, the boiling must be done under a higher temperature, and the proofs must be taken thicker. If a coarser grain be sought for, the temperature must be lower and the proofs thinner.

The concentrated juice is now let down through a cock or valve in the bottom of the pan into the "heater," which is a large tank made of cast or wrought iron having a revolving shaft in its center, with knives attached to keep the body of sugar in agitation and prevent its becoming a solid mass. The cooler this liquid can now be kept the better, in order to give the largest possible yield of sugar and the least proportional amount of sirup, except that heat must be applied if it should become too cold and thick to run through the apertures in the bottom of the tank into the centrifugus.

Instruments of Precision.

The ingenuity of medical men has been displaying an unwonted activity of late, and new methods and appliances for the examination of the human body are being continually announced. Instruments of precision just now are in the ascendant; and the *Medical Record* is correct in saying that never before have anatomical structures or physiological functions been put under such close and exact scrutiny.

The writer proceeds to give a summary of those discoveries most recently introduced by the medical profession. We learn that electrical lights are penetrating the viscera, and that the pathological changes in the blood corpuscles are being very exactly noted and classified. The news of these things has already reached the laity. It is announced in a leading New York daily that a celebrated microscopist has allowed a gentleman to marry because his white blood corpuscles were—or were not—finely granular. In fact, there have been so many other interesting reports of this kind that we find it well to call attention to some of these devices with which humanity is becoming so closely environed.

We have spoken in a previous issue of the apparatus that has been invented by a French physiologist for measuring the amount of heat thrown off from the body in any given time. If we may believe the inventor, the temperature changes of our systems can now be put under the exactest supervision; a man can neither change his diet nor undergo a physical exertion without its being registered in British units. With the present delicate surface thermometers also only local changes in nutritive activity can be determined.

Active cerebration, an overloaded stomach, or a deep-seated inflammation, all send up the index. To a lively imagination the practical application of these various forms of thermometry promises the most extraordinary results in the cerebral department. When it is established, as it is hoped it may be, that the value of a thought is to be measured by the amount of cerebral tissue consumed and heat evolved, every man's intellectual caliber can be definitely established in degrees Fahrenheit; the problems of life will then be greatly simplified.

There has always been much ingenuity shown in investigating the normal and pathological conditions of the lungs, but never before have investigations presented such large, we may say sonorous, results. Mr. Edison, for instance, promises us a stethoscope, with which we hope nothing less than that the breeze from the epithelial ciliæ may be heard and differentiated, as also that the noise from the development of a tubercle may be brought with melancholy distinctness to the ear. These are but hopes and promises, however, which may partially fail us. We take pleasure, therefore, in recording the more modest, but better established inventions of a gentleman from New Jersey; inventions which deserve notice, indeed, if only for the melody of their nomenclature. There is, first, the respiratory anemometer. This instrument consists simply of a tube, a valve, a movable pen, some gearing, a few levers, a strip of paper, and clockwork. By breathing into the tube, a record is obtained of the character of the respiration, with the relative length of inspiration and expiration.

Supplementary to this valuable piece of mechanism are the pneumosiren and the unison resonator. The former gives, among other things, the character of the respiration, while the latter announces to the ear the smallest deposit of tubercle. With these three instruments, a stethoscope, a pleximeter, and a sounding towel, it will be strange, indeed, if phthisis cannot be arrested even in the third stage.

Dr. Richardson, of London, has utilized the microphone in such a way as to form what he calls an audiometer. By it the capacity of the ear to appreciate sounds can be accurately measured, and he has already made some interesting discoveries in regard to hearing. The application of the carbon telephone to urethral surgery is well known. Sir Henry Thompson, by attaching a form of this instrument to a Maillechort rod, finds that the presence in the bladder of the smallest particle of gravel even is readily appreciated. It only remains to extend its application to the pelvis of the kidney. Some time ago Dr. Nestler, of Germany, announced that he had invented an endoscope, with which he could see the interior of the bladder, and even of the stomach. At the recent meeting of the International Medical Congress, M. Trouvé, of Paris, stated that with his electrical polyscopes he could accomplish this same result, and an exhibition of his instruments was made. Thus the glory, as well as the necessity, of Alexis St. Martin is taken away.

We have referred to but a small part of recent mechanical achievements, but it is enough to show that the medical profession is progressing, and is, as usual, absorbing the other sciences into its own. The present inventive tendencies, of which, perhaps, we have spoken too lightly, show the impress which modern physics is making on medical science, and we would by no means undervalue its benefits when within the scope of practical utility.

How to Stop a Cold.

Horace Dobell, in his little work on "Coughs, Colds, and Consumption," gives the following plan for stopping a cold. If employed sufficiently early it is said to be almost infallible: 1. Give five grains of sesquicarb. of ammonia and five minims of liquor morphine in an ounce of almond emulsion every three hours. 2. At night give ʒ iss. of liq. ammon. acetatis in a tumbler of cold water, after the patient has got into bed and been covered with several extra blankets. Cold water should be drunk freely during the night should the patient be thirsty. 3. In the morning the extra blankets should be removed, so as to allow the skin to cool down before getting up. 4. Let him get up as usual and take his usual diet, but continue the ammonia and morphia mixture every four hours. 5. At bed time the second night give a compound colocynth pill. No more than twelve doses of the mixture from the first to the last need be taken as a rule; but should the catarrh seem disposed to come back after leaving off the medicine for a day, another six doses may be taken and another pill. During the treatment the patient should live a little better than usual, and on leaving it off should take an extra glass of wine for a day or two. —*London Medical Record.* [We think the remedy here suggested is rather worse than the disease.]

A Brilliant Purple for Show Bottles.—Sulphate of copper, 2 drachms; water, 2 ounces; French gelatine, 1 drachm; boiling water, 2 ounces; solution of potassa, 2 pints. Dissolve the copper salt in the water, and the gelatine in the boiling water. Mix the two solutions and add the liquor of potassa. Shake the mixture a few times during ten hours, after which decant and dilute with water.—*Can. Ph. Jour.*

Price of Rare Metals.—Dr. Theodore Schuchardt, of Goerlitz, Germany, prepares some of the rarer metals, and charges for them the following prices: Cerium, 20 shillings per gramme; lanthanum, 40 shillings; didymium, 30 shillings. These are in globules obtained by electrolysis. Thorium, in powder, is 36 shillings per gramme.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

For best Belt Lacings, use Blake's Belt Studs. The strongest fastening for all belts. Greene, Tweed & Co., New York.

To Sewing Machine Inventors.—Any party having invented a sewing machine containing new mechanical principles, or improvements upon existing machines, attachments, or shuttles, and wishing to dispose of the invention, will find it advantageous to address Manufacturer, room 97 Boreel Building, New York City.

For best Fixtures to run Sewing Machines where power is used, address Jos. A. Sawyer & Son., Worcester, Mass.

American Novelties wanted for Export.—Loeb & Co., 40 White St., New York. Branch houses in London and Manchester, England, and Hamburg, Germany. Correspondents in all the European cities. Submit samples.

Save your Fuel.—From one-fifth to one-third of the usual amount of coal bills can be saved by the use of fireproof, non-conducting Asbestos Coverings on hot air and steam pipes, boilers, heater pipes in dwellings, etc. The genuine is manufactured only by The H. W. Johns Manufacturing Company, 87 Maiden Lane, New York, sole manufacturers of Asbestos Paints, Roofing, etc.

A Bargain.—Foot Lathe; back geared, etc. 530 Main, Buffalo, N. Y.

Band Saw Machines. P. Pryibil, 467 W. 40th St., N.Y.

Forges, for Hand or Power, for all kinds of work. Address Keystone Portable Forge Co., Phila., Pa.

Self-locking Stencils. Write P. O. Box 77, Chicago.

For Machine Knives and Parallel Vises, see advertisement, p. 349. Taylor, Stiles & Co., Riegelsville, N. J.

Wanted—Circulars about Hot Water and Steam Heating Apparatus. Address R. Campbell, 285 University St., Montreal, Canada.

Manufacturers of Cylinder Lubricators for oil or tallow, please send description to E. Bradley & Co., Three Rivers, Province of Quebec.

Metallic Pattern Letters to put on patterns of castings, at reduced prices. H. W. Knight, Seneca Falls, N. Y.

Linen Hose, Rubber Hose, Steam Hose; all sizes. Greene, Tweed & Co., 18 Park Place, New York.

Wanted—Parties to Manufacture and Sell a Rotary Shuttle Sewing Machine. J. J. Green, Boonton, N. J.

Wanted—No. 1 Cupola 2d hand. Stiles & Parker Press Company, Middletown, Conn.

Blake Crushers, all sizes, with all the best improvements, at less than half former prices. E. S. Blake & Co., Pittsburg, Pa.

Comb'd Punch & Shears; Universal Lathe Chucks. Lambertville Iron Works, Lambertville N. J. See ad. p. 333.

Jig Saw Machines. P. Pryibil, 467 W. 40th St., N. Y.

The Friction Clutch Captain will start calender rolls for rubber, brass, or paper without shock: stop quick, and will save machinery from breaking. D. Frisbie & Co., New Haven, Conn.

You can get your engravings made by the Photo-Engraving Co. (Moss' process), 67 Park Place, N. Y., for about one-half the price charged for wood cuts. Send stamp for illustrated circular.

Presses, and Dies that cut 500,000 fruit can tops without sharpening. Ayar Machine Works, Salem, N. J.

For Sale.—One Horizontal Steam Engine, 20″ x 48″; one 18″ x 42″; one 16″ x 36″. Atlantic Steam Engine Works, Brooklyn, N. Y.

Empire Gum Core Packing is reliable; beware of imitations called Phœnix. Greene, Tweed & Co., 18 Park Place, N. Y.

Situation Wanted.—Have had ten years' experience as mechanical superintendent of a large sewing machine business. Understand mechanical drawing, tool making, etc. Best of references. Particulars by letters. Address K., Box 254, Guelph, Ontario, Canada.

See Staples & Co.'s advertisement of Non-Congealable Lubricating Oils on inside page.

The Baker Blower ventilates silver mines 2,000 feet deep. Wilbraham Bros., 2318 Frankford Ave., Phila., Pa.

Wheelbarrows.—The "A. B. C. bolted" will outlast five ordinary barrows. $24 per doz. A. B. Cohu, 197 Water St., N. Y.

Park Benjamin's Expert Office, Box 1009, N. Y. Recipes and information on all industrial processes.

To stop leaks in boiler tubes, use Quinn's Patent Ferrules. Address S. M. Co., So. Newmarket, N. H.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

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

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Steam Excavators. J. Souther & Co., 12 P.O. Sq. Boston.

Bradley's cushioned helve hammers. See illus. ad. p. 373.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Noise-Quieting Nozzles for Locomotives and Steamboats. 50 different varieties, adapted to every class of engine. T. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 349.

Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See ad. page 269.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Solid Emery Vulcanite Wheels—The Solid Original 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, N. Y.

Portable Railroad Sugar Mills, Engines and Boilers Atlantic Steam Engine Works, Brooklyn, N. Y.

Silent Injector, Blower, and Exhauster. See adv. p. 334.

The Paragon School Desk and Garretson's Extension Table Slide manufactured by Buffalo Hardware Co.

Planing and Matching Machines, Band and Scroll Saws, Universal Wood-workers, Universal Hand Jointers, Shaping, Sand-papering Machines, etc., manuf'd by Bentel, Margedant & Co., Hamilton, Ohio. "Illustrated History of Progress made in Wood-working Machinery," sent free.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien M'f'rs, 23d St., above Race, Phila., Pa.

Diamond Saws. J. Dickinson, 64 Nassau St., N. Y.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

For Superior Steam Heat. Appar., see adv., page 334.

Special Tools for Railway Repair Shops. L. B. Flanders Machine Works, Philadelphia, Pa.

Brass or Iron Gears; list free. G. B. Grant, Boston,

Millstone Dressing Machine. See adv., page 351.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in SCIENTIFIC AMERICAN of this week.

The E. Horton & Son Co., Windsor Locks, Conn., manufacture the Sweetland Improved Horton Chuck.

For Reliable Emery Wheels and Machines, address The Lehigh Valley Emery Wheel Co., Weissport, Pa.

Pays well on small investments; Magic Lanterns and Stereopticons of all kinds and prices; views illustrating every subject for *public exhibition and parlor entertainments*. Send stamp for 80 page Illustrated Catalogue. Centennial medal. McAllister, 49 Nassau St., New York.

Patent Steam Boiler Damper Regulator; most reliable and sensitive made. National Iron Works, New Brunswick, N. J.

Deoxidized Bronze. Patent for machine and engine journals. Philadelphia Smelting Co., Phila., Pa.

Hydraulic Cylinders, Wheels, and Pinions, Machinery Castings; all kinds; strong and durable; and easily worked. Tensile strength not less than 65,000 lbs. to square in. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

The New Economizer, the only Agricultural Engine with return flue boiler in use. See adv. of Porter Mfg. Co., page 270.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Power Hammers. P. S. Justice, Philadelphia, Pa.

Drawing Materials. G. S. Woolman, 116 Fulton St., N. Y.

NEW BOOKS AND PUBLICATIONS.

JOURNAL OF THE CINCINNATI SOCIETY OF NATURAL HISTORY. January, 1879.

This number of the Society's Journal, in addition to the Proceedings, contains a note by Mr. V. T. Chambers, correcting some typographical errors in a former paper; a "Description of a New Family and Genus of Lower Silurian Crustacea," by Professor A. G. Wetherby; a "Revised List of Cincinnati Birds," by F. W. Langdon; and a "Report of Committee on Geological Nomenclature." The latter committee conclude that the Lower Silurian rocks exposed about Cincinnati, and in some parts of Kentucky and Indiana, are to be referred to the Trenton, Utica Slate, and Hudson River groups, and the term "Cincinnati Group" should be dropped, not only because it is a synonym, but because its retention can subserve no useful purpose in science, and because it will, in the future, as in the past, lead to erroneous views and fruitless discussion. The present being the last number of the first volume, closes with an index and title page. We are glad to observe that this flouring organization is confining itself mainly to a study of the natural history of the immediate vicinity in which it is located, a plan which should be, but is not, pursued by every local natural history society. For this reason its contributions to science will prove valuable, which they might not be were the efforts of the members directed towards the working up the geology, fauna, and flora of the entire continent.

SPONS' ENCYCLOPEDIA.

Part 7 of Spons' Encyclopedia of the Industrial Arts, Manufactures, and Commercial Products, continues the article on beverages, completing beer, and adding cider, cocoa, coffee, tea, water, and wine; 64 pages. Price 75 cents.

ELECTRIC TRANSMISSION OF POWER: ITS PRESENT POSITION AND ADVANTAGES. By Paget Higgs, LL.D. London and New York: E. & F. N. Spon. 12mo, cl., 87 pages.

Briefly describes the better known dynamo-electric machines in use in England, and discusses the practicability of transmitting power by electricity, the comparative efficiency of various machines, and related questions of electrical theory and practice. On the basis of 48 per cent of the power originally expended being realized in outside work, Mr. Higgs holds electric transmission to be much superior in economy and convenience to pneumatic or hydraulic transmission.

ATWOOD'S REVISED RULES OF PROPORTION. By D. T. Atwood. New York: Bicknell & Comstock.

A second edition, containing some revisions and seven additional plates illustrating the rules of proportion for town and country houses, as given in Part II.

FUEL: ITS COMBUSTION AND ECONOMY. Edited by D. Kinnear Clark. New York: D. Van Nostrand.

The previous edition of this work was noticed in our issue of May 31, 1879. There is no change except in the publishing office.

NOTES ON RAILROAD ACCIDENTS. By Charles Francis Adams, Jr. New York: G. P. Putnam's Sons.

In the course of his service as one of the railroad commissioners of Massachusetts, Mr. Adams had occasion to study carefully the more serious and instructive railway disasters which have occurred in this country and in England; and in this unpretending book he has brought together the information he then collected, especially with regard to the conditions making such accidents possible, if not inevitable, and also those which experience has shown to be well calculated to prevent railway accidents. He pays particular tribute to the excellence and importance of the Miller platform and buffer; the Westinghouse brake, and the International and Electric Signal Systems. In the course of these "notes" Mr. Adams has taken occasion also to discuss critically a wide range of matters connected with railway service, with which the public at large is quite as much concerned as are railway owners and officials. The book is well indexed.

A POPULAR GUIDE TO THE TERMS OF ART AND SCIENCE. By C. Bankes Brookes. Philadelphia: J. B. Lippincott & Co.

Contains between five and six thousand technical and scientific terms, with definitions, arranged first under headings such as anatomy, architecture, farming, botany, chemistry, mining, law, etc., and afterwards alphabetically in a general index. In this way the unscientific and non-technical reader is enabled to find not only the meaning of those scientific and technical terms most commonly met with in print, but also, in one group, the chief terms which enter into the special vocabulary of any art or science.

DRAWING TABLETS.

Messrs. Jones Brothers, of Cincinnati, Ohio, are publishing an excellent series of drawing tablets, for the use of learners in the art of drawing. They consist of paper tablets, each sheet having a series of copies and suggestions, so arranged that when one sheet is finished it may be readily removed, exposing a new lesson and sheet, a little more advanced than the last. The practical excellence and convenience of this method are certified to by a large number of teachers in the best public schools.

THE THEOSOPHIST. Conducted by H. P. Blavatsky. Bombay, India. Vol. I. No. 1.

A monthly journal devoted to oriental philosophy, art, literature, and occultism, embracing mesmerism, spiritualism, and other secret sciences. It is published under the auspices of the Theosophical Society, whose organ, so to speak, it will be. Contributions are promised from a large number of distinguished Eastern scholars, representing all the various phases of philosophical and religious belief in India, as well as from eminent scientific and literary men of the West. Translations of important Sanskrit and Pali works, hitherto beyond reach, will form a leading feature of the journal. S. R. Wells & Co., 787 Broadway, N. Y. take subscriptions in this country.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) A. A. A. asks how to arrange tumblers to produce, when struck, the notes of the scale. What is inside the tumblers? A. The tumblers are tuned by filling them more or less with water.

(2) W. M. B. asks: How can I brighten and polish skates, after they have been rusted? A. They should be polished on a fine emery wheel and finished with crocus. If you have not these conveniences at hand, you can use several grades of fine emery paper and oil, finishing with the finest.

(3) J. R. S. asks what horse power there is in an engine of the following dimensions: cylinder 16 inch by 30, double eccentric slide valve, cut off at half stroke, steam pressure 90 lb., revolutions 75; it has a balance wheel, 12 feet, and weighs perhaps one or two tons. Now, when it is doing its best the throttle and stop valve are open wide. Now what power would you call it when running thus? A. 16 inch cylinder = 201 inches area, 90 lb. pressure cut-off at ½ = say 68 lb. average, 75 × 2 × 2½ feet = 375 feet per minute; then $\frac{201 \times 68 \times 375}{33{,}000} = 156$ horse power, less 20 per cent for friction and other losses = 156 − 31 = 125 horse power.

(4) R. E. O. asks how to obtain and retain a perfect vacuum. I have been unsuccessful in my repeated endeavors to cause a vacuum by means of an air pump. A. The Torricellian vacuum found in every mercurial barometer is as nearly perfect as it is possible to make a vacuum by simple means. The most perfect vacua are obtained by means of the Sprengel air pump and the absorption of the residual gas by chemical means. You will find description of Sprengel's pump in almost any work on physics.

(5) W. M. W. B. asks: Can you tell of any mixture to put in cast iron in the ladle that will harden it? We want a very hard surface for plow points and the common chills don't seem to answer the purpose. A. Try the addition of say 1-10 of one per cent of titanic acid or a proportionate quantity of titaniferous iron to the metal.

(6) A. W. asks: 1. If a drill be made with twenty toggle joints on the lazy tongs principle, how much power will be lost by friction? A. The percentage of friction would be difficult to determine; it would depend much on the angle of your sections. 2. How much pressure per square inch is there at the lower end of a water pipe one hundred feet long by six inches in diameter with an incline of one to ten? A. At A a little less than 5 lb. per square inch. 3. Would the pressure be less if made in the form of an Archimedes screw? A. No. 4. Where will I find in detail the rules relative to friction? A. Consult "Thurston on Friction."

(7) S. L., in answer to U. C. on glass gilding, gives the following: Dissolve a piece of isinglass (gelatin?), the size of a silver dollar, in ½ pint of hot water, and after cooling apply this size, with a two or three inch flat camels' hair brush to the glass, previously freed from all traces of grease by washing with alcohol; apply the gold leaf cut to the size of letters desired with a gilder's brush, rubbing the brush on the hair while the size is wet. In presenting the gold leaf to the sized surface do not touch the glass with brush or gold; bring the leaf within ⅛ inch of the surface, when it will be found that the leaf leaves the brush and attaches itself to the sized surface (owing to the electrical condition of the brush). Spread the leaf evenly, give it a second coating of the size, outline with asphaltum varnish, and fill up the letters with the same. When all is dry rub off the superfluous gold with cotton wool.

(8) S. S. asks: How is petroleum refined? I understand that a diluted acid is used. What is "sludge acid"? What is it used for? A. The oil is violently agitated for some time with from two to three per cent of sulphuric acid, and then allowed to stand, when a dark, offensive, viscous substance (called sludge acid) gradually separates, clarifying and partially deodorizing the oil. After running off the clear oil it is again agitated with water and with a very dilute solution of caustic soda to neutralize traces of the acid, drawn off after standing, from the water, and again fractionally distilled to separate the lighter and heavier oils. The acid used is not diluted. "Sludge acid" is chiefly utilized in the manufacture of certain fertilizers, such as nitrogenized biphosphates, etc.

(9) P. H. McG. asks: How is gun cotton made? A. If you refer to trinitrocellulose—the explosive variety—it may be prepared in small quantities as follows: Mix 4½ ounces of pure dry nitrate of potash with 30 fl. drachms of sulphuric acid, specific gravity 1·845, and, after cooling thoroughly, stir into this mixture carefully 120 grains of best carded cotton. As soon as saturation is complete, in about one minute—in about one minute if proper care has been used—throw the cotton into a tubful of clean rain water, and change the water repeatedly until litmus ceases to show the presence of acid, then squeeze, it in a cloth, and after being well pulled out, dry it cautiously at a temperature not exceeding 140° Fah. It is now explosive, and too much caution cannot be observed in handling it.

(10) W. J. C. asks for directions for making Vienna yeast cakes like those sold in little tin foil papers. A. The Vienna pressed yeast is prepared as follows: Previously malted barley, corn, and rye are ground up and mixed, next put into water at a temperature of 150° to 170° Fah.; after a few hours the saccharine liquid is decanted from the dregs and the clear liquid brought into a state of fermentation by the aid of some yeast. As the fermentation increases the yeast globules formed rise to the surface and collect as a thick scum easily removed by a skimmer. It is collected on cloth filters, drained, washed with a little distilled water, covered with well woven canvas, and subjected to hydraulic pressure.

(11) J. S. P. asks: What is the best way to dilute muriatic acid for tinners' use so it will not burn the hands? A. The solution is prepared by digesting the acid with scrap zinc in excess for several hours. The solution of zinc chloride obtained must be used without dilution.

(12) T. A. B. writes: 1. When a locomotive is rounding a curve, does the difference in the length of the rails cause the driving wheels on the inside or shorter rail to slip or slide? A. Yes. 2. If three wheels are pressed on the same axle, one at each end, and one of smaller diameter than the other two in the center, the center wheel being provided with a raised track, so that the weight of the axle will rest on the three wheels equally when the whole is put in motion, would the center wheel slide on the track? A. It would.

(13) A. G. Q. asks how to fill the porous cell of a Leclanche battery. A. Remove the cement from the top of the cell; draw out the carbon and pour out the old filling; wash both the carbon and the cell thoroughly, and allow them to soak for 24 hours in clean water. The better way is to fill the cell with water and allow it to ooze out through the pores. Replace the carbon, and fill the cell with equal parts of pulverized gas carbon and peroxide of manganese. It need not be compressed. Seal the top of the porous cell after filling, leaving one or two apertures in the sealing.

(14) L. W. B., referring to the depths at which divers have operated, writes: In removing the cargo of the ship Cape Horn, wrecked off the coast of South America, a diver by the name of Hopper made seven descents to a depth of two hundred and one feet, and at one time remained down forty-two minutes.

(15) "Sharpie" writes: The SCIENTIFIC AMERICAN SUPPLEMENT of the week ending May 24 contained drawings for the construction of a Sharpie sail boat. I am getting out the material for the construction of the boat, but am not able to fix, by the drawings, the exact position of the center board. Would like to be informed as to the exact distance from deadwood inside measurement to forward end of center board trunk. A. The center board should be 7 feet long inside the

trunk; from aft side of stern post to after end of center board, 13 feet 6 inches.

(16) C. E. B. asks in what connection is an air pump used with a marine engine. A. To discharge the water, air, and vapor collected in the condenser.

(17) S. S. P. will find full directions for making row boats in SUPPLEMENTS No. 25, 26, 30, 32, 37, and 39.

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

W. B.—The quartzite (No. 1) can only be worked by mechanical means. We know of no substance which will corrode or dissolve the stone in the way you suggest. No. 2 is a limestone containing iron pyrites, of no value. We have not received the other specimen.—E. R.—It is calcareous tufa or travertine, carbonate of lime deposited from calcareous waters. It often forms beds of limestone which can be used for architectural purposes. The Coliseum at Rome is built of this rock.—C. E. R.—It is a decomposed feldspathic rock, useful in the manufacture of porcelains and white ware. Value 3 or 4 dollars per ton, washed and ground.—C. T.—Hornblende slate, contains no silver.—W. L. W.—Sample (in pen box) consists of magnetite, a valuable ore of iron.

COMMUNICATIONS RECEIVED.

A Cheap Rowing Machine. By C. W. F.
On Gun Boats, etc. By J. J. C.
On Traveling Rocks. By C. F.
On Finding the Distances of Inaccessible Points. By P. McC.
On Ice Yachts. By F. B. C.
On Horse Railroads. By S. G.
On Ice Yachts. By S. J. D.
On Edison Generator. By G. F. P.
On Ice Yachts. A. C. C.
On Mineral Discovery. W. G. C. B.
On Molecules. By J. W. C.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

[November 11, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, or any patent issued since 1867, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Aeration of water, apparatus for showing the, L. C. Warner 221,433
Air forcing apparatus, J. F. Barker 221,385
Air from vessels, apparatus for exhausting, T. G. F. Dolby 221,399
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Carpet, E. Pyne 11,504
Carpet, T. J. Stearns 11,505
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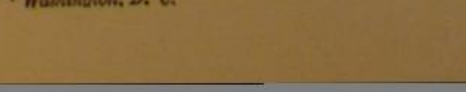

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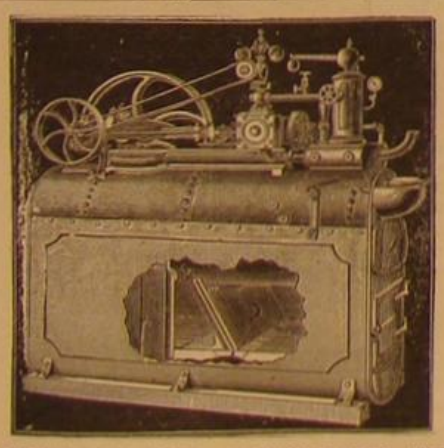

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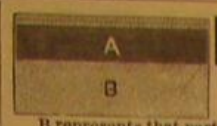

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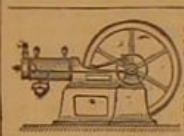

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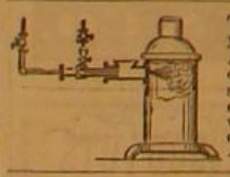

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SCIENCE AS APPLIED TO TANNING.

Considering the immensity of the trade, modern science has done but little for the tanning industry. Except in the perfecting of a comparatively few simple mechanical devices for the saving of labor, the work of tanning heavy leather is now very nearly the same as it was a hundred years ago. The time required for tanning has been shortened by the use of stronger bark solutions, and more frequent handling of the hide or skin in such liquors, but the principle is the same; a greater variety of tanning agents is employed, but the astringent principle, similar to that found in oak bark, and which exists in greater or less proportion in almost every plant, must be sufficient to combine with the gelatine of the hide, which alone makes tanned or tawed leather.

Yet there has been no lack of endeavor in this field, for a substantial, or even a partial success, in the making of something which would compete with an article so universally used as leather, or in perfecting a cheaper mode of producing it, would be sure to bring the discoverer or inventor large rewards. German chemists have been especially active in this direction. One of them has claimed that tanning is not, as it has always heretofore been considered, a chemical operation, but that it is simply mechanical, and that the tannin only surrounds, but does not actually combine with, the particles of gelatine. This theory has not met with general acceptance, but it is, nevertheless, certain that leather tanned with some descriptions of tanning material, such as valonia, gambier, and divi-divi, can be again so far brought back to the raw hide condition as to be suitable for use in the making of glue. The most noteworthy result of the recent efforts of German chemists has been, however, in the perfection of a method of making leather without the use of bark at all, by what is called a mineral tanning, with a solution principally of iron, making what is called an iron tanned leather. Some very fair samples of both upper and sole leather have been produced by this process, and it is claimed that leather can be made thereby in much less time than it takes by the old method, and with a material saving in the cost. It is to be remarked, however, that the sole leather so made is very hard and brittle, so that it is difficult to make up and finish in a boot or shoe, and is liable to chip out and wear away rapidly except in wet weather. It seems, however, to have sufficient toughness, when wet, to resist a good amount of wear, and its water-resisting qualities are about equal to those of many kinds of bark tanned leather. That it will, as at present made, come into competition with our leather, does not appear at all likely, but the fact that hides and skins are now chemically treated so as to make an article nearly resembling bark tanned leather, and which will make serviceable boots and shoes, marks a step forward in the progress of an industry which, though one of the oldest in the world, has probably shown less change than any other.

The German process above alluded to has been covered by two patents in this country, but no leather of such manufacture has yet been made here. In fact the process can hardly be said to have met with any decided favor in Germany, where, from the high price of tanning material, and the generally inferior quality of the sole leather manufactured, it would seem to have most chance of being adopted. The patents cover the process, and a new chemical compound, as a mineral reagent, in the place of a vegetable tanning material. The process includes the making of a peculiarly prepared basic sulphate of iron, which forms the tanning material, into which the hides or skins are placed for two, or at most four days, without any handling or changing liquors. It is this part of the process of making leather in the ordinary way which requires so much time and labor, heavy hides being kept in the bark liquors from four to six or seven months, and in some cases considerably longer. The preparation of the hide for the liquor or compound, so far as the removal of the hair, flesh, etc., are concerned, is supposed to be the same for the new process as by the old method of tanning, as are also the currying and finishing operations.

We can now make very cheap leather in this country, because bark is so abundant, and the iron-tanned leather has not yet been brought to such a standard of excellence that it can compete with the product which our native forests supply us with the means of furnishing; but it requires no long look into the future to see that these conditions may, at no very distant day, be reversed. Our woods are being rapidly destroyed, so that available bark for tanning is found, year by year, only at greater distances, and this will afford additional incentives to a spirit of investigation and research which may, in time, find us a substitute for bark in the manufacture of leather.

THE GREAT CHANOINE DAM AT PITTSBURG.

The general government is at present engaged in constructing near Pittsburg an experimental lock and dam, which when completed will be among the largest works of the kind in the world. The dam will be the largest "movable" one yet built in this country, being designed after the Chanoine system in use in the Seine and other European streams. The object of the work is mainly to test the applicability of the Chanoine system to the improvement of the Ohio and similar streams. The success or failure of this costly experiment will have a most important bearing upon the future of the entire Ohio valley from Pittsburg to Cairo, Ill., and more particularly upon the coal trade of the first named city.

The site selected for the work is located five miles below the junction of the Allegheny and Monongahela Rivers, and near the northwestern city limits of Pittsburg. The Ohio at this point has a width between banks of 1,300 feet, and the stream itself varies in width from that distance down to 700 feet, according to the stage of water. Operations were begun August 19, 1878, and with the exception of two months' cessation last winter have continued ever since. The force employed has varied from 50 to 450 men. Col. W. E. Merrill, whose headquarters are at Cincinnati, is chief engineer, but the work is under the immediate supervision of Lieut. F. A. Mahan, resident engineer. No great engineering difficulties have been met with, and the season of extraordinary low water during the past summer and fall has greatly facilitated the laying of the foundations for the river wall of the lock. The latter is located at the northern end of the proposed dam. Bed-rock was readily found for the shore wall, which is completed to the coping. The dimensions of this lock are as follows: Length, 600 feet; width, 110 feet; depth (of water), 12 feet, of wall, 17 feet.

The lock gates are unlike those in general use in every particular. They are immense affairs. In operation they will run directly across the lock at right angles to either wall. To enable them to be so operated immense recesses lead from the shore wall, each recess being 120 feet deep (long) and 15 feet wide. Into these the gates slide when the lock is opened. Each gate measures 118 feet in length, 10½ feet in thickness, and 14 feet in height; and these affairs will resemble, in place, a truss bridge on edge. Their material will be wood or iron. If of the former they will weigh 80 tons each. An offset in the masonry of the river wall serves as bearings for the outer end of each gate. The operating device for these ponderous gates will be turbine wheels, actuating upright and lateral shafting, so arranged in connection with suitable gearing, endless screw, reversing device, etc., as to draw the gate in and out of its recess upon seven pairs of iron rollers running upon rails. The latter are laid on the masonry at the bottom of each recess and across either end of the lock. Connecting the bottom of the upper recess with the bottom of the shore side of the lock is an immense arched tunnel termed the "filling culvert." Into it the water pours from seven circular inlets, 4½ feet in diameter, and fitted with balanced wing valves or gates, and is led to the lock, which is filled through ten openings, 3 by 3½ feet, and 17 feet below the coping. By this means the lock can be filled or emptied in four minutes.

So much for the lock. The dam will be 1,200 feet long, subdivided into three "passes" of 400 feet each. The channel pass, or that nearest the lock, will be that across which the movable or Chanoine dam will be placed. A solid sill of masonry and timber must first be laid across the bed of the river. To the timber is hinged a series of wickets of stout oaken planks, each 13 feet in length by 3 feet 8 inches in width. A space of 4 inches separates each wicket, and a hinged prop or arm forms part of the wicket, the whole being so arranged that when the wicket is drawn to a position almost perpendicular, its prop, as to its free end, slides into a metal "step." This operation repeated constitutes raising the dam, inasmuch as every wicket is a duplicate of its neighbor. Lowering the wickets is instantaneously accomplished by means of a "tripping bar" extending along the series and resting upon the dam sill. By its agency each prop is disengaged from its "step," the water presses wicket and prop prone upon the bottom, and the channel is virtually clear of obstructions. The spaces mentioned as existing between each wicket are thus provided for: Over each interval a plank is laid, kept in place mainly by the pressure of water upon its upper surface. These planks are connected by links at their upper ends only, in such a way that when the dam is "tripped," the chain of planks, being connected, and the whole series being permanently fast at one end only, swings away with the current—a sort of floating chain, ready for service again when the dam is raised.

Such, in brief, are the devices constituting the main features of the Chanoine dam, which will rise and fall—according to the stage of water—across the channel of the Ohio at the point in question. When the river falls to less than a six foot stage the wickets will be raised by gangs of men in boats working simultaneously toward the center of the pass. When up the crest of the dam will be 12 feet above the sill, and the "back water" will extend into the mouths of both the Allegheny and Monongahela rivers. This, of course, means navigable water about the wharves of Pittsburg and her sister city, Allegheny. At present local towage is only possible during a portion of the year.

The engineers in charge have as yet not definitely agreed upon the style of wicket for use in the two remaining sections of the dam, but that they will be movable is certain. Up to the present time 6,000 cubic yards of cut stone have been laid in this work, all in the shore wall. The river wall will require 4,000 yards, laid upon a foundation of concrete, the latter starting at a level 15 feet below the bed of the river, upon hard firm gravel. The concrete is composed of 5 parts sand and gravel as found in the river, 3 parts broken stone, and 1½ barrels Rosendale cement. Of the latter nearly 30,000 barrels will be incorporated in the walls and foundations. The sum of $200,000 has been expended, and the probable amount required for completion is placed by the resident engineer at $750,000. The most massive strength is noticeable in the work, and in all portions subjected to possible strain a factor of safety of 10 is preserved.

It might be added here, that the most intense opposition to the building of this dam was evinced by the river coal trade of Pittsburg, whose members held that the success of

the work and the resultant and possible multiplication of Chanoine dams along the Ohio would inevitably destroy the coal trade of Pittsburg, as far as river shipments were concerned. Within the past few months, however, this opposition has given way in marked degree. The change of feeling is mainly attributable to causes novel and unlooked for. Owing to almost unprecedented and long-continued drought laden coal craft, containing 20,000,000 bushels (760,000 tons) had up to the middle of November, 1879, accumulated at Pittsburg, when the article was bringing famine prices in Cincinnati. At the date mentioned timely rains permitted a third of the accumulation to pass down the Ohio. But the argument for an artificially improved river was potent in the extreme, and to-day even the river coal trade of Pittsburg advocates the "Davis Island Dam."

THE ANGAMAR STEAM PASSENGER CAR.

For ninety consecutive days during the past season the Angamar steam passenger car "Lillie" has been running upon the Third Avenue surface railway, part of the time hauling an extra car. The experiment continued long enough to make it clear that a proper steam passenger car can be used safely and successfully in summer time, even in crowded thoroughfares. There is probably no street railroad in the world on which cars are run at briefer intervals, or where the necessary stoppings and startings are more frequent than on our Third Avenue road, nor one where the necessity is greater for quickness of action and entire regularity in running. If the Angamar motor can meet the severe requirements of winter traffic with corresponding success, the car horse may look for a change of occupation, and the community be relieved of the growing nuisance of his presence in our cities.

Superior economy is claimed for this motor, as compared with other steam locomotives, on the following grounds: 1. The water is heated in a stationary boiler, thus making a great saving of fuel in comparison with locomotive boilers. 2. There is no water level to watch, no injectors to take care of, and no fire to attend to during a trip. Hence the motor does not require a high-priced skilled engineer to run it, any average man of the class of car drivers being able to do the work. 3. All the working parts are protected from dust and dirt by close-fitting boxes, thus reducing the wear to the minimum. There is a further advantage in the circumstance that the machinery is so arranged upon the truck that the ordinary cars in use can be easily converted into self-propelling cars.

The Angamar motor runs without any noise of escaping steam, is easily handled, and does not frighten horses. The boiler is supplied with hot water under pressure at the central supply station, where the furnace is filled with red-hot coal in quantity sufficient to keep up the initial pressure in the boiler during the trip. The amount of coal required for this purpose and for heating the water in the stationary furnace was, during the ninety days' test, one third of a ton of egg coal a day. The volume of water in the boiler is so large and the fire in the furnace so small that all risk of explosion is avoided.

A NEW PLAN FOR HEATING HORSE CARS.

The Third Avenue Company, of this city, have introduced a novel plan of heating their cars. Metal pipes about 4 inches in diameter are laid under the seats and filled with salt water. At one end of the car the pipes unite in a sort of box surrounding a chamber called the oven, about 12 inches long, 5 inches wide, and 4 inches high. The door to this oven is through the end of the car, just above the platform, and consists of a box of non-conducting material nearly filling the oven. The water is heated at the stables by means of a block of highly heated iron thrust into the oven, nearly filling it. When the car leaves the stable the iron is removed and the oven closed, the heated water in the pipes sufficing to keep the car warm throughout the trip. Salt water is used to lessen the risk of bursting the pipes by frost, should the car be kept overlong on the road. So far the plan contains nothing objectionable. To economize heat, however, the company have had the car windows fitted with extra casings, permanently closing them, trusting to the opening of the doors, in the admission and discharge of passengers, for the supply for fresh air. Unless the ventilators in the roof are kept well open this plan is liable to add a new terror to horse car traveling. The atmosphere of crowded horse cars is bad enough at best; if its renewal is to be left to chance they will be little better than pest holes.

A HOT WATER RIVER.

The projector of the Sutro Tunnel is of the opinion that the hot water which is so troublesome in the Comstock mines comes from a depth of ten or fifteen thousand feet, where the rocks are at a high temperature; also that there must be some connection between the water of the Comstock lode and that of the boiling springs at Steamboat, six or seven miles distant.

One of the great advantages of the tunnel is the means it affords for draining the mines. The tunnel discharges about twelve thousand tons of water every twenty-four hours. To lift this water to the surface would cost not less than $3,000 a day. Some of the water has a temperature of 165° where all the water mingles; four miles from the mouth of the tunnel the temperature ranges from 130° to 135°. If left to flow through the open tunnel this water would so fill the air with steam as to make the tunnel impassable. In flowing the four miles through a tight flume made of 3 in. yellow pine, the water loses but 7° of heat. At the mouth of the tunnel the water is conducted sixty feet down a shaft to a water wheel in the machine shop, whence it is carried off by a tunnel eleven hundred feet in length, which serves as a tail race. From this tunnel the water flows a mile and a half to the Carson River.

This large flow of warm water is now used for many purposes, the first to utilize it having been boys who made small ponds to swim in—pioneers, it may be, in establishing a system of warm baths, which may ultimately become a great sanitary resort. The water can also be turned to account in heating hot houses and for irrigation. The tunnel company have a farm of over a thousand acres which, when properly watered, is very fertile. In course of time there will probably be many acres of fruit and vegetables under glass at this point, all warmed and watered by the tunnel water.

NEW YORK ACADEMY OF SCIENCES.

At a meeting of the Academy, held December 1, President Newberry exhibited some very fine quartz crystals from Herkimer county, N. Y., and also two slabs of perfectly preserved fossil fishes from the extensive Eocene formation of Wyoming Territory. This formation, which is about 7,000 feet thick, shows evidences of three successive deposits, and is exceedingly rich, not only in the remains of fishes, but of birds and mammals. The abundance of fish remains is accounted for by the supposition that the fish were overtaken by some sudden disaster, by which great numbers perished at the same time; that they floated for a while on top of the great lakes they inhabited, and eventually sank to the bottom. The occasional great mortality of fish in the Gulf of Mexico, where the decaying remains sometimes cover a very large area, to the great annoyance of travelers, furnishes an analogy to these prehistoric catastrophes, and suggests the explanation that they were caused by the evolution of poisonous gases from the bottom during volcanic eruptions. In Oregon, where fish remains similar to those of Wyoming are found, there is also evidence of volcanic eruption.

Captain Blake stated that during the great eruption of Mauna Loa, in 1841, the surface of the water was covered with dead fish for miles. Dr. Martin suggested that numbers of small fish frequently perish near the shore by being cut off in lagoons left by the receding tide. As the water evaporates, the fish are brought more and more closely together, until, finally, there is not sufficient water left to keep them alive. The paper announced for the evening on

THE PROBOSCIS OF THE HOUSE FLY,

by Dr. George Macloskie, of Princeton College, was one of unusual interest to the comparative anatomist, as it embodied the results of orginal work in investigating and interpreting the organs of the house fly (*Musca domestica*).

The general structure of the proboscis is very similar in the house fly and in the other kinds of flies with which we are familiar. Indeed the analogies it is proposed to point out will apply with greater or less exactness to the whole order of diptera. The stomaxys, or piercing fly, which is sometimes very common in our houses, may be distinguished from the domestica by its brown, ringed proboscis, suggesting an elephant's trunk. It is only partially retractile, but able to pierce our skin, an offense which the domestica is incapable of committing. Another misdeed of the stomaxys, for which the house fly has been unjustly blamed, was found during these investigations. The piercing fly was often observed to have her head and proboscis crowded with eggs. That these were not her own eggs was evident from their different shape, and then they were in the wrong end of the insect. Further observation showed that these eggs developed into anguillula worms, resembling paste eels. Here then we have one of the ways in which the fly defiles articles of food, etc.

Dr. Macloskie then referred to large diagrams to show the structural resemblances of the cray fish, the cockroach, and the fly, calling especial attention to the number of segments in the body, the maxillæ, the mandibles, and the calcareous tendons attached to the latter. In all the diptera the mouth parts are modified into organs of suction with or without piercing apparatus. The house fly alone has a retractile proboscis that folds up like a letter Z, and is drawn into the head when not used. It is traversed by channels connecting with the trachea, and is protruded, not by muscular action, but by the inflation of its chitinous membranes. The anterior end of the proboscis consists of a knob, and contains the lips and a series of forked half rings, by means of which the fly rasps the surface from which it gathers its food. The teeth of the house fly have three cusps, and form a single row of five or six on each side, while the blow fly and others have as many as thirty teeth, or three rows on each side, each tooth having only two cusps.

No difficulty was experienced in explaining the analogy of these and the other numerous parts of the fly's mouth apparatus to those of the crustaceæ, until the largest of them was reached, the organ to which the tendons, corresponding to the mandible tendons of the lobster, are attached. An opportune katydid, that flew into the room of the investigator at the critical moment, solved the difficulty, as a dissection of its head revealed the presence of an interior skull or endo-skeleton, a part not possessed by the diptera. The explanation laid before the Academy was that the organ in question represented a rudimentary internal skull in the head of the house fly. C. F. K.

Sorghum in the West.

The first annual convention of the Mississippi Valley Cane Growers' Association met in St. Louis, December 3. The secretary reported that since the organization of the society last spring he had been in correspondence with persons in 35 States and Territories in regard to the culture of sorghum, and that a very great interest is manifested in regard to the matter everywhere, especially in the North. Colorado is particularly well adapted to cane growing, and Texas might raise two, perhaps three, crops a year. In the discussion of seeds and their culture several members gave their experience.

Mr. C. H. Miller, of Minnesota, thought the Minnesota-grown seed preferable for that climate, the cane from it being earlier than from seed raised in more southern regions. Southern-grown seed produced larger cane and more sirup, but the cane did not, as a rule, mature early enough for the extreme Northern climate. The weight of testimony seemed to be in favor of the early amber variety, but Honduras early, and orange Siberian, and one or two other varieties, were well spoken of. There is much enthusiasm among cane growers, and some of them believe that in five years this country will not only have stopped importing sugar, but will export large quantities.

Advance in Leather Belting.

A meeting of manufacturers of leather belting, at which were representatives of fully 75 per cent of the capital invested in this business, was held at the Astor House, New York, on the 4th inst. It was determined to advance prices ten per cent over those now ruling, such increase to take effect immediately. This is the third advance in prices which has been made since the 24th of July, the aggregate increase amounting to 40 per cent. By the new scale of prices, the charge for pure oak belting will be 33 cents per foot for 3 inch, 69 cents per foot for 6 inch, $1.05 per foot for 9 inch; $1.41 per foot for 12 inch, and $3.22 per foot for 24 inch, with 100 per cent more right through for double belting; but with discounts ranging from 30 to 37½ per cent with the different firms. The belt manufacturers, although they do not form a close combination, have for a long time past made a common scale of prices, which it is generally understood they will all adhere to, except in such particular exigencies as may seem to call for variations in order that a house may protect its own trade or its customers as against outside competition.

One More Number.

The next issue will close another volume of this paper, and with it several thousand subscriptions will expire.

It being an inflexible rule of the publishers to stop sending the paper when the time is up for which subscriptions are prepaid, present subscribers will oblige us by remitting for a renewal without delay, and if they can induce one or more persons to join them in subscribing for the paper, they will largely increase our obligation.

By heeding the above request to renew immediately, it will save the removal of thousands of names from our subscription books, and insure a continuance of the paper without interruption.

Kitchen's Horse Detacher.

In the illustrated description given in our last issue of the novel horse detacher recently patented by Mr. W. R. Kitchen, the address of the inventor was omitted. Persons desiring information concerning this much needed invention should address, Mr. Kitchen, at Willard, Carter Co., Ky.

A Ten Years' Average of American Crops.

The annual averages of the below-mentioned crops include the period from 1868 to close of 1877. The estimates are from the statistics of the Treasury Department:

	Annual average product'n bushels.	Annual average total value.	Average value per bu. cents.	Average yield per acre. bu.	Av. value of yield per acre.
Oats	291,036,670	$116,810,592	40·1	28·	$11·22
Rye	18,016,030	15,091,207	83·7	13·7	11·51
Corn	1,068,959,550	535,211,602	49·1	26·4	12·97
Wheat	273,583,174	301,481,541	110·2	12·12	13·40
Buckwheat	10,938,970	9,204,801	84·1	17·2	14·51
Barley	30,606,609	25,385,450	82·9	22·2	18·41
Potatoes	126,250,470	75,011,668	59·4	90·9	54·04
	Tons.		per ton.	tons.	
Hay	26,272,810	331,261,659	$12.60	1·21	15·25

Temperature of the Sun.

Newton, Waterston, Ericsson, and Senchi have asserted that the sun's temperature cannot be less than from 1,000,000° to 2,000,000° (1,800,000° to 3,600,000° Fah.); Pouillet, Vicaire, Violle, and many others maintain that the temperature cannot exceed from 1,500° to 2,500° (2,700° to 4,500° Fah.). The French Academy, in 1876, offered a "Bordin Prize" for the solution of the question, which resulted in a reward to Violle, certificates of "honorable mention" to Vicaire and Crova, and a withdrawal of the prize, in consequence of the difficulty and uncertainty involved in the question. Senchi obtained more than 2,000,000° by Newton's formula, while Violle obtained only 1,500° by the formula of Dulong and Petit from the same set of observations. F. Rosetti, in a memoir crowned by the Royal Academia dei Lincei, discusses experiments and methods of his own, from which he concludes that the temperature cannot be much less than 10,000° (18,000° Fah.), or much more than 20,000° (36,000° Fah.).—*Ann. de Chim. et de Phys.*

The Petroleum Industry.

The production of crude petroleum in the Pennsylvania oil fields has been a very progressive business from a very insignificant beginning. In 1859, when Colonel Drake sank the first oil well and obtained a few barrels of oil per day, he probably had no idea, says *Stowell's Petroleum Reporter*, of the growth and magnitude of the business as it is to be seen to-day with its 12,000 producing wells; with its daily production of 60,000 barrels of crude oil; with its 500 iron tanks with storage capacity for 10,000,000 barrels; with 8,000,000 barrels of stock in the tanks; with its refining capacity of 60,000 barrels per day; with its 3,000 miles of pipe lines for carrying the product to the iron tanks and refineries; with its 3,000 tank cars with capacity to transport 250,000 barrels of oil; with its 2,000 miles of iron tubing and casing used in and around the wells; with its 12,000 engines and 10,000 boilers used at the wells; with its 200 miles of rope cable, and its 500 tons of iron and steel used in drilling the wells; with its export trade with all the countries of the world of 40,000 barrels per day, and its home consumption of 10,000 barrels per day.

The outlook for better prices for the future are somewhat encouraging, as the great prolific Northern oil field apparently has its limits well defined, and its producing area circumscribed. The haste now manifested in drilling the best territory is so apparent that we may look for a speedy exhaustion of the field.

In Pennsylvania the number of producing wells at the close of October was 11,860, and the oil production for the same month was 1,863,378 barrels of 41 gallons each.

American Turbines in Peru.

An eighty-stamp mill has been recently erected for reducing the silver ores of the Cerro de Pasco Mines, Peru. It is driven by water power coming from a lake near the mines, the supply being sufficient to work more than 1,000 stamps and the accessory machinery. The power is utilized by means of six double turbines made by Messrs. Leffel & Co., of Springfield, Ohio. Four of these turbines are 30 inches in diameter, and develop each 200 horse power; the other two are 23 inches in diameter, and are of 100 horse power each. They are placed vertically, and the main driving pulleys are fixed on the turbine shafts. The capacity of this mill is five tons per stamp per day, or a total of 400 tons, and the value of the ore treated is about $30 per ton.

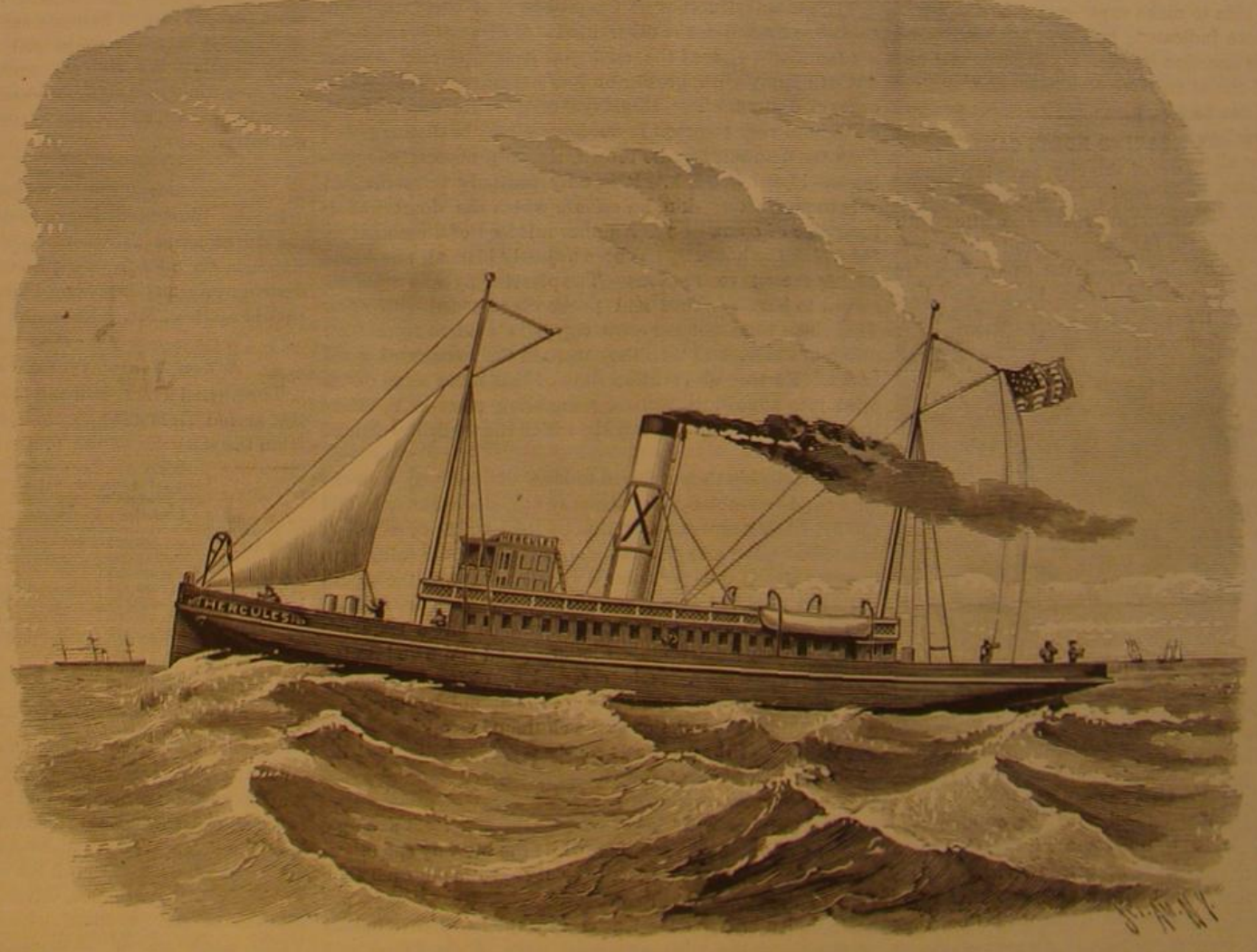
THE STEAM PILOT BOAT HERCULES.

Notice was taken, last week, of the latest phase of the ancient controversy between vested interests and new improvements, as shown in the contest over the steam pilot boat Hercules. This week we are able to place before our readers an engraved illustration of this much abused pioneer in a field in which such an innovation has long been needed.

The Hercules was built two years ago for a tug boat, and was constructed on the usual model for tugs of her size. She is 130 feet long with 25 feet beam. Since being adapted for the new service the Hercules has been completely overhauled and refitted, and berths have been provided for twenty-five persons.

The five pilots who have undertaken the task of introducing the new system, in defiance of their old associates, are W. H. Anderson, P. R. Bailler, G. Cisco, G. Mapes, and R. Noble. The new boat takes the place of the Widgeon, now retired, and receives the same number (10), as shown on the smoke stack.

The Hercules is intended for inshore service, and is expected to be of special value in times of light or contrary winds, when the channel is obstructed by ice, and on other occasions when steam has the advantage of wind.



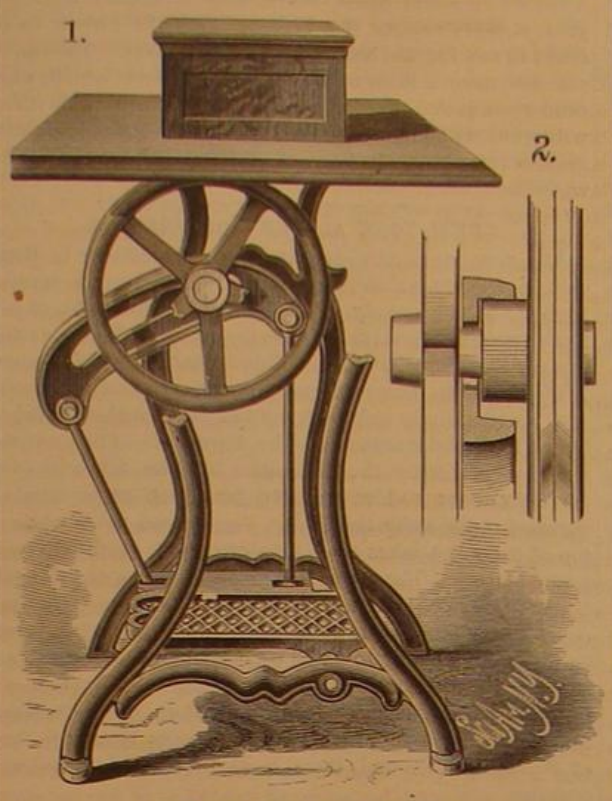
THE STEAM PILOT BOAT HERCULES.

A Moving Village.

A moving village is causing great alarm to the inhabitants of the department of the Hautes Alpes, in Southern France. Gradually within the last few years the village of Villard-d'Arenne has been slipping down hill. The church, built on solid foundations, has copied the example of the houses, the cemetery has followed suit, and so has a large neighboring hill. Heavy rains are believed to have undermined the ground, and dikes are being raised to prevent further damage, but they have not yet proved of much use.

NOVEL TREADLE MOTION.

A new and practical mechanical movement for propelling sewing machines is shown in the accompanying engraving.



ROMIG'S TREADLE MOTION.

It replaces the ordinary crank and connecting rod, and admits of either a rapid or slow movement. It also admits of a regular or irregular movement of the feet, and is practically noiseless.

The sewing machine balance wheel has a rubber covered boss which is revolved by contact with the reciprocating yoke. This yoke is connected with the treadle by two rods, one of which is pivoted to the toe of the treadle, while the other is pivoted near the fulcrum of the treadle. By pressing down upon the toe of the treadle the yoke is first brought into contact with the upper side of the wheel boss; it is then moved forward, causing the wheel to revolve. On pressing down the heel of the treadle the yoke is brought into contact with the under side of the wheel boss and is then returned to its original position, revolving the wheel as it goes.

By referring to the sectional view, Fig. 2, the relation of the yoke to the boss will be readily understood.

This novel device is the invention of Mr. John Romig, of Mifflinburg, Pa.

MISCELLANEOUS INVENTIONS.

Mr. Charles A. Righter, of New York city, has invented an improved card for use in putting up buttons for market. It is so made that several different styles of buttons may be attached to the same card in such a way that all or any desired part of either style may be detached without interfering with either of the others.

An improvement in apparatus for filling capsules, patented by Mr. Franklin E. Davenport, of Auburn, Ind., consists in a funnel, tube, and plunger. The funnel is flattened at one side to assist in taking up the material. The tube is adapted to receive the capsule, and is beveled at its end to aid in placing the same; and the plunger is fitted with an elastic collar, which prevents it from being forced too far into the tube.

Mr. James Kerr, of Church, County of Lancaster, England, has patented an improvement in apparatus for guiding and delivering woven fabrics to cloth finishing machines. It consists in a peculiar arrangement of two conical rollers, by means of which every deviation of the fabric to the right hand or the left causes a deflection of a frame and brings into operation devices which arrest or retard one of the rollers, thus bringing the fabric back automatically to its central position.

Mr. Thomas G. Brown, of New York city, has patented improvements in the construction of combination lock bracelets, the object being to enable the lock-bar or staple to be entered into the socket of the lock when the two parts of the bracelet are pivoted together, and it consists in connecting the lock-bar or staple with the end of the bracelet opposite to that on which the lock is placed by a concealed pivot, so that when the two ends are brought together the bar will turn sufficiently to enable it to enter with ease the straight socket in the lock.

Mr. James W. Smith, of South Schroon, N. Y., has patented an improved washing machine, which is so constructed as to wash the clothes quickly and thoroughly, and to allow any desired part of the clothes to be rubbed more or less as may be required.

Mr. Albert Clunan, of Brooklyn, N. Y., has invented an improved device for connecting the ends of leather, rubber, canvas, and other belt traces for harness and other bands and straps. It consists in combining a plate with a bar bent, threaded, and provided with an end nut.

Mr. Charles Bried, of Newark, N. J., has patented a mail bag fastening formed of four metallic strips of equal length, hinged together at the ends, having axes, with perforated arms on two of the strips and slots in the two opposite ones, having the axes adapted to be revolved so as to make the perforations in the arms coincide to receive the lock.

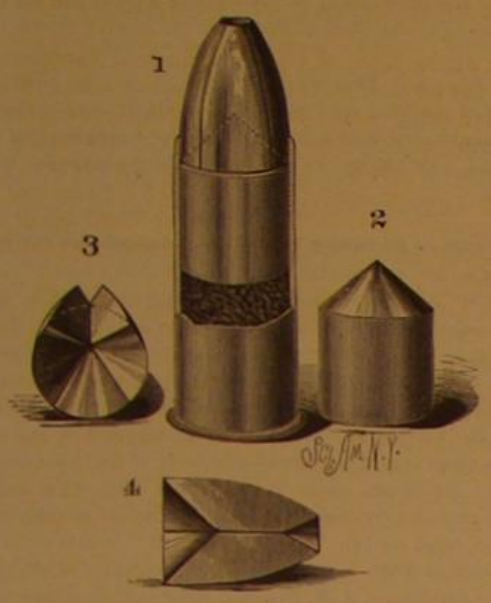
An improvement in sleeping car berths has been patented by Mr. Moritz Leiner, of New York city, N. Y. The object of this invention is to furnish an attachment for car and steamboat berths to facilitate entering and leaving the berths, and to prevent occupants of berths from falling or being thrown out. It consists in providing car and steamboat berths with ladders so constructed as to promote the convenience of passengers in entering and leaving the berths, and as guards to prevent the occupants of the berths from falling or being thrown out.

An improved implement, which will hold a rope or chain attached to the hook firmly and securely, has been patented by Mr. James Robertson, of East Cambridge, Mass. It consists in a hook formed of the screw shank and provided with a cylindrical nut made with an enlarged lower end, the hook arm having a grooved cavity or slot in or through the arm longitudinally in its upper or inner side, the eye, and the head.

An improvement in watch regulators, patented by Mr. Aloys Platt, of New York, N. Y., is designed to provide a means for more easily and accurately moving and adjusting the regulator lever of a watch. It consists of a screw set upon the regulator lever and engaging in a screw groove made in the regulator bridge, so that by turning the screw the lever may be easily and delicately adjusted.

NEW PROJECTILE.

The annexed engraving shows a sectional projectile recently patented by Mr. I. L. G. Rice, of Cambridge, Mass. It consists of a main bullet having a conical end, and placed wholly within the cartridge shell, with its conical end pointing outward, and a sectional bullet composed of several parts, held in place by the cartridge shell. The sectional portion has a conical cavity adapted to the conical end of the main bullet, and there is a conical aperture in the outer end of the sectional bullet to allow the air to act upon the sections to separate them after they are discharged from the firearm.



RICE'S IMPROVED PROJECTILE.

The complete projectile is shown partly in section in Fig. 1, the main bullet is shown in Fig. 2, and the sectional part is shown in Figs. 3 and 4.

A New Photo-Printing Process.

M. Leon Vidal, in a letter to the *Photographic News*, says: Since I have had occasion to mention the name—a name never to be forgotten—of Poitevin, I should like to say a word on that gentleman's special process depending on the action of light on a layer of gelatine made insoluble by the following solution:

Water	100 cub. cents.
Iron perchloride	3 grammes.
Tartaric acid	1 gramme

Gelatine, with which this solution is incorporated, is insoluble, but ceases to be so in those parts where light is able to act by reducing to its natural state the iron compound. I have not myself been able to make experiments on the very interesting reaction here indicated; but as it has been published by a man whose assertion on such a point it would be impossible to doubt, I can at once see very important results that follow from it. I can foresee here a means of producing carbon papers for special purposes; these could be sensitized from the very first, for all that is requisite is to have insoluble pellicles of pigmented gelatine, stored in a dry and dark place, where they could be kept for a long time without deteriorating. With this inverse method of working—I call it "inverse" because the action of light produces an effect quite opposite to that which it has when the gelatine has been sensitized by bichromate—we ought to be able to arrive at results of quite an opposite kind to those of the ordinary processes. Adopting this method in the Woodburytype process, as pointed out by M. Boivin, we might leave the film of gelatine in contact with the glass plate over which it had been flowed, and expose this upper surface against the negative. The gelatine, which is at first insoluble, would become soluble to a depth corresponding to the greater or less transparency of the negative. Opposite a very transparent part a depression would be formed much deeper than in a place opposite a comparatively opaque part. The transparency produced would be positive; a moulding taken from it would be negative, and this, in its turn, would give the ordinary metallic plate of the Woodburytype. With a positive transparency a print could be taken serviceable for the first moulding.

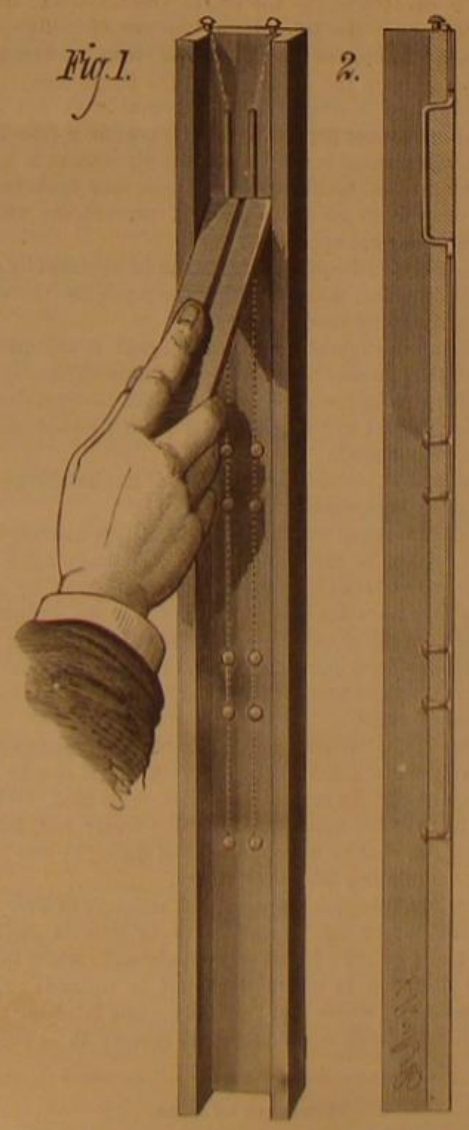
When applied to special kinds of carbon printing, or for the reproduction of line drawings, the layer of gelatine must be very thin, and not highly colored, and then the following action takes place: if it be exposed beneath a positive—for instance, a pen and ink drawing on thin paper—the light acts through all the translucent parts, but not on the parts beneath the lines. When sufficiently printed, it is only necessary to place it in hot water, and the lines alone will remain visible; the whole of the ground, which has been acted on by the light through the white paper, has become soluble, and has been washed away by the hot water. Hence we have the means of obtaining as a direct positive the reproduction of a drawing in black lines on a white ground. This application of the process appears to me to be of great importance, and to have a successful future in prospect. I believe, moreover, that in this country it will soon be worked on a larger and commercial scale. The experiments that it is my intention to make will, I hope, have practical results, which may be of great service to those endeavoring to work out such applications, and I shall be glad, so soon as I have completed them, to lay those results frankly before my readers. I have already discovered another means of applying this action to the production of the negative copy of a line drawing on a sheet permeable only in the parts corresponding to the drawing, and rendering by pressure the exact reproduction of the original drawing. The conclusion to which we are led by the arguments of this letter is: all honor to those who lay down the great principles! The discovery of the practical applications to which those principles can be put is merely a question of time. All honor to such men as Van Monckhoven and Poitevin!

A Railway up the Volcano of Vesuvius.

The railway for the ascent of Vesuvius is now finished. It is 900 meters in length, and will enable tourists to ascend by it to the edge of the crater. The line has been constructed with great care upon a solid pavement, and it is believed to be perfectly secure from all incursions of lava. The mode of traction, says the *Engineer*, is by two steel ropes put in movement by a steam engine at the foot of the cone. The wheels of the carriages are so made as to be free from any danger of leaving the rails, besides which each carriage is furnished with an exceedingly powerful automatic brake, which, should the rope by any chance break, will stop the train almost instantaneously. One of the chief difficulties of the undertaking was the water supply, but that has been obviated by the formation of two very large reservoirs, one at the station, the other near the observatory.

ELECTRICAL SIGNALING INSTRUMENT.

In electric signaling apparatus, as usually made, some sort of clockwork is considered necessary to give uniformity to the movement of the interrupter. In the signaling instrument shown in the engraving no gearing or springs are required, and although it is of the simplest character it is found in practice to work equally as well as the more expensive instruments, and is much less liable to derangement. It is the invention of Mr. William Hadden, of 145 Broadway, New York, and it consists in a plain grooved strip of wood or other non-conductor of electricity, containing contact points arranged in pairs and placed so as to represent any desired signal. These contact points are in electrical communication with the line wires or with a ground and the line, so that when any two of the adjacent points are simultaneously touched by an electrical conductor the circuit will be completed through the points and the conductor, and a signal will be received at a distant point. To facilitate the operation of sending the signal and to insure the contact of the metallic conductor, the latter is made of spring metal and split. The signal is given by drawing the spring circuit closer over the contact points from one end of the apparatus to the other. The movement of the hand is sufficiently uniform without making a special effort.



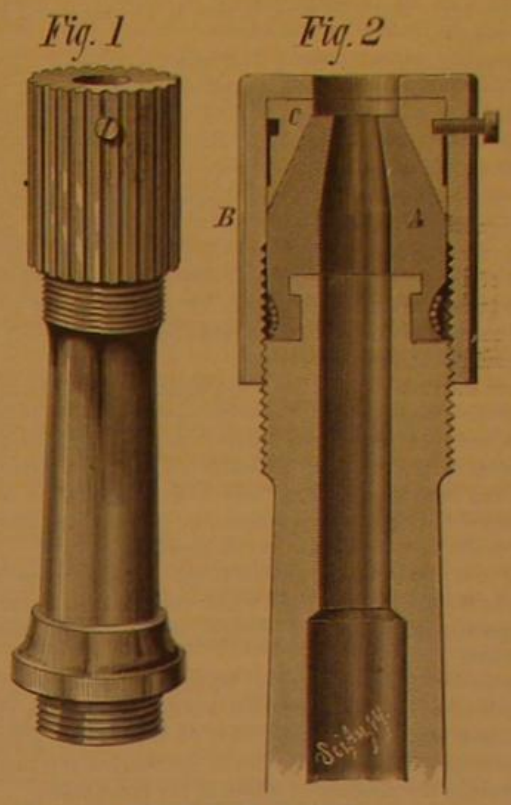
HADDEN'S SIGNALING INSTRUMENT.

This device is adapted to fire alarm telegraphs, district telegraphs, bell signals, etc.

IMPROVED HOSE NOZZLE.

The accompanying engraving shows in perspective and in section a new hose nozzle recently patented by Mr. George C Palmer, of Rochester, N. H. It may be adjusted to deliver a uniform stream of any desired size by turning the nozzle cap one way or the other.

A short elastic rubber tube, A, is secured to the end of the tube forming the main body of the nozzle, and is surrounded at its outer end by a conical washer, C, contained by the cap, B, which screws over the end of the body of the nozzle.



NOVEL HOSE NOZZLE.

The inside diameter of the rubber tube in its normal condition is the same as that of the body of the nozzle. When it is desired to diminish the stream the rubber tube is contracted by forcing down the conical washer, C, by means of the screw cap.

Developing Gelatine Plates in Daylight.

The one drawback—and beyond question a serious one—attendant upon the use of highly sensitive gelatine plates, has been found in the fact that they could not be developed—or, in fact, uncovered for any purpose—in the ordinary dark room, illuminated with sufficient yellow light to permit of comfort in working. Extreme sensitiveness to feeble radiations has inevitably brought with it the risk of fog or abnormal action of light on the surface of the plate, if light possessing any actinic power whatever should come in contact therewith. The special claim of these plates is their sensitiveness to weak light, and that they are not wholly insensible to yellow light. Hence it should not be matter of surprise or impatience that they fog if opened or developed in the light of the ordinary dark room. To secure safety, it has been found necessary not only to reduce the area through which light could pass, but also to glaze that with deep ruby glass, two thicknesses being better and safer than one. With patience and practice it is not difficult to succeed with this small amount of light. But beginners often fail in the necessary precautions, and often, in consequence, blame the plates or the process altogether, and so fail to secure for themselves one of the greatest boons the art has ever placed within their power.

Mr. Werge has changed all this, and made development of the most sensitive plates easy in an ordinary sitting-room, or, at any rate, in a well lighted dark room. Among the many ingenious appliances exhibited at the recent South London technical meeting, none excited greater interest than the developing tray of Mr. Werge, in which he developed in the full gaslight of the room a gelatine plate which had been exposed in the morning, and exhibited to the meeting the result in a clean transparency, without fog or any trace of the abnormal action of light. The matter is, of course, very simple. The plate is developed in a covered tray, and is so protected from light. The arrangement consists of an ebonite tray, fitted in a casing of tin, grooved to allow a plate of ruby glass to slide in and cover the top of the dish or tray. There is also an aperture for a funnel, through which is poured the developing solution, etc. What arrangement exists for watching the progress of development we do not know, as we have had no opportunity of examining the apparatus. This and some other matters are doubtless provided for. We can here simply record the fact, interesting to many, that the demonstration before the South London meeting was a perfect success.—*Photographic News.*

New Fashion.—Foot Jewels.

The bracelet slipper has been introduced in Paris. The shoe is cut very low in front and high up on the instep, it is fastened with a finely chiseled real gold bracelet instead of the usual strap. Another expensive novelty in the same line is the Andalusian boot, made of black satin, with lace ruffles down the front seam, and fastened with real jewel buttons.

AMERICAN INDUSTRIES.—No. 26.

THE MANUFACTURE OF PIANOS AND ORGANS.

The history of the development of the pianoforte reaches back more than a century and a half, and possesses considerable interest on account of the adoption of the instrument in almost every household. The most ordinary of modern pianos, compared with those used by Haydn, Gluck, and other composers and artists of the eighteenth century, are immensely better in tone, in size, in elegance, and in all other respects.

The piano, like everything else, had a beginning, and the history of the class of instruments from which it has been developed dates from the remote time when stretched strings were first employed in producing musical sounds. One of the early instruments of this kind was the ancient lyre, from which the harp, the psaltery, and the dulcimer were gradually developed. The clavicitherium, or keyed cithra, was the first marked approach to the piano. It consisted of an oblong box holding a series of stretched strings, which were struck by a plectra of quill attached to the inner ends of the keys. This instrument, it is believed, was first made in the twelfth century.

From the first days of the clavicitherium until the invention of the action, in 1711, the instrument was made in many forms, and took on as many different names. The invention of the action, by which hammers are made to strike the wires and fall back out of the way so as to permit the string to vibrate, has been ascribed to several persons, and there is great doubt as to who was the real inventor.

The first pianos manufactured in the United States were made in Boston in 1822, since which time the instrument has been greatly improved and brought to its present state of perfection.

The parlor or cabinet organ, which is the outgrowth of the melodeon, has been perfected within the last few years, and is now made in a great variety of forms, with different stop arrangements, and at prices so low that but few families need forego the pleasure of music in the household.

For many years a few old established houses controlled the business of piano making and selling; but latterly competition has increased, and new modes of doing business have been inaugurated, some of which have been very advantageous to the buyer and user. The largest manufacturer in this country doing business directly with retail purchasers is Mr. Daniel F. Beatty, whose factory we illustrate on the title page. The idea of dealing directly with the users of the instruments is a recent one, which not only benefits the buyer, but the manufacturer also, as it enables the manufacturer to sell a better instrument for less money than he could if agents were employed.

The central view at the top of the page represents Mr. Beatty's new factory, situated on Railroad Avenue, corner Beatty Street, in the city of Washington, New Jersey. The small building in the foreground is the office belonging to the factory. The larger building is the new factory. The building seen some little distance behind the new factory is the Beatty Building, a spacious structure, containing in addition to the hall proper, the office devoted to the extensive business connected with the piano and organ factory. The large building in the distance at the right is Beatty's Factory, No. 3. Samples of the products of these factories are shown in either of the upper corners. We have chosen a few only of the departments of this concern, as space will not permit us to enter into all of the details of piano and organ manufacture.

While the case of an organ is little more than an elegant piece of cabinet furniture, the case of a piano must not only be as elegant and well finished as skilled labor can make it, but it must be very strongly made of the very best of materials to insure its durability. The iron frame, which is to withstand the stress of the wires aggregating many tons, is fitted to the case; the sounding board is also supported by the case. In the assembling room the wires are placed on the pins, the action is fitted, the soft and loud pedal mechanism is put in, and the instrument is turned over to the workman who adjusts the action, then to the tuner, who puts the strings under their normal strain. The strings stretch somewhat; this, taken together with the slight but unavoidable yielding of the frame, soon throws the instrument out of tune, so that it requires tuning again and again. Finally, when it is capable of standing in tune, it is given to the final inspector, who gives it the last touches, which make it a complete instrument.

The organ is so entirely different from the piano in every respect that it requires workmen of altogether different qualifications. The actions—consisting of the keys, the nicely fitted valves, and the delicate springs which hold the valves to the seats—are made in the department shown in one of the lower engravings. It is with the utmost care that each piece is fitted in its appropriate place, and the workman, when he leaves one part to go to another, knows that what he has finished is well and perfectly done. Without this care on the part of the workman there would be no end to difficulties, and the work would never be completed.

The small central figure in the lower part of the engraving represents the room in which the reeds of the organs are tuned and voiced. The workman in this department must not only be a careful and experienced mechanic, but he must have a correct musical ear and a faculty of distinguishing between the shades of quality in a tone. Upon this workman depends all that is pleasing in an organ, as he has it in his power to make the tone soft, sweet, and mellow, or harsh and unpleasant.

Everything in this factory is conducted on a perfect system. None but the best of workmen are employed, none but the best of materials are used, and the most modern machinery and appliances are adopted to facilitate the work and to render it not only cheaper but better.

Mr Beatty's offices are extensive and well appointed It requires twenty or more assistants to attend to the details of this immense business The advertising bureau alone keeps a goodly number of persons constantly employed

The business, started but a few years ago by its proprietor without a dollar, has grown beyond all precedent, amounting at present to several millions of dollars a year.

Mr Beatty was lately elevated to the Mayoralty of Washington entirely without his own seeking. His fellow-citizens chose him. He conducted no campaign, and was not even present on election day, business having called him to New York on that day, and the news of his triumph was telegraphed to his headquarters at the Fifth Avenue Hotel. He bears his honors modestly, and his neighbors testify to his being the same genial, open-handed, free-hearted man as ever, not forgetting to relieve the unfortunate, to give freely to his church, nor deeming it beneath him to preside at Children's Day services in his own church.

The Beatty piano and organ are everywhere known. Mayor Beatty's success has been rapid and complete, and he claims to possess to-day the largest manufactory of pianos and organs which sells directly to the people.

Winter Precautions for Hydrants, Valves, Etc.

On the 1st of November Mr. Edward Atkinson, President of the Boston Manufacturers' Mutual Fire Insurance Company, issued the following to the mills insured in that company:

Many of the yard hydrants and those connected with standpipes are of the variety known as Y or branch hydrants, and are not provided with means of draining off the water when the hydrant is closed.

When the fire pumps are used for inspection, or for the drill of the fire organization, water remains in the upper portion of such hydrants as were closed before the pipes were drained; and also forces its way into the upper portion of every hydrant that does not remain perfectly tight under the heavy pressure. The hydrants are generally tight enough to retain this entrapped water, and the hydrant caps prevent its evaporation.

Our inspectors have discovered many instances of broken hydrants, several of broken pipes, and two of rotary pumps injured by the freezing of entrapped water, during the last year; while, undoubtedly, a larger number of similar cases were discovered by those in immediate charge and promptly repaired.

The hazard of a single broken hydrant does not lie so much in the possible deprivation of its use, as it does in the fact that when water is forced into the pipes there is a great risk of the hydrant breaking; and in most mill yards such an accident would tap all the pipes and prevent the efficient operation of the fire apparatus.

The possibility of such accidents can be obviated by opening all the hydrants when draining the pipes for the winter months and closing them afterwards.

It is therefore suggested that each agent shall, either on receipt of this circular or at such other time as he sees fit to prepare for freezing weather, cause all the hydrants of the description named to be opened, the pipes drained, and the hydrants then closed.

Rotary pumps should be emptied, if not submerged, by turning them backwards.

In this connection, we also urge that all left-handed valves and water gates be distinctly labeled, as many cases have been observed where the valves have been broken by an attempt to turn them the wrong way, even in the presence of our inspectors when causing them to be examined; some great disasters have occurred from the mismanagement of such valves both in premises insured by us and also outside of our line of risks.

The want of similarity in the direction of opening and closing valves is a great misfortune that cannot now be remedied in all cases. In several instances mills have been wet down when the fire apparatus has been under test, because the persons in control were ignorant of the right method of opening and closing their own valves.

It therefore behooves the principal manager of every mill to see that every left-handed valve or gate is distinctly labeled and marked with an arrow painted in white to indicate the direction in which it should be opened; or what would be better, where there are only a few left-hand valves in a yard containing many others, to remove them entirely.

Benzoate of Soda.

Professor Klebs, of Prague, announces that the benzoate of soda is the best antiseptic in all infectious diseases. It acts, as the experiments of the author show, very powerfully. It is claimed that a daily dose of from 30 to 50 grammes to a full-grown man will render the poison of diphtheria inoperative. The benzoate is prepared by dissolving crystallized benzoic acid in water, neutralizing at a slight heat with a solution of caustic soda, drying, and then allowing the solution to crystallize over sulphuric acid under a bell glass. Large doses do not appear to be absolutely necessary. Good results may be obtained by the daily administration of about 12 grammes.

AGRICULTURAL INVENTIONS

An improvement in plows has been patented by Mr Charles T. Crook & Logan J Huffman, of Fort Mill, S. C This plow has a bifurcated foot for a plowshare that will allow of the raising and lowering of the share at will, and is so adjusted as to prevent the clogging of both foot and plowshare from grass, litter, etc

An improvement in sulky plows has been patented by Mr Aden K Munson, of Marysville, Kan The object of this invention is to provide for vertical movement of the plow beam independent of the sulky, so that the plow will run at a uniform depth, and also for leveling the plow sidewise on uneven ground, and to provide for shifting the supports of the plow beam bodily on the axle of the sulky for adjustment to the size of plow and the desired width of furrow

Mr Joseph P Prairie, of Raleigh, N. C., has patented an improved machine for chopping and cultivating cotton. It is so constructed that it may be used for chopping, for chopping and cultivating, or for cultivating alone, as may be desired.

The Fruit of Shrubby Trefoil as a Substitute for Hops.

All who are acquainted with the tall shrub called "shrub by trefoil" (*Ptelea trifoliata*) know that its fruit is bitter, and in odor is almost exactly the same as the hop. In fact the fruit is sometimes used in this country as a substitute for the latter; and for this reason the plant is also known as the "hop tree." In consequence of the ravages of the phylloxera the French are now looking about for new beverages, and, as observed in the *Revue Horticole*, if the destruction of the vine continues there is no doubt that wine must be largely replaced by beer. M. Charles Baltet has discovered that the fruit of the "shrubby trefoil" makes equally as good beer as hops. At a recent agricultural exhibition at Châlons-sur-Marne, a M. Ponsard exhibited a sample of beer in which the fruits of this plant were substituted for hops, and its quality and flavor are reported as being equal to those of the best Strasbourg beer. As above stated, the fruit of the *Ptelea* is sometimes used in the United States as a substitute for hops, but whether it has ever been so used in the manufacture of beer, we are unable to say.

The World's Commercial Marine.

According to the *Répertoire Général*, Bureau Veritas, for 1879–80, the sailing tonnage of the civilized world has decreased from 14,218,072 to 14,103,605—a falling away which shows the decided tendency which now prevails to give steamers the preference over sailing vessels. The total sailing tonnage of Great Britain, which includes colonial tonnage, is 5,584,128, so that considerably more than one third of the tonnage which sails the sea is under the British flag. When we come to steamships, Great Britain takes a still prouder position. The total number of steamers which can be classed as sea-going is 5,897, of which Great Britain has 3,542; and the total net tonnage of steamships is 4,021,869, of which Great Britain has 2,555,575 tons, or about three fifths of the whole. Counting sailing vessels and steamers together, the civilized world has 18,125,474 tons afloat, of which 8,139,703, or not much less than half are under the British flag. Canada occupies the fourth position among nations. The leading nations are Great Britain, United States, Norway, Canada, Germany, Italy, and France.

Artificial Rotten Eggs.

Mr. J. Fletcher, F.C.S., recently described a new method of preparing sulphureted hydrogen. The plan is simply to fuse sulphur and solid paraffine in a small glass flask, leading the resulting gas by means of a perforated cork, India-rubber, and glass tube directly into the solution to be tested. The first gases are not sulphureted, but when the mixture has been thoroughly fused and mixed the sulphureted hydrogen passes over abundantly. The advantage of the process is that the moment the flame of the lamp is removed the evolution of gas ceases, and the little apparatus can be laid aside without fear of creating offensive smells. When used again, the gas passes at once when sufficiently heated. There are few precautions to be taken The mixture is inclined to BUMP when strongly heated, but a few pieces of broken tobacco pipe shank prevent it. Care must be taken that when the lamp is removed and the gas ceases to pass, none of the solution is sucked back into the bulb; it is very easily prevented. A very strong heat should not be applied, as then distillations would commence and the product condense in the tube.

National Exhibitions.

The years 1880 and 1881 will both be marked by two national exhibitions—the one at Brussels, the other at St. Petersburg. The preparations for the Brussels Exhibition, which will be opened next May, are in a very forward state, and the building will be handed over by the contractors before the end of December. The total space at disposal is 66,000 square meters, one half of which will be devoted to the arts and industries of the past, the other half to modern industrial arts and sciences. All the Belgian industries will be fully represented, including those of agriculture and horticulture, and there will be an additional space of 16,000 square meters set aside for a show of live stock. The Exhibition will be fourteen times as large as the one of 1874 held in the Halles Centrales. The Russian Exhibition is also proceeding rapidly, as far as the building is concerned, and the ironwork is being made at the St. Petersburg foundry.

Changes in the Appearance of Jupiter.

Writing with reference to the strange belt on Jupiter, in a communication dated September 28, Mr. J. A. Brashear, of Pittsburg, Pa., says:

"I first saw it at 2:45 A.M. on the 26th of June. A nine inch silvered glass Newtonian telescope was used in this observation. The belts on the equator were of a beautiful pinkish brown color. The broken belt noticed by your correspondent was so vivid and clear that it reminded me of a coke fire seen on a dark night. It made such an impression on my mind that I at once made a sketch of it, which has been of great value in subsequent observations. In referring to my note book I find I have eight drawings of the planet since the above date. Comparing the last drawing with previous ones, I am led to believe that the spot has slowly diminished in size, though not in general outline. Another and still more strange phenomenon has occurred, and to this I should like to call the special attention of observers. In my drawings I have located the white spots plainly visible between the equatorial belts, and by comparing the consecutive sketches I find that either the spots or the red belt has shifted in reference to one another about one-fourth the length of the red belt.

"Any one who has read Camille Flammarion's interesting article on Jupiter in the last number of your SUPPLEMENT, will see that this shifting of the spots is no new thing, but the question is, Which belt or spot has shifted? I am inclined to think, with my esteemed friend, Mr. F. W. Very, assistant to Prof. Langley at the Alleghany Observatory, that it may be some terrific action is going on in a local spot beneath the red belt which has dissipated or torn away the vaporous envelope of the planet over the place of local disturbance, and we possibly see the *actual surface of the planet* beneath or through the rift in the vaporous envelope. If this conjecture be true, then it is more than likely that the shifting has been in the white spots beneath the equatorial belts, as the local action which gives us the red belt would hardly be of a shifting character. I have used 6·5 inch, 9 inch, and 12 inch aperture silvered glass telescopes, and 4 inch and 13 inch achromatics, at different times of observation, and have had some exquisite views of this marvelous planet and its attendant panoramic phenomena."

A FUNGOID GROWTH—THE CAUSE OF WHOOPING COUGH.*

(*Tussio Convulsiva, Pertussis.*)

BY HENRY A. MOTT, JR., PH.D., E.M.

The idea has prevailed, and in fact is still prevalent now to a very great extent, that whooping cough must run its course, or that it has a definite limit; and if the cough is broken up it would be much worse for the child, for it would be laying the foundation for some fearful disease in the child's system. To this conclusion, I fully believe, can be attributed much of the mortality among children. The deaths from whooping cough, according to Condie, are 1 to 82 of the entire mortality in Boston, 1 to 46 in Charleston, 1 to 95 in Baltimore, 1 to 63 in Philadelphia, and 1 to 64 in New York.

When we consider such figures as these, surely any effort made to discover the cause of this terrible disease, and to point out the proper line of treatment, should be met with a hearty reception. Much diversity of opinion has existed in regard to the pathology of whooping cough. Fortunately, however, owing to the investigations of Dr. Letzerich, of Germany, in 1871, and the confirmation of his results by myself, our knowledge of this disease has been greatly enhanced. Condie says: "A majority of the most authoritative writers refer it to bronchial inflammation, which, by few, is considered to be of a specific character. By some, however, who have written very ably upon the disease, the bronchial affection is viewed as a mere concomitant, or effect of the whooping cough; and not in any degree essential to its existence. Most of the writers refer it either to disease of the pneumogastric or phrenic nerve, or to disease of the brain affecting the origin of the respiratory nerves; while others consider cerebral irritation to be secondary to the bronchial disease, and oftener absent.

"That the essential symptoms of whooping cough are the result of a spasmodic closure of the glottis there can be but little doubt, but whether this is owing to an irritation seated in the larynx or trachea, or in the brain, it is difficult to determine." In pathology so uncertain as this, how are the proper remedies to be selected? Are they to be addressed to the brain, the origin of the nerves, or to the larynx or trachea?

The question having only recently been answered, among the former remedies are found purgatives, astringents, emetics, expectorants, narcotics, vesicants, tonics, depletants, antispasmodics, caustics, revulsents, antiperiodics, ablutions, etc. As Dr. J. O. Hamilton, in his able article‡ on whooping cough, remarks: "How can we imagine such a hydra-headed disease, requiring such fearful instruments for its decapitation?" From the above it is certain that Dr. R. Dugleson, in his work on disease of children,† stated the truth when he said, "But little is known of the cause of whooping cough."

As stated before, in 1871 Dr. Ludwig Letzerich commenced a series of microscopical investigations as to the real cause of whooping cough, and his original investigations are to be found in full in Virchow's *Archiv*, vol. 49, p. 530.

* Read before the New York Academy of Sciences, November 24, 1879.

† Illinois State Med. Soc. Rep., p. 48, 1875.

‡ Page 250.

Letzerich showed, for the first time, that if the expectorated mucus whooped up during the short duration of the first catarrhal-like stage of the disease, be examined under the microscope, there will be seen, besides the portion of phlegm, etc., etc., small elliptically-shaped brownish-red fungus spores, some of which have partially germinated and brought into existence mycelium. This discovery gave a clew at once to the cause of pertussis, and opened a new channel for its treatment.

As the editor of the *Quarterly Journal of Microscopy* stated that this observation of Letzerich had not as yet been confirmed by any other investigator, and having an opportunity offered to study the disease in my own children, I concluded to do so, and after a careful microscopical investigation of the phlegm whooped up at various stages in the development of the disease, I can now state that in the main my investigations confirm those of Letzerich.

The following is an illustration of the fungus spores and the mycelium. Of course no one slide gave the field here presented, but it is the result of the examination of a very

large number. A represents the mycelium; B, cells thrown off from the epithelium; and C the fungus spores, which exist in great numbers; D represents a film of epithelium from the under surface of the epiglottis. Letzerich represents the fungus spores when developed as brownish-red. These I did not detect.

The ripe spores of whooping cough differ from those of diphtheria in not being circular, and in not showing any finger-like protuberances. The growth of the mycelium in the masses of phlegm goes on very rapidly, and the threads acquire considerable length, especially when the disease is at its height. The expectorated mucus is also very thick at this stage, and on drying becomes of a glassy appearance, although quite tenacious. In these latter stages the mycelium are very plentiful, and there is an energetic formation of spores. If the fresh spores are treated with iodine and concentrated sulphuric acid, the mycelium are colored beautifully blue, and the unripe spores, which are white, now appear brown. To show how this theory was received by Dr. Hamilton, who made such a careful investigation of all theories, I will quote what he says: "The only theory that seems to me tenable, and I think the success of certain remedies bear it out, is that whooping cough is the direct result of a fungous growth; that the spores are thrown off by the individual coughing, and are received by another in the saliva of the mouth, which retains them until they have time to attach themselves to the underside of the tongue, where the mucous membrane is the thinnest and softest of any part of the mouth, and at the same time are not so liable to be dislodged by drink or food. In this situation they remain until they are able to germinate and spread along the sides of the tongue and backward until they reach the larynx and pharynx, when the full whoop is established. Elevations or lumps can very plainly be seen under the tongue before the patient begins the whooping, but the catarrhal symptoms at this time are quite prominent; discharges from the nose, suffused eyes, headache, some fever, and general lassitude. The time of incubation is from nine to fifteen days, though varying in the different subjects. These elevations on either side of the frænum linguæ are small, and might escape observation unless carefully sought for, as it is quite difficult to induce the young subject to turn the point of the tongue up long enough to make proper observations."

Letzerich made numerous experiments on rabbits with the spores from whooping cough. The spores were cultivated on pieces of bread soaked in milk, and then introduced into the trachea of young rabbits for future development. This was affected by tracheotomy, but the animals rapidly recovered from the effects of the operation, and in a short time became affected with a cough—the same as whooping cough. The rabbits were killed, and their air passages and lungs were found to contain enormous quantities of fungus; the expectorated mucus was also the same as in man.

From Letzerich's valuable investigations he was able to show the difference between the action of fungus in diphtheria and that in whooping cough. He says: "Disease produced by the vegetation of fungi in the epithelium stratum of the respiratory organs are of two kinds. 1. *Diphtheria:* The vegetation of the fungus originates at the head of the windpipe and trachea, seizes and destroys the epithelium with startling rapidity. 2. *Whooping Cough:* The fungus germinates in the epithelium web; at first in the upper part, and then over the whole respiratory organs, without destroying the web, produces whooping cough and its manifest complications. If the growth of the fungus is confined to the epithelium of the epiglottis, of the larynx, and trachea, then it is simply whooping cough; but if the fungus enters into the delicate bronchial tubes and the cavities of the lungs, then the dreaded complications arise."

It is therefore best to meet the disease in its earliest stages and treat it properly; that is, with an object to kill the fungus and prevent its further development; and then we shall seldom have the complications of bronchitis, cholera infantum, or cerebral difficulties to contend with.

What, then, shall be the proper remedy? Quinine has been used for a long time with excellent results, but its use was not founded on the fact that it kills fungus plants. It was not so used until 1869, when Professor Binz made numerous experiments to show that it would check very markedly the alcoholic fermentation in various fluids; and that the antiseptic action was due to the poisonous influence of the drug upon the fungi, which are the cause of such fermentations. According to his experiments the largest infusoria are killed by a solution of quinine of the strength of 1 in 800 immediately, and upon the ordinary mould penicillium, upon vibrios and bacteria the drug acts with a similar fatality.* In the latter part of 1870 Prof. Binz, and later in the same year Breidenbach, published articles on the beneficial action of quinine in the convulsive stage of pertussis.

Their application of this drug indicated that they thought pertussis was due to the growth of fungi; but still this had never been demonstrated until Letzerich undertook the investigation. In 1871 Steffin confirmed in the main the accuracy of the observations of the savants mentioned above, and two years later Dr. B. F. Dawson reported eighteen cases in a valuable pamphlet, and advocated strongly the value of quinine in curing the whooping in this disease. Since then the use of quinine has been ably defended by Dr. Hamilton, of Jerseyville, Ill., and by Dr. Charles W. Earle, of Chicago. My experiments lead me to the same conclusion, as after administering quinine to my children, and in fact to numerous other children, they all speedily recovered, not whooping more than once a day after the second day it was given them, and discontinuing to whoop entirely by the end of the fifth to sixth day. The time could be made much shorter if children could be induced to take it in a powder directly on their tongue and let it dissolve slowly; but owing to its extremely bitter taste they object. So I found by dissolving the quinine in "gum"—that is to say, sugar and water—they soon became accustomed to the taste and craved for it, as as it afforded them relief.

The best time to administer it is just after a coughing spell and just before retiring at night. As regards the size of the dose, this should depend on the age and severity of the case. To a grown person, from three to five grains of powdered quinine can be put right on the tongue and allowed to dissolve itself. To a child from two to five grains may be dissolved in two ounces of gum (sugar and water), and one teaspoonful can be given as stated above. The gum helps to keep it in contact with the parts longer. Quinine administered in gelatine or sugar-coated pills is of no use whatever.

* Virchow's *Archiv*, 1869, p. 68. Wood's Therapeutics, Materia Med. and Toxicol., p. 62.

Sound Waves.

C. Decharme has extended the investigation of nodal systems, and drawn some interesting comparisons with the earlier researches of Chladni, who indicated three systems of nodal lines: the diametral, the concentric, and the compound. He substitutes a thin layer of water or some similar liquid for the sand which Chladni employed, and finds many interesting relations among the peripheral and eccentric networks, the number of sonorous vibrations, the breadths of the striæ, the areas of the internodal sectors, and the numbers of nodal divisions. By means of these equations it becomes easy to estimate the wave lengths of different sounds.

K. H. Schellbach and E. E. Boehn have experimented with waves of sound, in illustration of the wave theory of light. Connecting two Leyden jars with the conductors of a Holtz electrical machine, so as to produce sparks of 1 centimeter (0·39 inch) between the balls of the discharger, concentric rings were formed in coal dust sprinkled on a glass plate 4 centimeters (1·57 inch) from the balls. The longer the spark the more strongly marked were the rings. By reflecting the reports of the discharges, by means of parallel walls and mirrors of various kinds, the dust waves were made to assume such forms as are theoretically deducible from the reflection and refraction of light, thus visibly confirming the views of Huyghens and Young. That the results are not modified in any way by mere electrical action can be readily shown by substituting explosive gas or powder for the sparks. From ten to twenty sparks or explosions were generally sufficient to show the character of the waves and of their nodal intersections.—*Ann. d. Phys. und Chem.*

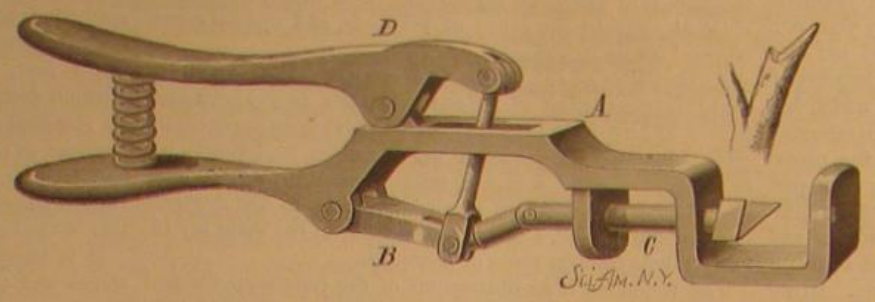
PRUNING AND GRAFTING IMPLEMENT.

The tool shown in the engraving is designed for grafting and pruning, the knives being changeable, so that it may be readily adapted to either purpose.

The main portion, A, of the tool contains a toggle joint, B, connected with the sliding bar, C, which carries the knife. A lever, D, pivoted to the part, A, is connected by a link with the toggle joint, B, completing an arrangement of levers capable of moving the knife with great force as the handles of the implement are brought together.

The part, A, is bent to form a support for the limb to be cut, and the support is lined with wood or soft metal to prevent injury to the knife.

The knife represented in the engraving is V-shaped, and the cut made by it is shown in the little detail view. This form of cut is made in grafting. This tool is the invention of Mr. Charles M. Kingsbury, of Tama City, Iowa.

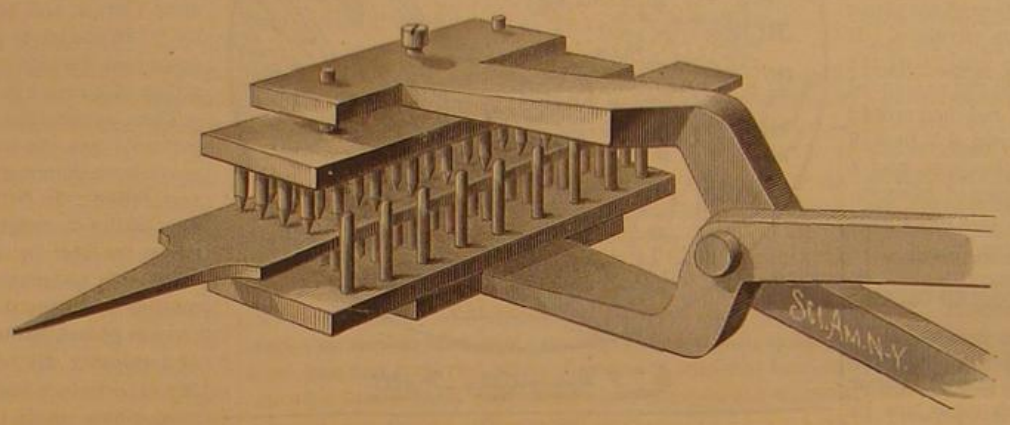


NOVEL PRUNING AND GRAFTING IMPLEMENT.

IMPROVED HARDENING TONGS.

The annexed engraving represents an improved implement for holding and manipulating steel articles during the process of hardening. It consists in a pair of tongs having T-shaped jaws, provided with pointed pins which bear upon opposite sides of the article, and prevent it from twisting out of shape when it is plunged into the water to cool, while it allows the water to completely surround the article and cool it as readily as it would if it were plunged in the usual way. One of the jaws is movable and is capable of adapting itself to tapering surfaces.

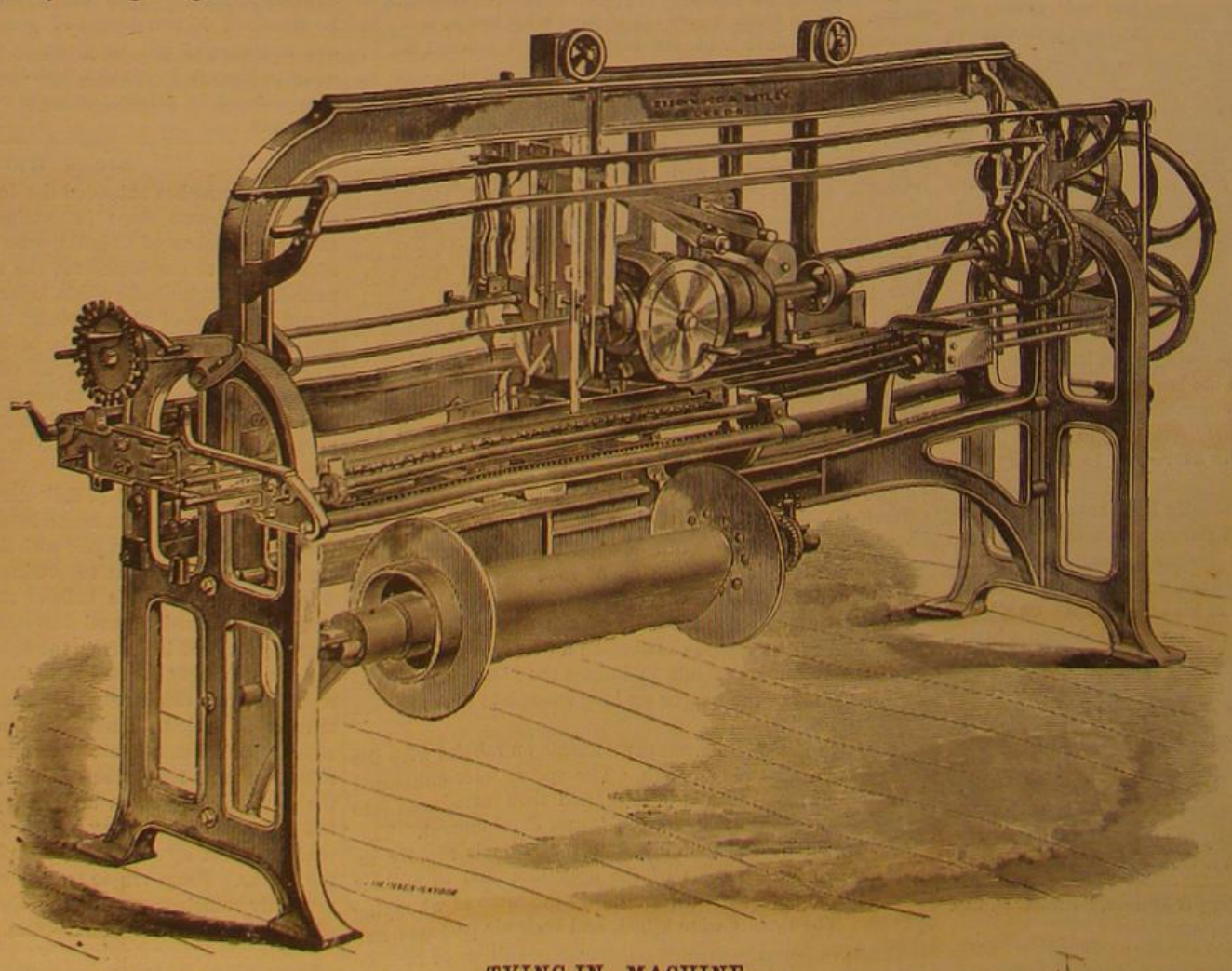
This implement is the invention of Biel Le Doyt, deceased. The patent is issued to Mary M. Taylor, administratrix, Mansfield, Mass.



HARDENING TONGS.

TYING-IN MACHINE.

The tying-in machine shown in the accompanying engraving is the invention of Messrs. J. P. Binns and J. Shackleton, and is made by Messrs. Greenwood & Batley, of Albion Works, Leeds, England. It is designed for tying-in the new warp to the old in weaving operations, or connecting each end or thread of the new to the ends or threads of the old warp, so as to allow them to be drawn through the mails or eyes in the healds or harness and sley or reed. Until the present time this operation of tying-in has been done altogether by hand, either by taking the two ends of each thread separately and tying them together, or, as in the manufacture of fine goods having a light and elastic warp, by twisting them together. The object is satisfactorily effected by the machine, working entirely automatically and by power, making a secure knot, and thus performing with accuracy and dispatch what was previously a tedious hand operation. The machine, well illustrated by the engraving, has a suitable framework, on one side of which is placed the warp beam with the new warp upon it, and on the other side the healds or harness and sley or reed, with a portion of the old warp in them, the ends or threads being secured to rails, and extending across or lapping over each other sufficiently to allow for the forming of the tie. A carriage is mounted upon the framework, sliding upon rails or rods, and capable of being moved laterally or crosswise of the warp threads. The framework also supports a rotary horizontal driving shaft, which the carriage slides upon, and which carries and gives rotary motion to a barrel having several cams attached to it for operating the various levers which control the movements of the working parts of the machine. This carriage supports a vertical reciprocating slide bar carrying a needle or hooker by which the threads are seized and placed in position to be tied together, the bar receiving its motion from one of the cams already referred to and a suitable lever. Another barrel or hollow shaft is supported on this carriage, receiving rotary motion from the driving shaft, and on one side of it is a boss. A sliding finger is mounted on the outside of the barrel, carrying a cam at one end, and a reciprocating sliding needle within the barrel is operated by another cam and lever. Intermittent motion is given to the carriage across the warp by a screw shaft which is worked by a ratchet wheel and catches. Knives are furnished for cutting the ends or threads of the warp, at the time required, to the proper length for tying together. There are four horizontal shafts, each carrying a half flange or finger for freeing and separating the warp threads. These shafts are geared together at one end, and intermittent rotary and reciprocating motion is imparted to them by means of a cam with lever and rod, working in connection with ratchets and catches, and operating the screw bushes or bearings of the shafts. In the framework of the machine are two guide pins for the vertical needle to pass and draw the warp threads between after being cut, keeping them together and holding them while the finger on the rotary band turns them around a curved groove in the boss on the end of the barrel to form the loop. When the loop is formed, the sliding needle within the barrel draws the ends of the threads through the loop, and a lever is brought into operation, pushing the loop off of the boss, drawing the threads tight against the holding of the needle, and forming the knot. The knotted threads are removed by a finger, the next threads are in turn taken up, and the operation is continued until the whole of the warp is tied in. A self-acting stop motion is attached which stops the machine should a knot be missed, thus securing good work, and insuring that all the ends of the new warp are attached separately to those of the old.



TYING-IN MACHINE.

MECHANICAL INVENTIONS.

Mr. Henry C. Green, of Bascobel, Ga., has patented an improvement in the class of windlass presses, or presses whose followers are operated by a system of ropes and pulleys. Instead of placing a windlass shaft at each side of a vertical press box, as usual heretofore, the inventor arranges a wheel horizontally beneath the bed of the press, and provides it with a lever attachment, by which it is rotated and caused to take up or wind on the ropes connected with the follower.

Mr. Martin W. McCortney, of Mount Pleasant, Mich., has patented a single cylinder double acting force pump for wells, of novel construction, having its valves and connections fitted in a simple and durable manner, and so as to be readily accessible.

An improvement in that class of drag saw machines in which the saw is attached to a lever that is pivoted in a frame and vibrated by a hand lever, has been patented by Mr. William N. Kyle, of Edinburg, Ind.

An improved windmill, patented by Mr. Ratti Lorenzo, of Loyalton, Cal., consists of vanes affixed to a carriage adapted to move freely on an incline attached to the pivoted head of the mill, and extending backward parallel to the face of the wheel, whereby, when a strong wind is blowing, the carriage is forced out on the incline, and by the greater leverage thus obtained it carries the wheel nearer to the wind, and thus lessens the speed; but when a lighter wind is blowing the carriage descends the incline, lessening the leverage and permitting the wheel to come around in opposition to the wind.

An improvement in parallel vises, patented by Mr. Niels P Ringstad, of Mankato, Minn., consists in connecting the jaws with links pivoted to a central slotted guide, in which a traveler is held and pivoted to one pair of the links, whereby, when the jaws are screwed open or shut, the links, turning on their pivots, compel the moving jaw to move in a line parallel to the stationary jaw.

Mr. Alexander McRonald, of Toronto, Ontario, Canada, has patented an improved brake for children's carriages, which is simple, readily applied, and capable of holding the carriages securely, preventing them from moving when left alone.

An improvement in that class of water elevators in which a well bucket is attached to a rope or chain plying over a windlass provided with a crank for rotating it, has been patented by Mr. James C. Barrett, of Marion, N. Y. This is an improvement upon that for which the same inventor received Letters Patent of the United States No. 41,410.

Mr. Fredrick Stedman, McBride's, Mich., has patented improved journal boxes for the machine known as "Hall's shingle machine," which is so constructed as to allow the shafts to play freely as the gear wheels are thrown out of and into gear, and which may be adjusted vertically and horizontally, as may be desired.

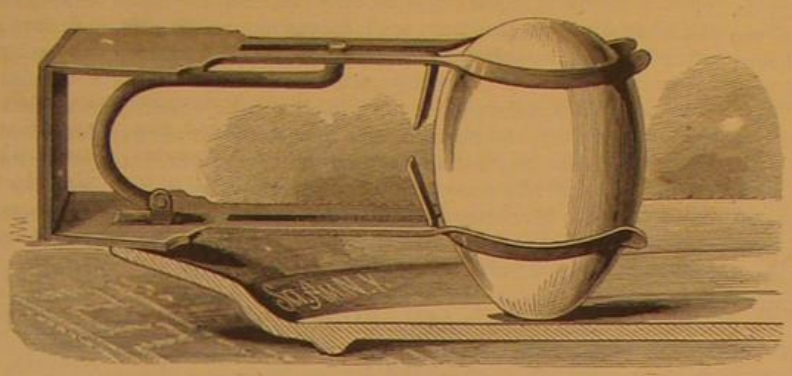
An improved machine for forming carriage shackles has been patented by Mr. Stratten M. Rowell, of Port Chester, N. Y. The invention consists in the construction of peculiar bending dies, which cannot be described without engravings.

An improved pole for telegraph wires, flag staffs, lamp posts, clothes line supports, etc., has been patented by Mr. David Lathrop, of Hazle Dell, Ill. It consists in the pole formed of three sections sliding or telescoping into each other.

Mr. Andrew Elvin, of Paterson, N. J., has patented a steam boiler which is so constructed that they may be easily, conveniently, and cheaply built, and easily, conveniently, and cheaply repaired. It consists in a steam boiler with a flue extending through it and filled with vertical tubes, and provided with braces or partitions, the whole detachably secured into an outside shell.

NEW EGG HOLDER.

The egg holder represented in the accompanying engraving is the invention of Mr. John S. Birch, of Orange, N. J. It consists of a spring tongs having branched and bow-shaped prongs adapted to clutch the sides or ends of the egg. It is designed more particularly for use at the table, and is better adapted than the ordinary cup to hold the egg on the plate. The prongs are provided with guards to compel the egg to assume the right position, and there is an egg shell discharging device consisting of a curved wire hinged to the lower jaw of the tongs and capable of sliding in a slot in the upper jaw. By pulling this wire the jaws are separated, allowing the shell to fall out.



NOVEL EGG HOLDER.

King Cotton.

The stern-wheel iron steamer Charles P. Choteau recently landed at New Orleans the largest cargo of cotton ever carried by one vessel on the Mississippi, and probably in the world. It consisted of 8,841 bales, the huge mass, piled tier above tier, almost hiding the steamer from view.

New Mode of Exciting an Induction Coil.

Mr. W Spottiswoode, LL.D., finds it a good plan to use the alternating currents of a De Meritens magneto-electric machine to excite an induction coil. In this arrangement the "make" and "break" currents in the primary are alternately in one direction and the other, hence the secondary discharge appears to be the same at both terminals. The advantages of the method are: First, the fact that as the machine effects its own make and break, both the contact breaker and the condenser of the induction coil can be dispensed with; secondly, that the breaking of the primary, and consequently the delivery of the secondary currents is perfectly regular; thirdly, that the quantity of the currents in the secondary is very great. With a 20 inch coil by Apps a spark about 7 inches in length, of the full thickness of an ordinary cedar pencil, has been obtained. But for a spark of thickness comparable at least with this and of 2 inches length, an ordinary 4 inch coil is sufficient. In vacuum tubes under this discharge the striæ are perfectly steady, as with a battery (Gassiot's or De la Rue's), and their brilliancy and configuration can be controlled by means of a shunt in the secondary circuit, formed by a column of glycerine and water, so as to diminish at will the amount of current flowing into the tube.

A Mine of Palm Oil.

According to the *Colonies and India*, that portion of the west coast of Africa which lies south of the River Volta furnishes the principal supplies of palm oil. Nearly 1,000,000 cwt. of this oil are annually exported to Great Britain, of the value of $7,500,000, its principal use being in the manufacture of soaps, perfumery, candles, and similar articles. Among the natives it is highly valued, both for food (taking the place of butter), for lighting and cooking purposes, and for anointing the head and body. The so called oil, which is rather a fatty substance, resembling butter in appearance, is obtained from the fruit of several species of palms, but especially from the one known botanically as *Elais guineensis*, which grows in abundance on the western coast of Africa, and from which it takes its specific name.

So thickly do these trees grow, and so regular and rapid are their supplies of fruit, that in some localities where the regular collection of the produce is not practiced, the ground becomes covered with a thick deposit of the oily, fatty matter produced by the ripe berries. Deposits of palm oil, which may almost be called "mines" of vegetable fat, exist in some parts of the Gold Coast, and which, if not in themselves worth working, at least practically illustrate the natural wealth of the country in such productions, and indicate its undeveloped resources. These "mines" would probably not repay the cost of exploration, as the palm oil is apt to become rancid and valueless for its general uses after long exposure, though for such purposes as candle making these deposits might still be valuable.

THE GILA MONSTER.

This reptile, which Professor Cope calls *Heloderma suspectum*, and to which the specific name *horridum* has also been given, is not uncommon in Utah, New Mexico, and Arizona. It is believed to be very poisonous, but such is not the case. It will bite fiercely when irritated, but the wound is neither painful nor dangerous. The Mexicans assert that its breath is fatal, probably because of its habit of blowing when disturbed.

In the "Zoology of the Survey of the 100th Meridian" it is stated that several specimens were secured in 1881, 1873, and 1874; but with one exception all were lost in transit to Washington. The specimen from which the accompanying drawing was made was kindly forwarded to us by Mr. T. W. Parker, of Phœnix, Arizona Territory, who writes that it inhabits all the mountainous regions along the Pacific coast as far east as the dividing ridge. Very little is known of its habits, except by the natives, who regard it as the most terrible of reptiles, not excepting the rattlesnake.

The Gila monster grows to the length of three and a half feet. Its food is such small reptiles, mice, crickets and other insects that it can easily capture. It is sluggish in movement, traveling no faster than the tortoise. When disturbed it stands as erect as possible and blows at its antagonist, sending forth a stream resembling fog, and believed by the natives and Mexicans to cause instant death. The first Gila monster Mr. Parker ever saw was on Salt River, ten miles from Phœnix. It was about 14 inches long, and was in combat with a snake 4 feet in length. The snake coiled in the usual manner, and as the monster advanced struck his blow firmly, producing no effect upon the tough scaled skin of his foe. The monster then rushed upon the snake, and seizing it with its arms and legs gave two or three bites, then let the snake go. The latter crawled away slowly, seeming to be badly hurt. The monster also took refuge in the brush. Evidently the monster's breath does not paralyze snakes. However, from what he has seen Mr. Parker is inclined to believe that there is truth in the stories the natives tell.

A saloon-keeper of his aquaintance captured a monster alive, and kept it for the amusement of his customers. It was tied in a corner, and as the floor was of earth, as in all houses in those parts, the reptile burrowed a considerable hole as a hiding place. One day—Mr. Parker does not say that he witnessed the affair—a mouse ventured near the hole; the monster sent forth a stream of poisoned breath, and the mouse fell paralyzed. The monster then seized and devoured it. One cannot but wonder that with so favorable an opportunity no one had the wit to test the truth of the popular belief as to the poisonous character of the monster's breath by submitting to it a variety of small animals.

Mr. Parker does not think the monster able to defend itself with its teeth, the latter being so small. Yet he says that he is credibly informed that a man in Arizona, who was bitten while tantalizing a monster, has been paralyzed on that side ever since. It is certain that the Mexicans and natives of those parts regard the reptile with the liveliest apprehension.

Names of Wood Manufactures Wanted.

Mr. Charles S. Sargent, special agent of the tenth census, to whom has been committed the collection of statistics of forest wealth and products for the coming census, wishes information with regard to uses of unsawn lumber. All lumber which passes through sawmills can be readily reached by the ordinary enumerators. What Mr. Sargent wishes to get track of is the considerable applications of wood in manufacture, where small timber or unsawn wood is employed. Any one who can furnish him lists of such uses may materially aid in increasing the scope and value of this portion of the census statistics. Mr. Sargent's post office address is Brookline, Mass.

Cotton by White Labor.

It used to be said that white men could never take the place of the blacks in our Southern cotton fields. Experience has shown the assertion to have no foundation in fact. Inquiries made during the past season by several Southern members of Congress develop the fact that a large portion of the last crop was raised by white men by their own labor. Mr. Manning, of Mississippi, says that the facts he has collected justify the opinion that three-fifths of the crop of 1879 was produced by free white labor.

TO PREVENT any break in the continuity of their subscription, and to enable the publishers to know how large an edition to print at the commencement of the new year, subscribers are invited to remit for a renewal as early as possible.

GILA MONSTER.—(*Heloderma Suspectum.*)

Preparation of Castor Oil.

BY ERNEST P. BAAB, PH.G.

Castor oil is obtained in the United States by the following method, as witnessed at the "Belleville Oil Works," owned by Messrs. Brosius & Son. The seeds having been thoroughly cleansed from the dust and particles of the pod, with which they are more or less contaminated, are placed in an iron reservoir and slightly heated. Great care is taken to prevent them from being scorched, the object being only to make the oil more fluid for expression. The pressing is now proceeded with by means of hydraulic presses, which are preferred on account of the great force exerted by them. Each piece has a series of movable plates and cylinders, of which each cylinder is filled, the plate pushed in, and then the power applied. The first quality oil is thus expressed, and runs into a large tank below. The pressed seeds are now heaped into a pile and allowed to remain for a day. Next day they are again heated in another iron reservoir, put into a series of cylinders, power is applied, and the second quality, or lubricating oil, is obtained. Messrs. Brosius & Son use a portion of their oil cake for fuel, and send the remainder to the East, where it is utilized in combination with other matter to produce artificial guano. A Philadelphia firm, Messrs. Baeder, Adamson & Co., have resorted to bisulphide of carbon as a solvent for the press cake, thereby obtaining a dark thick liquid. The process is similar to that carried on in France with alcohol, the product, however, being a very common lubricating oil, but without smell of bisulphide of carbon. The firm does not now manufacture any more.

The oil made by the process in use at the Belleville Oil Works is called cold pressed, to distinguish it from any of the other methods in which more heat is employed. The cold pressed oil without doubt deserves the preference, and is now extensively used. The yield per bushel after two expressions is sixteen pounds, or two gallons; the first expression yielding twelve pounds, the second four pounds. Sometimes a third expression is resorted to, but this oil is much colored, and the yield so very small that it hardly pays for the labor and expense incurred; the yield is from one to three pounds.

The process of purifying and clarifying the oil is accomplished in various ways, and is the specialty of every factory. The great point in purification as well as clarification to be noticed is the fact not to expose the oil too long to the air, as it is then liable to become rancid. The first expressed oil is clear white, or rather colorless, like water; the color of the second expression is yellowish, like sirup of squills. Castor oil is remarkable for its power of mixing, in all proportions, with glacial acetic acid and with absolute alcohol without the aid of any other agent. It is soluble in four parts of alcohol, 0·835 or 0·850, at 15° C., and mixes without turbidity with an equal weight of the same solvent at 25° C. Its specific gravity is 0·97 to 0 98; it congeals —at 12° to —13° C., and becomes solid at—40° C.

The oil of the first expression is used for medicinal purposes; that of the second for oiling leather, lubricating machinery, burning, and various other purposes.

The oil cake is either, by the addition of animal matter and other ingredients, made into manure, artificial guano, or is used for fuel. The latter is the customary practice in large oil mills, where a saving of from 40 to 50 dollars a week is effected thereby.—*American Journal of Pharmacy.*

Gum Copal.—A New Theory Concerning the Supposed Sand Marks.

At a recent meeting of the Society of Natural History at Portland, Me., the President, Dr. William Wood, made a verbal communication of much interest in relation to the resin commonly known as gum copal. We copy from the report of the Portland *Advertiser:*

Dr. Wood stated that M. C. Cooke, of London, had made the only approach to a scientific arrangement of the gums and resins that he had been able to find. He has made four principal groups—gums, gum resins, resins, and oleo-resins. The gums, like the arabic and cherry kind, are more or less completely soluble in water. The gum resins are partially so, but the true resins are insoluble in water to any degree, and the hard resins, like some of the copals, are absolutely insoluble in oils or alcohol without some previous method of preparation, while others are capable of being suspended in volatile oils, and are classed as oleo-resins.

Resins are derived from the vegetable kingdom, and nearly all plants produce them in a greater or less degree. But the trees which produce them in sufficient quantities to be of commercial value are to be found principally in South America, the East Indies, and Africa. These belong principally to the natural families of *Dipteraceæ*, or wing fruited trees, only found in India and the islands of the Indian archipelago, and the *Leguminosæ*, or trees which bear pods, like the locust and acacia trees. Of these the Hymenæa seems to be the tree from which the resins most nearly akin to the true hard or fossil copal are mostly derived, though the Vateria and some others have been regarded by many as the sources of the copal resin known in England as anime. But in a note to the *Gardener's Chronicle* (1865) the conclusion seems to be reached after careful comparison with specimens in the Kew Herbarium, that they are derived from *Hymenæa mossambicensis.* From these trees and many others a great variety of copaline gum resins are derived, and are known in the markets as raw copal, copal *vert* in the French market, "tree copal" or *chakazi*, corrupted by the Zanzibar merchants to "jackass" copal.

But the true or ripe copal, properly called *sandarusi*, is the produce of vast extinct forests, and furnishes at the present day the only yet very conclusive evidence of their former existence. It is found buried at depths varying from a few inches to two or more feet, over immense tracts of sandy deserts in Africa, where now no traces of vegetable life exist, except such as, in small masses, are occasionally found under the sands, still clinging to the gum, but so frail as to crumble away at the touch. The resins derived from this source are found to be fretted all over, and that, too, very equally in every angle, indentation, and curve of the surface, with little elevations and depressions of nearly uniform size and character, to which the technical name of "goose skin" has been given. This peculiarity distinguishes the true ripe copal, or "fossil" copal, from all other kinds; and as it is the most valuable, the natives resort to many devices for making the *chakazi* sell for the true copal. The general opinion in regard to the origin of these indentations upon the surface is, that they were made by the impress of sand, when the gum in a soft state was buried in it. This opinion seems to have been a sufficiently satisfactory one, so far as is known, down to the present time, to all who have written upon this subject. So plausible and apparently so natural was this explanation, that no one seems to have doubted its correctness, and, like many another error, it has been passed down from one to another unquestioned.

It was with the design of calling the attention of the society to the question of the origin of the markings upon its surface, that the subject of copal has been introduced for discussion this evening. An examination of some very fine specimens that have been recently presented to the society by Mr. Augustus P. Fuller of this city, was the means of first raising a doubt in the minds of some of us as to the correctness of the established sand theory. It did not seem to bear the test of criticism. Here were masses of very different forms and sizes, some round, others angular, even triangular, with curved faces and jutting points with thin edges; yet all were equally embossed and indented at every point of their surface, even to the thin edges and extremities of the angular ones, and upon every portion of the surface of the rounded ones. It would be difficult to explain how such finished masses could be formed by the ordinary exudation from a standing tree of a liquid mass into the sand. The theory is that the vast areas now occupied by sandy deserts were at some former period, in their whole extent, covered by mighty forests, when the trees must have stood in deep and more or less fertile soil. But even taking it for granted that these exudations were poured out upon the sand, the first layer that reached it would become covered by it, and the next layer would cover this and in its turn be covered by sand, so that the sand itself would have been confined in its interior, very much as the insects which are occasionally found entombed in its transparent walls. But no such occurrence is known. No particles of sand are found in the interior of these masses of resin; or if at all, they are probably even more rare than the insects. This method of pouring out the more or less fluid resin upon the sand cannot be made to fulfill the requirement of indentations made upon the surface only

But suppose that this resin is poured into cavities within the tree itself, made in the progress of natural decay or by the inroads of wood ants or other insects. We shall have all the conditions by which to explain the peculiarities in forms of these masses of resin, the indentations upon every particular part of their surface, and the entire absence of sand from their internal structure. These resins in their nature are imperishable by the lapse of ages and by the causes that have removed from the surface of the earth all traces of the soil and trees that produced them. Buried in the sands that, in the gradual process of change from forest to desert, have swept over these vast areas, they furnish to-day the only evidence of the former existence of such forests. We have some proof of the imperishable character of these resins where they have been employed in the mummifying processes of the ancient Egyptians. Yet these are probably as modern as they are imperfect in comparison with the mummied insects that nature has preserved in all their perfection and beauty in these wonderfully transparent and highly burnished walls of the copal. In regard to the age of copal no entirely satisfactory answer can be given. Professor Gunning has well said "that the revolutions of nature from forest to desert are never achieved in a day, and that the fly or moth which looks as if it had just lit in its crystal coffin, may have been there a hundred thousand years. We are sure that it was there, just as you see it to-day, long before there was any man on earth." The insects found in the copal are said to be those of living species, while those found in amber are of extinct species, and it is claimed that this becomes one of the tests by which gum copal is prevented from being passed off as amber. If this be so it becomes a difficult task indeed to measure the immense antiquity of the amber in such common use at the present day.

The microscope has furnished an important aid in support of the theory of the formation of these copaline masses in cavities of the trees. Coniferous trees, such as the pines, firs, etc., have a peculiarity of structure by which microscopists can determine their presence with certainty whenever and wherever this structure is found, whether in peat, lignite coals, or silicified wood. The woody tissue of these trees is wholly made up of little tubes or cells pointed at at both ends, having upon the surface of each tube one or more rows of circular gland-like disks, each disk having apparently a smaller opening in the center, looking like a ring within a ring. As the pointed extremity of one tube overlaps that of another, the tubes have the appearance of being continuous and of being placed between parallel lines. The impression of just such a structure is easy to be observed upon the surface of the copal, and it is difficult to understand how these impressions could have been made in any other way than by the resin in a liquid state being poured into cavities within the trees. The walls of these cavities in some instances were probably in a state of partial decay and allowed the resin to well penetrate its tissues. There it would harden, and in process of time, when the trees crumbled to dust, would become loosened and ultimately buried in the sands that took the place of or covered up the former soil. These impressions indicate that these trees were almost certainly of the cone-bearing family, and this may in part explain the difference in solubility of the fossil copal and all the species of the *chakazi.*

I have examined several pieces of amber kindly loaned to me by Mr. Kirsch, of this city, in their natural condition, or rather, as they were received by him for the purpose of manufacture. But if this "goose skin" was ever to be found upon them, it has been roughly removed in their preparation for the market, which is, probably, in no way made better by its preservation, as it is in the case of the copals. The surface, however, still appears to bear the impression of cellular tissue.

Chest Development and Consumption.

It is stated "that during the last twenty-five years not a single singer has died of consumption at St. Petersburg, although this disease has outstripped all others and now holds the first place among the causes of death in the Russian capital." From this and other facts Dr. Vasilieff draws an inference in favor of the exercise involved in singing, as a preventive measure against consumption. There would seem to be room for question as to the relation of cause and effect. It may either happen that singers are not consumptive because they can use their chest and throat freely, or that consumptive persons are not singers because the weakness which precedes disease incapacitates the chest and throat for exertion. Both of these hypotheses are true up to a certain point, but neither holds good in all cases. A very little observation will suffice to show that a good singing voice may coexist with a weak or diseased chest, whereas the perfectly healthy may be unable to sing.

It was some forty years ago a common practice to give consumptive patients a specially arranged tube to breathe through with the view of exercising the chest. We venture to hope the experiment will not be repeated. Chest development can only be accomplished in a manner consistent with health during the growing stage of childhood, and then the most natural and convenient methods of exercise are the best. Later on in life great mischief may be done by unduly straining the muscles of the thorax and those of the throat, besides the peril of injuring the smaller tubes and air vessels of the lung by violent exertion, for which the organs of respiration and voice are not adapted because they have not been early trained.—*Lancet.*

Counterfeit Eggs.

It is well known that in America everything is counterfeited; the wooden hams and nutmegs sent from the New England States are well remembered. Eggs are now also counterfeited, and this manufactory is carried out on a large scale. On one side of a large room the reporter saw several large copper vessels filled with a thick glutinous yellow mass, which a man was constantly stirring. This was the yellow of the egg—the yolk On the opposite side were similar vessels, in which the white was fabricated. The egg shells were made of a white substance resembling plaster of Paris, by means of a blowpipe, just as soap bubbles are blown. After being dried in an oven, the egg shells were filled: first with artificial albumen, then with some of the artificial yolk, and lastly with a little of the artificial albumen. The small opening at the end of the egg was closed with white cement; and the greatest achievement of modern civilization, the artificial egg, was ready. In appearance it resembled a natural egg; but, whether cooked or raw, it was indigestible and injurious to health.

[The above we find in the *Canada Medical and Surgical Journal*, credited to the *British Medical Journal.* To make his story complete the writer should have added that at this same manufactory he also saw a number of patent incubators employed in hatching out chickens from these artificial eggs, which was causing great excitement among the farmers and poultry raisers.—EDS.]

Leather from Bison Hides.

The *Western Shoe and Leather Review* remarks that leather from bison hides will soon cease to be a factor in the leather market. These hides began to be sent East in considerable quantities about ten years ago, but did not at first find favor with the tanners here. In the latter part of 1873 two or three large tanning firms took hold of them, and by careful attention in saving and properly preparing the hair and glue stock for market, as well as in the proper tanning of the hide to make a serviceable article of cheap sole leather, they made a great hit in this specialty.

It is estimated that for the past five years about 350,000 bison hides have been taken off annually; now, however, the supply is virtually exhausted, and East India and common hides must be depended upon for future supplies of cheap sole leather.

Calico Printing.

[Abstract of a paper recently read before the Roundabout Club, a literary society, of Melrose, Mass., by L. Williams.]

The lecturer remarked, in commencing, that if Cotton is King, Calico must be *Prints*. Like charity it covers a multitude of sins, and many a man has experienced the dangers that lurk in calico, so that only a veteran should approach it No material for garments was ever so universally worn except one, and that years ago, in a far off land, where the whole female population wore fig leaves. Calico is derived from Calicut, a town in India where the cotton cloth was first made, and strictly speaking is plain cotton cloth, after being figured it becomes prints. The most common cloth now used for printing is known as 64 square 7 yards, meaning a square inch of the cloth counts 64 threads each in the warp and filling, and 7 yards weigh a pound. Immense quantities of this cloth are used annually by the calico printers In the city of Fall River alone there are thirty printeries, and their weekly product is 149,000 pieces, and their monthly pay roll amounts to $310,000; and besides these mills there are hundreds of thousands of yards made in Lowell, Manchester, and other large cities. There are cheaper prints, but the demand at present is for higher grades than the average, which shall weigh 6 yards to the pound and count from 72 to 100 square. Printed calico was probably known to the Egyptians several thousand years ago In India, the printing of calico was originally the well known Randanna pattern, and printed on silk as well as cotton. The manner of making the little squares and other figures seen upon these goods was very primitive, and consisted of tying bits of cord around small portions of the cloth before it was put into the dye pot. Then the yellow or red dye would color the cloth except where it was tied by these cords, these latter spaces being left irregular and white. This was followed by a certain paste or wax laid upon the cloth, which would resist the dyestuff, thus saving the spot beneath so that the wax being removed the white figure would remain. The next idea was to prepare plates of lead, through which were cut the required figures. One of these was laid at the bottom of a large number of these layers of dyed calico, and the other on top, the figures being exactly opposite each other. A powerful pressure was then applied, and an acid, strong enough to take out the color without injuring the fabric, was poured in at the top upon these figures, slowly penetrating the mass and being kept in by the pressure, and thus forming the figure. The next advance was to block printing, the pattern being engraved on blocks of wood, smeared with the color, and stamped on the calico. A greater variety of figures and colors were produced by these, but only by using separate blocks for each color, and also one for the ground and another for the dark line always observable between every figure.

By the "Toby Tub," next invented, all the colors were stamped with only one block, and on the edges of these were pins, which pricked the cloth exactly where to place the next block in stamping, which was done by boys seated at long rows of tables, each with block and color. The calico was stretched between the feet of the boy from one end of the room to the other, and as it was pulled slowly along, each boy would stamp his pattern.

The printing of calico was introduced into England in the seventeenth century, but little progress was made until 1764, when Robert Peel, grandfather of the future prime minister, left the plow for the printery. The block he used, however, had a handle on the back, struck by a mallet to produce an impression. A piece of calico of 28 yards required 448 applications of the block. Copper plates, working much like an old-fashioned press, came next, and in 1785 the cylinder press was invented, and one of the old style was shown by the speaker and described, who said the calico printing press of to-day is the same thing, and the 28 yards of cloth can now be printed in two minutes. The expense of engraving the copper rollers of the cylinder was very great, and they soon wore out. About this time Jacob Perkins, of Newburyport, born there 1766, and who also invented *steel* plates for bank notes, brought out a process of transferring the engraving from a small three inch long steel cylinder to the large copper roller, by first cutting on the soft steel, hardening it, and then bringing it out in relief on a second cylinder, from which, after again hardening, it is pressed on the copper roller, which, when worn out, can easily be renewed.

The partograph is another method of engraving, and the operator sits at a table with the print design before her (for a partographist is generally a very skillful young lady), marked out on a zinc plate nine times the size required. Above the table and in front is the copper roll to be engraved, covered with wax. The operator applies the point of the partograph to the zinc, and immediately a set of pointers attached to the one she is using, by machinery, scratches the same figure through the wax on to the copper roller above. This roller is then immersed in a bath of nitric acid, which eats into the copper where the lines are traced, and thus engraved. The design is made nine times its size by being placed in a camera, and afterward rubbed into the zinc, making it more distinct to the designer.

Let us follow a piece of calico from its unbleached state to a finished condition. First, it is bleached to make it white, then it is singed by placing over gas jets or red hot plates to remove the nap or fuzz, and it is then ready for the printing machine, which weighs 10 tons, is 10 feet high, and will print from 1 to 12 colors at once. The figure is engraved on copper rollers, each having a separate roller, which revolves in a trough of coloring matter, covering the roller completely, but a parallel flat rod called the 'doctor," the exact length of the roller, scrapes from it all the color except in the engraved lines, and as the cloth is pressed against the roller, the figure is stamped, each roller imparting one color only, and each exactly fitting the other. Colors and their formation of various chemicals were very fully described by the lecturer, who stated that within eighteen months a great revolution has taken place in the printing of calicoes, and that certain colors, like green, blue, and yellow, once hard to produce, can now be brought out at will, and madder, once so important, is now a thing of the past, and superseded by steam colors and chrome, which last fixes the color. Finishing, folding, labeling, and packing into cases complete the task of printing.

Each case contains 2,000 yards, or enough to clothe 200 women. There are 350 printing machines in the country, with a capacity of printing 1,500 pieces each, or a total of 525,000 per week, each piece containing 40 yards, or 21,000,000 yards, and the United States stands second in the business, the printeries of England placing her number one, one printery alone near Manchester running 52 machines; and in France, also, are many manufactories. Mr. Williams said that twenty years ago not a jobbing house in Boston but had a line of English goods, but to-day, and for some time past, it would be difficult to find any; our best designers, however, are from the mother country, and those printers are most successful which employ best designers and printers.

In the Centennial year numerous curious and patriotic designs were made, and a very rare bed quilt made from these was exhibited, the lecturer declining to mention the number of pieces in it, remembering the old proverb, "As you make your bed quilt so will you *lie*." He first suggested a design for patchwork calico, thus saving the time of old ladies, who formerly spent it in making patchwork quilts; and one of these patchwork designs has been produced more than any other engraved in this country. There was a fierce struggle against the introduction of calico by manufacturers of linens and woolens in England and France, and laws were enacted forbidding its manufacture and also its sale, until Madame Pompadour first procured its use in France for furniture covering. It first made its appearance in America in 1788, in the State of Rhode Island, but strenuous opposition was made by the English to have either machinery or printers brought over the water. The lecture closed with some humorous stories concerning calico, and good advice was given to young men about choosing a wife who always displayed neatness and good taste in her morning calico.

A collection of designs of various styles and of the machinery and apparatus used in producing these prints, was used in connection with the lecture, and aided in making it one of the most interesting and instructive ever given in the town, and one much appreciated by the audience.—*Boston Journal.*

Timbuctoo.

The following information with regard to the little-known city of Timbuctoo was lately obtained by the Geographical Society of Oran, Algeria, from an Israelite Rabbi of Morocco, who was on his way from Timbuctoo to Paris. The Rabbi described Timbuctoo as an Arab town in every sense of the term, built absolutely like all those of the interior. The inhabitants are Foulah negroes, and there are no whites. There are, however, sometimes Jews from North Africa, who come to trade, but they never settle there. The town is at about an hour's distance to the north of the Niger. Its population is about 50,000; it is larger than Oran (about six miles round), but not so large as Marseilles. The town is, in fact, a mass of villages, extending over a very considerable area. The Niger, which passes to the south of the town, flows from the west to the southeast, and is very broad; there is abundance of fish. Navigation is carried on by means of oared barges and rafts, constructed of pieces of wood bound together by cords. The blacks call the Niger the Nile, or "El Bar" (Arab, "the sea"). The river is subject to regular floodings, which fertilize the lands on its banks, the only ones which are cultivable; the inundation reaches the walls of the town. The country is very fertile; the crops are sorgho, millet, rice, tomato, onions, turnips; indigo grows wild. There are also many cocoanut trees, gum trees, and a tree which produces oil which the natives use for lighting. There are also forests of valuable timber trees. The country is governed by a Marabout, who takes the title of Sultan; the present ruler is named Mohamet-el-Bekai. He does not reside at Timbuctoo; his capital is Ahmet-Ellah, a town of more than 100,000 souls, situated about twelve leagues from Timbuctoo. The road connecting the two towns is covered with villages and gardens. The town of Timbuctoo is under the command of a Caid, who has very great authority, and who has under his orders a tax collector, also very powerful. The Sultan has no army, but when fighting is necessary everybody is a soldier They are armed with bows and arrows; only the chiefs have guns, pistols, and sabres. Trade is carried on principally by barter or by means of cowries. Caravans bring cotton or linen goods, glass trinkets, mirrors, arms, swords, guns, pistols (generally of English manufacture), knives, needles, etc. Salt is a valuable import, a slave often being given for a kilogramme or two. The caravans take back loads of the grain of the country—rice, sorgho, millet, ostrich feathers, gum, ivory, gold dust, lead, copper, etc. Trade in slaves is carried on on a very large scale. To the north of Timbuctoo many camels are reared; to the south the people wander about with herds of sheep and cattle.

ENGINEERING INVENTIONS.

An improved engine governor and speed regulator has been patented by Mr. Joseph Reid, of Monroe, La. This invention relates to a governor based upon the principles of gyroscopic action. A reliable automatic stop device is provided, which, being a portion of the governor that is regularly in use, is not liable to become gummed or stopped, but is always in working order.

An improvement in rock boring machines, patented by Mr. William W. Graham, of West Rutland, Vt., relates to adjustable brackets, gauges, and guides for what are known as "diamond rock boring machines," the object being to provide means for boring the alternate holes of a series the proper distance apart, at whatever angle they may enter the rock surface; also to provide means for preventing the boring hub and spindle from running to the right or left of the line, thereby insuring an open communication between the holes bored by the first and second operations.

An improvement in bridges has been patented by Mr. Robert B. Vardell, of Dardanelle, Ark. The object of this invention is to provide a bridge of great strength and durability, that can be thrown across a stream at a single span, and require for its support only an abutment at each end.

Mr. Michael F. Craig, of Nevada City, Cal., has patented a device which consists in the combination, with a locomotive, of apparatus for sprinkling or wetting the rails either in front or behind the driving wheels, as circumstances may require, the apparatus being under control of the driver.

An improved rotary engine has been patented by Mr. George Murray, Jr., of Cambridgeport, Mass. The object of this invention is to provide a novel and simple device that can be used as a steam or hydraulic engine to transmit power, or as a force pump or blower when power is applied to it. It consists, essentially, of a universal joint with solid sections fitted snugly, but so as to revolve within a globular shell.

Mr. John C. Dean, of Indianapolis, Ind., has patented an improvement in valve gears, which consists of an arrangement in the steam chest of a direct-acting steam pump, of an auxiliary piston and valve, that are so operated as to regulate the admission and exhaust of steam to and from the main steam cylinder, and prevent loss of steam when the pump is in operation.

An improvement in spark arresters for locomotives, patented by Mr. David Hawksworth, of Plattsmouth, Neb., consists in a cup-shaped spark arrester that deflects the sparks against the sides of the stack. This is combined with a stack having an annular chamber that receives the sparks, from which chamber they are drawn by suction obtained by the use of an interior conical pipe or nozzle, the sparks and cinders being thus circulated and broken up until they pass off in dust.

Mr. Charles Bried, of Newark, N. J., has invented a boiler shell constructed of convexo-concave plates, united together with their convex surfaces inward to form a fluted cylinder, and with their joints stayed against springing by braces applied at the outside of the boiler, whereby the shell is rendered capable of sustaining high pressure at the inner side without spreading or rupturing.

Gloomy Thoughts and Gloomy Weather.

Dull, depressing, dingy days produce dispiriting reflections and gloomy thoughts, and small wonder when we remember that the mind is not only a motive, but a receptive organ, and that all the impressions it receives from without reach it through the media of senses which are directly dependent on the conditions of light and atmosphere for their action, and therefore immediately influenced by the surrounding conditions. It is a common-sense inference that if the impressions from without reach the mind through imperfectly-acting organs of sense, and those impressions are in themselves set in a minor æsthetic key of color, sound, and general qualities, the mind must be what is called "moody." It is not the habit of even sensible people to make sufficient allowance for this *rationale* of dullness and subjective weakness. Some persons are more dependent on external circumstances and conditions for their energy—or the stimulus that converts potential kinetic force—than others; but all feel the influence of the world without, and to this influence the sick and the weak are especially responsive. Hence the varying temperaments of minds changing with the weather, the outlook, and the wind.—*Lancet.*

The Scientific American in Turkey.

The United States Consul General at Constantinople writes to this office, under date of October 31, that he had sent a copy of the SCIENTIFIC AMERICAN to the Palace, and it is, adds the writer, a gratifying evidence of the interest it creates, that the Sultan has ordered portions of it to be translated into Turkish for his reading.

MEN of science, students, inventors, and every other class of persons desirous of keeping up with the times should become regular subscribers to this paper. They will find it a paying investment, for the SCIENTIFIC AMERICAN not only contains a record of all the important discoveries and inventions of this country, Great Britain, and other English speaking countries, but translations from the French, German, and other foreign scientific and industrial publications.

The Origin of Coal.

Various theories have been propounded to account for the origin of the different kinds of mineral fuel which form the basis of modern industry. The most eminent geologists have hitherto ascribed the formation of coal to large quantities of driftwood accumulating in estuaries, where they were subsequently covered by sedimentary deposits, the ligneous structure becoming modified in the course of ages. Mons. E. Frémy has recently published some valuable researches on the origin of coal, in the course of which he arrived at results differing considerably from those obtained by other observers. In examining the various substances which might be supposed to give rise to beds of coal, some interesting observations were made. It was found, for instance, that all wood contains a substance which has been called vasculose, and to which its physical properties are chiefly due. It is present in oakwood to the extent of 30 per cent. In searching for a method to distinguish lignites from genuine coal or anthracite, it was found that the former are completely decomposed by nitric acid, which is not the case with the latter. In the first series of experiments, vegetable tissues, or the skeletons of plants, were heated in closed iron tubes for many hours, at a temperature of from 200° to 300° Centigrade. Steam, acids, gas, and tar were given off, while the vegetable substances, although becoming black and brittle, retained their original shape, and offered no resemblance to coal.

Other substances produced by the vegetable world were then treated under similar conditions. Among those bodies experimented upon were sugar, starch, gums, chlorophyl, and resinous and fatty substances of vegetable origin. By prolonged heat combined with pressure these bodies were converted into substances offering a certain resemblance to coal. They were of a brilliant black, frequently fused, in soluble in neutral acid or alkaline solvents, and, when exposed to a red heat, gave off water, gas, and tar, leaving as residuum a hard and brilliant coke. The chemical analysis f these substances confirmed their resemblance to coal, as may be seen from the following examples:

	Carbon.	Hydrogen.	Oxygen.	Ash.
Coal made from sugar	66·84	4·78	28·48	—
Coal made from starch	68·48	4·68	26·84	—
Coal made from gum arabic	78·78	5·00	16·22	—
Pit coal from Blanzy	76·48	5·23	16·01	2·28

These three substances were chosen for experiment because, being most abundant in the vegetable kingdom, they probably played an important part in the formation of coal. But, although these bodies were so easily converted into coal, it remained to be explained how the tissues of plants could be changed into the same substance. A clew was given by the analysis of pieces of fossil wood, which were found to contain considerable quantities of ulmic acid. This acid exists also in peat, and may be produced from the vasculose contained in wood. In order to ascertain the influence of ulmic acid on the formation of coal, it was exposed to a high temperature in closed vessels. The following analyses show that the percentage of carbon increased with the duration of the experiment:

	Carbon.	Hydrogen.	Oxygen.
Coal made from ulmic acid heated for 24 hours	67·48	5·84	26·68
Coal made from ulmic acid heated for 72 hours	71·72	5·03	23·25
Coal made from ulmic acid heated for 120 hours	76·06	4·99	18·95

Like natural coal, the substance produced was insoluble.

Ulmic acid produced from vasculose was remarkable for its fusibility; this may account for the similar property of bituminous caking coals. On treating leaves with alcohol, various substances, such as chlorophyl, fatty bodies, and resins are extracted. When these were heated together for 150 nours a mass was obtained closely resembling natural bitumen.

The above experiments render it highly probable that the plants which gave rise to coal first underwent a species of peaty fermentation, during which they lost their organic structure. The peat thus formed became gradually converted into coal by the combined action of heat and pressure.

Tobacco, Cotton, Corn, and Wheat.

The estimate of the tobacco and cotton crops of this year, printed in this paper some weeks ago, proves to have been over-hopeful. Instead of exceeding last year's yield they will both probably be short. The report of the Department of Agriculture, issued November 15, gives the following estimates:

Tobacco.—The indicated produce for the entire country is 98 per cent of that of 1878. The gain has been greatest in Tennessee, Connecticut, and New York; the loss greatest in Ohio, Missouri, and West Virginia, with a material decrease, also, in Maryland, Illinois, and Indiana. In general, the quality is better than that of the previous crop, though damage to some extent from "house-burn" is reported from Kentucky and Virginia, and from frost in Ohio.

Cotton.—The returns indicate a yield per acre of 176 pounds lint, against 191 last year. This yield, estimating the area planted at 2 per cent more than last year, would make a deficit in this year's crop of 290,000 bales of 450 pounds each. All the South Atlantic States show some decline. Texas falls off 35 per cent. All the States bordering on the Mississippi River show decided gains.

On the other hand corn and wheat show gains, as follows:

Corn.—According to the returns of November 1 the corn crop promises an increase of 200,000,000 bushels, or nearly 15 per cent over last year. The Atlantic and Gulf coast States note some decrease, but the other portions of the Union have greatly increased their yields. The Southern inland States increased nearly 30 per cent, and the other parts of the Mississippi valley nearly 20. The Pacific States report about the same yield as last year.

Wheat.—The returns of November 1 show an increase in this wheat crop of 26,000,000 bushels over that of last year. This great increase is the result of the very large yield in all the States bordering on the Ohio River and Missouri. The Northwestern States show little variation from last year. Kansas and California both decline in yield. Texas, of all the Southern States, is the only one that falls off in yield this year.

How Wheat is Raised in Dakota.

Recent investigations as to the methods of cultivating wheat in the northwest, the cost of the crop, and so on, have been made by a special commission appointed by the British Government. In the course of their observations and inquiries the following information was obtained at the Dalrymple farm:

So soon as the frost has left the first six inches of soil, which is generally by April 1, the seeding of the wheat commences. Scotch Fife, a good, hard, thin skinned red variety, is used. The seed is selected for the newly broken up land. If any cockle or other weeds are observable, they are carefully winnowed out. No dressing or pickling is adopted. During autumn or winter, in 1 5 8 bushel lots, the seed for each acre is bagged up. Whenever the weather permits seeding commences. The seed is distributed by broadcast machines, one hundred being at work daily for three weeks. Two hundred sets of harrows complete the operation, two or three turns being required, and Mr. Dalrymple jocosely states that he orders it "to be well done, and then give one turn more." Four harrows, united by chains, work in a set, cover twenty feet, and are drawn by four mules. In each harrow are seventy-two round teeth. The set costs $14 to $15. Immediately after the wheat seeding, the oats and barley grown for horse provender are put in.

No horse or hand hoeing, no weeding, or any further expenses are incurred until harvest, which begins early in August. About 300 extra men are engaged. One hundred and fifteen automatic self-binding harvesters are busily at work; 100 of these are Walter Woods', the remainder McCormick's. Both are reported to do their work admirably; no objection is found to the wire binding. The grain is shocked, and cutting is overtaken in twelve days. No time or outlay is expended in stacking. The twenty-one steam thrashing machines, made the Buffalo Company, and costing $600, with thrasher, winnower, and straw elevator in one, are placed at convenient points throughout the fields. Ten wagons, each with a pair of horses or mules, bring up the shocks and carry off the thrashed corn in three bushel bags an average distance of two miles to the railway cars. A gang of twenty-five men keep wagons and thrashing machines steadily going, and deliver at the station 1,000 bushels of wheat daily. Each day the thrasher and engine, which is partially self-propelling and costs $800, is moved so as to shorten haulage of sheaves. Every busy day, fifty railway cars, each containing 400 bushels, are loaded, and stand ready for dispatch, usually to Duluth, 254 miles distant, on the western corner of Lake Superior.

The crop of the present year Mr. Dalrymple states to be much the same as that of former seasons. It averages 20 bushels an acre of 60 lb. to the bushel. The natural weight is 59 lb. to the bushel. As usual the produce of the newly broken-up land is best. The quality is fully as good as that of 1878. When run once through the winnower at Duluth, it will be graded No. 1 hard. Mr. Dalrymple usually sells as fast as he can deliver, but this year, holding for the rise, he has still the chief portion of his crop warehoused at Duluth. The oats are reported to yield 50 bushels to the acre, and 38 lb. to the bushel; last year 60 bushels were produced. The barley has not done particularly well this year, but generally runs 40 bushels. On each farm a few potatoes, cabbages, swedes, and other vegetables are grown for home use and for the cows which are kept to supply dairy produce; but wheat growing is the great business of this great farm.

Now comes the important question of the cost of production. Mr. Dalrymple furnishes the following figures: Land valued at $12 per acre, interest thereupon at 6 per cent, 72 cents; taxes and rates, 10 cents; buildings, machinery, and teams valued at $10, interest at 10 per cent, 10 cents; plowing $3; seed, $1.50; harvesting and thrashing, $3, total, $8.42.

Mr. Dalrymple thus produces an acre of wheat for less than $8.50 (34s.) per acre; indeed he asserts that hitherto the actual cost has not reached $8, excepting in the case of the first year's crop, which the extra expense of breaking up and two plowings advanced to $11. For four years his acreable yield has averaged 20 bushels, each of which, on the basis of the above calculation, would cost 42 cents, or 1s. 9d. On his own and other suitable wheat-growing farms, in favorable seasons, Mr. Dalrymple declares that the crop does not cost more than 35 cents per bushel. Sold, as it readily can be at the railway station at Casselton, at 75 cents to 80 cents, a very handsome profit is obtainable.

M. L. COLLOT has discovered the true *Phylloxera vastatrix* upon *Vitis caribbæa*, a wild species of vine found in the forests of Panama, far removed from any vineyards or localities where the true vine (*V. vinifera*) is cultivated. This strongly confirms the opinion that the *phylloxera* is indigenous in America.

The Indians as Farmers.

In his annual report to the Secretary of the Interior, Commissioner Hoyt states that during the past year there has been among many tribes a marked advance toward civilization. The substantial results of Indian farm labor during the year 1879 are given as follows:

By Indians, exclusive of the five civilized tribes of the Indian Territory:

Number acres broken	27,131
Number acres cultivated	157,056
Number bushels wheat raised	328,637
Number bushels corn raised	643,286
Number bushels oats and barley raised	189,054
Number bushels vegetables raised	390,698
Tons hay cut	48,333

By the five civilized tribes:

Number acres cultivated	273,000
Bushels wheat raised	565,400
Bushels corn raised	2,015,000
Bushels oats and barley raised	200,000
Bushels vegetables raised	336,700
Tons hay cut	176,500

The Commissioner says that the only sure way to make Indians advance in civilization, under the best conditions to promote their welfare, is to give each head of a family 160 acres of land, and to each unmarried adult 80 acres, and to issue patents for the same, making the allotments inalienable and free from taxation for twenty-five years; also that from all except the five civilized tribes there has been a call for such allotment of land, and a largely increased desire for houses, agricultural implements, wagons, civilized dress, etc., etc.

The End of a Famous Mill.

English papers announce the total destruction by fire of the famous Heathcoat Mill at Loughborough. The founder, Mr. Heathcoat, in 1809 invented an improved twist lace machine that virtually revolutionized the industry. The introduction of these labor-saving machines led to the Luddite outrages, and in 1816 a gang from Nottingham, armed with pistols, hatchets, and axes, attacked Heathcoat's mill, overpowered the armed watchmen, shot and injured one of them named Asher, destroyed fifty-five costly frames, cut and burnt the lace, and did damage to the amount of more than £10,000. Some accomplices in the outrage gave evidence against their companions, and at Leicester Assizes six men were sentenced to death on a charge of shooting with intent to murder. They were executed at the New Bridewell in Leicester, and it is a noteworthy fact that at those Assizes twenty-three men were condemned to the punishment of death. The six Luddites were hung up with a man whose crime was that of setting fire to a stack of oats. The action of the Luddites drove the manufacture from Loughborough to Tiverton, where Mr. Heathcoat amassed a princely fortune.

The Revival of Trade.

Speaking of the more hopeful condition of British trade the London *Times* traces the improvements to "a genuine growth of the industrial organism of the United States." "The revival of our trade, so far as it is healthy and has promise of permanence, has been due to the recovery of industry in the United States. The self-love of some appears to be wounded by this admission. It makes our economic condition appear to be more dependent on the economic condition of other countries than they like. They may be consoled by the reflection that the interdependence thus revealed is mutual. If the recovery of the United States helps to give life to some of our industries, we by those same industries sustain the recovery in the United States."

Good Tunneling.

The new Almaden quicksilver mines, in Santa Clara County, California, are said to have over 35 miles of workings underground, it being a two days' journey to make a circuit of all the shafts, tunnels, drifts, etc. In the Santa Isabel shaft, after descending 1,700 feet, ventilation became so bad that the work had to be stopped, although the vein at that point was very rich. Another shaft was sunk over a quarter of a mile from the first, but when the same depth was reached, the atmosphere again became insupportable. To meet the difficulty, the engineer, Hennen Jennings, commenced the construction of a drift, to connect the two shafts on the 1,700-foot level, and thus secure ventilation. The excavation was begun simultaneously from each shaft, and the error at the point of connection was, it is said, only 25 thousandths of a foot, while the walls of the drift came together so closely that the point of intersection could not be detected without the use of a transit. When the tunnel was complete, a draught of air rushed through, putting out the lights of the miners, and reducing the temperature to an agreeable coolness. It is doubtful whether closer surveying under equally difficult circumstances has ever been performed.

The Assay of Silks.

The recent spontaneous combustion of grossly adulterated silk brought somewhat prominently into notice the extent to which such adulteration prevails in Europe. The weighting of silks has awakened complaint in another direction, namely, from the silk-growing departments of France, whose industry is ruined by it. Cheap foreign silks serve equally well for loaded tissues, and the market is spoiled for the high class products of France. Accordingly it is proposed to establish at Lyons a central office for the cheap and rapid assay of silks, so that in all sales of silks the value of the goods may be rated by the proportion of silk which they contain.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion - about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

Oval Turning Lathes. P. Pryibil, 467 W. 40th St., N.Y.

Steam Launches. R. A. Morgan, Builder, Noank, Ct.

Steel Castings; quality superior to any heretofore made in America; sound, solid, weldable; work same as bar steel high or low in carbon enormous tensile strength our specialty is plowshares, also make full line of wrought agricultural steels. Correspondence with plow makers desired. Read, McKee & Co., limited. Pittsburg Pa

Oak Tanned Leather Belting, Rubber Belting, Cotton Belting, Polishing Belts. Greene, Tweed & Co., N.York.

Buzz Planers. P. Pryibil, 467 W. 40th St., N. Y.

Wanted—Small Article or Piece of Machinery to Manufacture. H. Hubbell, Jr., 319 E. 14 St., New York.

Walrus Leather, Solid Walrus Wheels; Wood Wheels covered with walrus leather for polishing Greene Tweed & Co. N. Y.

A Foreman to take charge of an Architectural Iron Works must be a thorough practical mechanic, understand plans and drawings, and have had experience in the management of men. Address M. Clements, Architectural Iron and Jail Works, Cincinnati, O.

Moulding Machine Wanted.—Manufacturers send full description with price, to T. Reid, Brush Handle Manufacturer, W. Arlington, Vt.

Electric Engine and Battery, complete for $2. Crook, Herring & Co., cor. Center and White Sts., N. Y.

For best Horse Detacher, see illustration in the SCIENTIFIC AMERICAN of Dec 13th. Address the inventor, W. R. Kitchen, Willard, Ky.

Read the "Ohio Idea" adv. and make money.

To Sewing Machine Inventors.—Any party having invented a sewing machine containing new mechanical principles, or improvements upon existing machines, attachments, or shuttles, and wishing to dispose of the invention, will find it advantageous to address Manufacturer, room 97 Boreel Building, New York City.

Forges, for Hand or Power, for all kinds of work. Address Keystone Portable Forge Co., Phila., Pa.

For Machine Knives and Parallel Vises, see advertisement, p. 349. Taylor, Stiles & Co., Riegelsville, N. J.

Wanted—No. 1 Cupola 2d hand. Stiles & Parker Press Company, Middletown, Conn.

Blake Crushers, all sizes, with all the best improvements, at less than half former prices. E. S. Blake & Co., Pittsburg, Pa.

The Friction Clutch Captain will start calender rolls for rubber brass, or paper without shock; stop quick, and will save machinery from breaking. D. Frisbie & Co., New Haven, Conn.

You can get your engravings made by the Photo-Engraving Co. (Moss' process), 67 Park Place, N. Y., for about one-half the price charged for wood cuts. Send stamp for illustrated circular.

Presses, and Dies that cut 500,000 fruit can tops without sharpening. Ayar Machine Works, Salem, N. J.

For Sale.—One Horizontal Steam Engine, 20" x 48"; one 18" x 42"; one 16" x 36". Atlantic Steam Engine Works, Brooklyn, N. Y.

Empire Gum Core Packing is reliable; beware of imitations called Phœnix. Greene, Tweed & Co., 18 Park Place, N. Y.

See Staples & Co.'s advertisement of Non-Congealable Lubricating Oils on inside page.

The Baker Blower ventilates silver mines 2,000 feet deep. Wilbraham Bros., 2318 Frankford Ave., Phila., Pa.

Park Benjamin's Expert Office, Box 1009, N. Y. Recipes and information on all industrial processes.

To stop leaks in boiler tubes, use Quinn's Patent Ferrules. Address S. M. Co., So. Newmarket, N. H.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts. Importers Vienna lime, crocus, etc. Condit. Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

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

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Steam Excavators. J. Souther & Co., 12 P.O. Sq. Boston.

Bradley's cushioned helve hammers. See illus. ad. p. 373.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Noise-Quieting Nozzles for Locomotives and Steam boats. 50 different varieties, adapted to every class of engine. T. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 349.

Sheet Metal Presses. Ferracute Co., Bridgeton, N. J.

Solid Emery Vulcanite Wheels—The Solid Original 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, N. Y.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery. Send for catalogue to Rowley & Hermance, Williamsport, Pa.

Latest improved methods for working hard or soft metals, grinding long knives, tools, etc. Portable Chuck Jaws and Diamond Tools. Address American Twist Drill Co., Woonsocket, R. I.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Company, Buffalo N. Y.

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

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Sawyer's Own Book, Illustrated. Over 100 pages of valuable information. How to straighten saws, etc. Sent free by mail to any part of the world. Send your full address to Emerson, Smith & Co., Beaver Falls, Pa.

Eclipse Portable Engine. See illustrated adv., p. 318.

Eagle Anvils, 9 cents per pound. Fully warranted. For Pulley Blocks, write Block Works, Lockport, N. Y.

Cylinders, all sizes, bored out in present positions. L. B. Flanders Machine Works, Philadelphia, Pa.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus'd adv. p. 30.

Elevators, Freight and Passenger, Shafting, Pulleys, and Hangers. L. S. Graves & Son, Rochester, N. Y.

The Horton Lathe Chucks; prices reduced 30 per cent. Address The E. Horton & Son Co., Windsor Locks, Conn.

$275 Horizontal Engine, 20 H. P. See page 390.

Emery Wheels for various purposes, and Machines at reduced prices. Lehigh Valley Emery Wheel Company, Weissport, Pa.

Magic Lanterns and Stereopticons of all prices. Views illustrating every subject for public exhibitions. Profitable business for a man with small capital. Send stamp for 80 page illustrated catalogue. McAllister, Manufacturing Optician, 49 Nassau St., New York.

Pat. Steam Hoisting Mach'y. See illus. adv., p. 318.

National Steam Pump. Simple, reliable, durable. Send for catalogue. W. E. Kelly, New Brunswick, N. J.

Wheels and Pinions, heavy and light, remarkably strong and durable. Especially suited for sugar mills and similar work. Circulars on application. Pittsburg Steel Casting Company, Pittsburg, Pa.

Rue's New "Little Giant" Injector is much praised for its capacity, reliability, and long use without repairs. Rue Manufacturing Co., Philadelphia, Pa.

Steam Engines, Automatic and Slide Valve; also Boilers. Woodbury, Booth & Pryor, Rochester, N. Y. See illustrated advertisement, page 285.

Drop Hammers, Die Sinking Machines, Punching and Shearing Presses. Pratt & Whitney Co., Hartford, Ct.

Hoisting Machinery of all kinds a specialty.

Light and Fine Machinery contracted for. Foot Lathe Catalogue for stamp. Chase & Woodman, Newark, N. J.

Drawing Instruments, Woolman, 116 Fulton St., N. Y.

NEW BOOKS AND PUBLICATIONS.

RIVER SURFACES. By Henry F. Knapp.

A lecture delivered last April before the polytechnic branch of the American Institute, in opposition to the employment of jetties for the improvement of river mouths, as at the passes of the Mississippi. Mr. Knapp believes that the work done by Captain Eads will be overwhelmingly and permanently disastrous, and asserts that all similar works in Europe have not only been great engineering failures, but terribly injurious in their effects. The pamphlet does not say by whom or where it is published nor where it can be purchased.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) J. S. M. writes: I have a six inch (21 inch swing) lathe, foot power 3 speeds, 1 inch belt. 1. What size and weight balance wheel do I require? A. From twenty four to twenty-seven inches diameter and eighty to one hundred lb. weight. 2. Which bearings are preferable, friction wheel or wheels, boxes, or points? A. Either good journal boxes or roller bearings will do. 3. What advantages do swivel bearings possess? A. They admit of springing the lathe frame without binding the journals. 4. What is the proper speed for a 1⅛ inch circular cutter (1-16 inch thick) for metal? A. It depends on the material being cut. For steel and wrought iron, about two hundred turns per minute; for brass, from four hundred to five hundred turns per minute.

(2) A. W. C. asks for a preparation for coating paper to make it resist the action of acids, alkalies, and water. A. Dissolve caoutchouc cut into small shreds, in a mixture of bisulphide of carbon with six per cent of absolute alcohol. The solution may be diluted as desired with the mixed solvents.

(3) D. E. writes: I have some silicate of soda that has got so thick that I can hardly get it out of the bottle that it is in. Will you tell me how to soften it, or what solvent to add to it in order to make it thinner? A. Use boiling water.

(4) H. C. T. asks whether there is any difference by using solid piece of charcoal iron well annealed, or is it best to use several wires bunched, for a core of a medical battery in the coil. A. The core formed of a number of wires is best, as it is more readily magnetized and demagnetized.

(5) J. A. H. asks. Does the combination of all colors produce black or white? A. White light is union of all the colors of the spectrum. Black is the absence of color.

(6) W. E. J. writes: My store front contains two plate glasses, measuring five feet by ten feet each, and during cold weather are heavily coated with frost in such quantity that it is impossible to get a view of contents in window. What shall I do to prevent it? A. Some of the storekeepers in this city place a gas pipe provided with a number of burners along the bottom of the window near the glass; a small flame burns from each burner, the heat thus generated prevents the moisture from condensing on the glass.

(7) J. L. asks (1) how to make toy rubber elastic faces, such as are shown by street men, by pressing into all manner of expressions with the finger and thumb. I think gelatine and sugar are used. A. The composition consists of glue, 5 parts; glycerine, 5 parts; zinc white, 2 parts; oxide of iron—rouge—q. s. Soften the glue in cold water, dissolve it in the hot glycerine, and continue the heating over the water bath for several hours, to expel as much of the water as possible; then add the coloring matters reduced to impalpable powders, and cast in warm oiled moulds. 2. We find 1 part of white glue and 4 parts of glycerine make too soft a copying pad. How shall we remedy? A. Heat over a water bath to expel excess of water. See notes on this subject, p. 325, current volume. 3. Your advice to use tungstate of soda in which to dip lamp wick to make it non-combustible does not work. Would silicate of soda answer, or would a mixture of glue and asbestos powder answer? A. If tungstate of soda is properly used, it will answer admirably, silicate of soda will also answer, but not so well. The mixture you suggest would be of little use.

(8) G. A. H. writes: I have been constructing an annular hydro-oxygen blow pipe, and find the effect better when I let the hydrogen come from the inner jet, and the oxygen from the outer one. A. If your blow pipe is properly proportioned you should get the best effect by allowing the hydrogen to escape through the outer orifice, and the oxygen through the central one.

(9) E. S. M. writes: I have been experimenting on lens grinding and polishing, with a convex and concave tool, using the one to keep the figure of the other perfect. After grinding I coat one of the tools with pitch, and shape it by pressing the other on it while still warm, with a piece of paper between them, according to Dick's practical astronomer. I have made my tools ⅛ of the diameter of the lens larger. Now, the center of the lens polishes nicely, gradually growing more dim toward the edge. What is the cause? A. Your difficulty probably arises from your method of grinding and polishing. When the tool in grinding seems to bear hardest and cut most near the edges of the lens, it is necessary to take long, bold circular strokes, with the pressure principally sideways.

(10) W. H. S. asks (1) how to make a good rheostat. I am using a Wallace electric machine, and wish to use nearly all the current at one bath and only a small part at two others. A. A good rheostat for your purpose can be made by winding copper wire in open coils on wooden reels. This arrangement allows the heat to escape readily from the wire. 2. Also how to bronze iron door hatch catches and hinges, by dipping or brushing—something quick and cheap—a brown color that we see on cheap hardware? A. The finish you mention is obtained by dipping the articles in linseed oil and baking them until the required color appears. We do not know of a quicker or cheaper way of doing it.

(11) P. J. H. writes: I have a Bunsen cell with a six quart jar: can I arrange it to give shocks? A. You can give shocks by connecting with your battery an induction coil like that described on page 203, Vol. 39, of SCIENTIFIC AMERICAN.

(12) R. H. B. writes: A dispute arose among certain parties in this city which it was agreed to leave to your paper (SCIENTIFIC AMERICAN) to decide. A argues that on January 1, 1879, the Christian world was eighteen hundred and seventy-nine years old. B that it was only eighteen hundred and seventy-eight. A. Both wrong. The custom of dating from the birth of Christ was introduced about the middle of the 6th century by a Roman abbot named Dionysius Exiguus, who placed the event some four years too late. That would make the "Christian world" actually about eighteen hundred and eighty-two years old at the close of 1878, assuming, of course, that the second year of the "Christian world" began at the close of the first twelve months after the birth of Christ. With the 31st of December, 1878, the 1878th year of the Christian era was completed. The next day and date marked the beginning of 1879.

(13) W. G. H. asks: 1. How many telegraph cables between America and Europe are there at the present time, and what are the termini on this side? A. Anglo-American has two cables in operation from St. Pierre, and one from Heart's Content. The Direct U. S. Cable Company has one cable in operation; lands at Torbay, U. S., and connects by short cable to Rye Beach, N. H. The French cable, which is one of the two landing at St. Pierre, is connected by short cable to Duxbury, Mass. 2. Is there any truth in the statement sometimes made that the rotation of the earth on its axis from west to east, tends to wear the eastern rails of railroads running north and south more than the opposite side? Is such difference in the wear capable of any actual proof by experience of railroad managers? A. It has been asserted by some railroad men that this is the case; we know of no direct experiment or observations to determine the question, nor have we heard any good reason assigned why it should be true.

(14) J. W. S. asks: 1. Could an astronomical eye piece be made of two plano-convex lenses to give a power of 100 times on a telescope having an object glass 3 inches in diameter and a focal length of 48 inches? A. Yes, the magnifying power of the instrument is represented by the ratio of the focal length of the object glass to that of the eye piece; therefore in order to get a power of 100 times with an objective having a focal length of 48 inches, the eye piece should have a focal length of 0·48 inch. 2. If so, of what size and focal lengths should they be? A. The eye lens should be about ⅝ inch in diameter and ⅛ inch focus, the field lens ¼ inch in diameter and 1⅛ in focus. 3. How far apart should they be placed? A. 1 inch—one half the sum of their focal lengths.

(15) E. G. M. writes: I am about to build a road machine on a large scale; it is to be like a three wheel velocipede. The front wheels to be 12 feet in diameter, the rear 4 feet. What kind of motor is light and strong? How would two springs do, each one to work separately while one is running down, the other to be wound up, and so on? A. Springs might probably do, but manual effort is the real power after all, and might be much better applied direct to the work.

(16) W. C. M. writes: 1. Will the induction coil described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 160, be too strong to use for giving shocks with small battery power? A. Yes. 2. How many small bichromate battery cells will be necessary with the induction coil to give a 1½ inch spark? A. 6 or 8. 3. Could the coil be fixed in any way so as to be used with an electric pen? A. Yes; see experiments with induction coil in SUPPLEMENT 166.

(17) G. G. P. asks: Is there a vacuum in a siphon pipe when the siphon is in operation? A. There is a vacuum more or less perfect produced when the siphon is first started in the usual way, but if as it continues to operate it remains full, there can be no vacuum, as the whole pipe is filled with liquid.

(18) R. C. asks: 1. Why are inches on American carpenters' rulers and yard measures numbered from left to right, while the English are from right to left? A. We do not know that this is the universal practice. 2. Why are the closing exercises of American colleges and academies always called "commencements?" A. Because it is the time when students commence bachelors.

(19) N. P. S. writes: 1. I notice in a late number of the SCIENTIFIC AMERICAN an excellent article on "brass finishing." Now will you please give some instruction how to finish small iron castings, japanning and bronzing, or coppering? A. A good black japan varnish is made by melting together 50 lb. of pure asphaltum, 8 lb. dark gum anime, and 12 gallons of linseed oil. Boil for 2 hours. Melt 10 lb. dark gum amber, boil it with 2 gallons of linseed oil. Add this to the other with a quantity of drier, and boil for two hours longer, or until a little of the mass when cooled may be rolled into pills; then withdraw the heat and thin down with 30 gallons of turpentine. Apply with a brush, and bake the japanned articles in a hot oven. For process of coppering castings, see p. 219, Vol. [illegible], SCIENTIFIC AMERICAN. 2. In performing the well known experiment of producing a musical note on a glass tumbler, I am unable to understand why in filling the same with water the pitch of the note changes from a high to a low, as the quantity of water increases. A. The water retards the vibration of the walls of the tumbler, and consequently lowers the tone.

(20) S. S. W. asks for a good recipe for polishing wood, such as walnut, cherry, and maple. A. Mix three parts of rather thick alcoholic shellac varnish with one part of boiled linseed oil. Shake well and rub briskly on the wood with a cloth rubber.

(21) J. McG. writes: I have made a copying pad according to the directions given in your last issue, and have been quite successful apparently, as it seems just as good in every respect as those which are being sold in this city at ten dollars. I have, however, not succeeded so well with the ink, for although I have followed your directions, I cannot get more than ten copies with it, and each copy is fainter than the preceding one. The ink seems quite thick, but does not assume that green color which you speak of. Can you give me any further particulars as to making the ink? A. You have probably not selected the proper dye. Use 3 B aniline violet, and do not add an excess of glycerine. From ink prepared according to the formula referred to 170 clear copies have been taken.

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

J. F. McC.—No. 1 contains a small quantity of gold associated with copper pyrites. No. 2. It is a cephalopod (*Orthoceratite multicamerata*) replaced by iron pyrites. The *orthoceratite* had a long straight shell divided into sometimes as many as 70 chambers, formed to accommodate the periodic growth of the animal, which, as it increased in size, moved forward into larger quarters and built a new apartment with wall behind it. Thus, in time, a long series of chambers were made, each larger than its predecessor but all connected by a membranous tube ("siphuncle"). The animal had many muscular arms, with which it seized and entangled its prey. Some of these shells have attained a length of 30 feet and a foot thick. They inhabited the Lower Silurian ocean. No. 3. Portions of a crinoidal column or "stone lily," an order of radiates, of the animal, not vegetable, kingdom. No. 4. It is a magnesium limestone (dolomite), not a very good building stone. No. 5. They have practically the same composition, namely, sulphate of lime, but are known by different names; the transparent crystal is selenite associated with satin spar; the reddish amorphous piece is common gypsum (from which plaster of Paris is made) and the other sample is alabaster.—H. P. K.—The crystals in the sandstone are quartz.

COMMUNICATIONS RECEIVED.

On Rats. By W. M. P.
On Telephone. By G. H. S.
On Ice Yachts. By E. P. M.
Sailing Faster than the Wind Blows. By L. M.
On the Value of ₰.—1. By I. B. N.
On a New Musical Instrument. By J. M. B.
On Employment of Farmers in Winter. By S. B.
On Ice Boat Propulsion. By J. I. V.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

November 18, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, or any patent issued since 1867, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Air compressor, W. Gardner 221,802
Air injecting nozzle, D. C. Green 221,726
Alumina, making sulphate of, A. A. Croll 221,797
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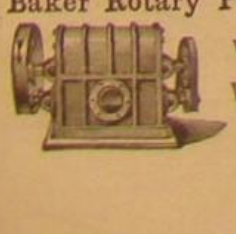

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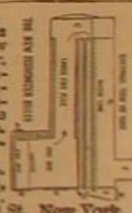

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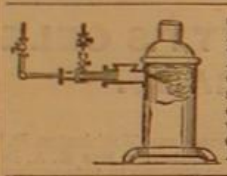

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VIII. HORTICULTURE.—Curl in the Peach.—Late Peaches.—Early Freestone Peach.—Good Culture of an Orchard.

A YEAR'S PROGRESS.

During the twelve months now drawing to a close there have quietly happened not a few events which in times of slower progress, when great projects and great achievements were less a matter of daily occurrence, could scarcely have failed to make a grand stir in the world. There can be indeed no stronger proof of the exceptional character of the present time than our proneness to accept such things as matters of course. It is only when era-making events become common that they cease to be remarkable.

The regular readers of the SCIENTIFIC AMERICAN do not need to be told at this late day what important, if not memorable, occurrences in the world of progress—commercial, industrial, and scientific—have characterized the past year. Having followed from week to week this record of the world's most effective thought and action, they are already possessed of the grand results of the year's activities. It may not be unprofitable, however, before closing the history of the year, to recall to mind some of the more significant of its events, some of the more notable movements of progress it has developed.

It is safe to assume that the progress which has added most to our individual enjoyment, as well as to our national well-being, has been connected with the wonderful improvement in industrial and commercial affairs which the year has shown. The country was never more generally and earnestly at work than to-day, and was never working to better advantage. And, although in certain quarters an over-eager speculative spirit forbodes disaster to many, there is every reason to hope that the solid industries of the land will not be seriously infected, or seriously injured by the natural and inevitable consequences of speculative "booms."

Of purely scientific events it is hard to say which of the many important ones stand out most prominently; and the work of discriminating is made all the harder by the circumstance that the achievements first made known this year have largely been, as usual, the final outcomes of long series of patient labors; while the larger part of the year's work of our scientific men, in the field and in the laboratory, remains unreported.

Three or four new metals have been discovered; but that sort of thing has ceased to excite general interest. While one class of chemists has been thus adding to the list of elements, another class has been working with no slight promise of success to show that several if not all of the elements are but variant forms of one matter stuff. Meantime Mr. Crookes has been carrying forward his researches in connection with the ultra-gaseous state of matter, though apparently without making any discoveries of a radical character. Mr. Edison has made some valuable observations with regard to the behavior of highly heated metals in vacuo, and has materially improved the means of converting power into electricity. His electro-chemical telephone has been rapidly developed and practically applied; the sonometer has grown out of his induction balance, and the micro-telephone has been the basis of not a few more or less useful instruments of physical or physiological investigation. Mr. Edison's call for platinum for his long promised electric lamp has resulted in the discovery of many deposits of the metal in the West and elsewhere. A late dispatch from Colorado reports the discovery of the rare metal uranium in the Sacramento mining district. The ore is said to run 60 per cent; but the probable quantity of ore in the deposit is not mentioned. The development of the mines of gold and silver in the West during the year has been very rapid; and close at home we have the discovery in Westchester county, New York, of what promises to be of greater utility than any mine of gold or silver, namely, vast deposits of excellent emery. Another matter of local interest has been the addition made by the State surveyors to the accurate knowledge of the geography and topography of the central parts of New York. The work of geological and geographical exploration in the West has been pushed forward not a little during the past season; and the Canadian geological survey has done much good work. Further north the expedition in search of the remains of Sir John Franklin have made valuable corrections in the map of the region north of Hudson's Bay. On the opposite side of the continent the Jeannette has made a bold and promising push into the unexplored regions within the Arctic circle north of Behring's Strait. The safe passage of Nordenskjöld through the Siberian seas is the most notable event in northern exploration. Prejvalski and other Russian explorers have been doing good work in high Asia. Major Pinto has crossed the African continent; and a large number of exploring parties have pushed in various directions into the little known interior. The last report of importance mentions the discovery of the head springs of the Niger by a couple of Frenchmen.

In Australia, Forrest has made a bold and successful passage across regions hitherto unexplored, discovering vast tracts of farming and grazing lands where all was supposed to be desert.

In the field of engineering, a large number of important undertakings have been brought to successful issue, particularly in the construction of long and lofty railway bridges and great tunnels. Among the latter is the famous Sutro tunnel, and we are almost able to add the St. Gothard, which is rapidly approaching completion. The great work of improvement in the harbor of Genoa has been largely advanced; considerable good work has been done in the Hell Gate channel of New York harbor, and on the proposed tunnel under the Hudson. Several extensive ocean piers have been constructed at Long Branch and Coney Island. The mouth of the Mississippi has seen the practical completion of the opening of its channel to deep-draught shipping. A new Atlantic cable has been laid, and other works of the same character have been carried out in the Indian Ocean and elsewhere.

These are but a few of the topics of more than temporary interest which the readers of the SCIENTIFIC AMERICAN will recall. To speak of the important projects proposed, discussed, or actually begun during the year—like the proposed ship railway across the Isthmus of Panama, for example—would swell this article, already too long, beyond all reasonable limits. Besides, our readers do not need to be specially reminded of them. Enough appears at the hastiest glance to show that progressive men have not been asleep during the year, and that those who have cared to read about the world's real work have not lacked material for engaging their attention. This, not to speak of the hundreds of inventions described and figured in our pages; the numerous illustrated papers on our great industries; the illustrated papers on practical mechanics, and the many suggestions for inventive work that have been furnished from time to time.

STRENGTH, WEIGHT, AND FINENESS OF WOVEN FABRICS.

The last few years of particularly close competition in finding a market for all kinds of manufactured goods has rendered necessary very close attention to many little details which has before escaped notice, or were considered too trivial to be taken into account. It has been found, however, that these small items have often made the difference between a paying and a losing business, and, as is almost always the case, the closer study given to the practical working up of stock, in order to make these savings, has made possible a higher standard of excellence, and secured greater regularity and evenness in the production.

In the making of plain cotton cloths, as at present conducted in this country, we find an illustration of probably as great improvement in this direction as can be pointed out in almost any of our industries. It is but a few years since when all the yarn worked up was largely put in the goods by guess as to its weight and strength, or with very insufficient tests as to either point, and, although a certain number of threads to the inch was generally designed, this was not always obtained, while the weight of the fabric was largely only a question of average. To do business after this fashion now would be simply ruinous, even supposing that goods so made would meet the demands of buyers, who have been thoroughly educated on these points during the steadily falling values of all manufactured goods from 1873 to 1879. Now the yarn, almost from the time it ceases to be "roping," is tested as to its weight and strength, and, before it is ready to go to the loom, a very close standard must be obtained. This is secured by frequent trials for strength in a tester so nicely adjusted and so delicately balanced that it will determine the strain under which a thread will break even to the thousandth part of an ounce, and by scales which will show the slightest variations. The different qualities of cotton, of course, give varying results as to strength, but the fineness of the thread, the number of threads to the inch, and the weight of cotton to the yard (as also the amount of sizing or starch, which all our manufacturers use, though to a less extent than is done in England), must run exactly according to the specified quality and description of goods to be made. It is common enough for buyers to have little magnifying glasses, with the aid of which they can count the number of threads to the inch, but it is not so easy for them, after the goods are made, to determine the strength of the thread to a nicety, or tell how much of the weight has been added in sizing—at least, these are points about which very few of them trouble themselves much. The very low figures at which all kinds of cotton goods have sold for the past three or four years have caused the production of a much larger proportion of cheap goods than usual. Manufacturers have sought in every way to make something which would sell for a small price. Their efforts in this direction have given them a better gauge of the different points of superior or inferior goods than most of those who handle their products have yet attained. It is true, we have heard frequently how much better our goods are than some of those made in England, and how much more starch and sizing English manufacturers put in the finished cottons they export, and, as to a considerable proportion of the goods we make, we have no reason to doubt their superiority. It is equally true, however, that our manufacturers have nothing to learn from those in England in the way of cheapening their goods, and in making a poor article look like something a good deal better than it is. While we keep from sending such goods abroad we shall probably retain, and may even improve upon, the reputation we have already obtained, but our foreign competitors will be so exceedingly watchful that any progress we make will only be a success well earned. In the goods made for home consumption, however, it will be well for buyers not to take too trustingly anything offered them, on the broad ground that American cotton goods, because they are made here, are necessarily honest and well made. This used to be the rule a few years ago, but our manufacturers have now learned so well how to cheapen their goods that all those wishing to place low priced fabrics on the market, and such too as will look as well as those of higher cost—are thoroughly informed as to the manner of doing it.

ERASTUS BRIGHAM BIGELOW.

In the death of Erastus B. Bigelow, America loses another of the great inventors whose genius has so largely helped to raise her industrial prosperity to its present high position. Thirty-five years ago all carpets were woven on hand looms. The cost of labor in this country made it impossible for American carpet makers to compete in cheapness with the work turned out by the ill-paid hands of England and France; and even then, the high price of carpets made them rather an article of luxury than one of everyday use and convenience. In 1842 Mr. Bigelow, after making several useful though less important inventions, perfected a series of devices for making the carpet loom automatic, so that the costly labor of man might be displaced by the cheaper labor of women or boys.

After many unavailing efforts to induce carpet makers to undertake the manufacture by the new method, Mr. Bigelow succeeded in persuading the Lowell Manufacturing Company to make the experiment, and in 1845 the successful weaving of ingrain carpets by power was demonstrated. Subsequently Mr. Bigelow achieved the invention of power looms for the weaving of Jacquard Brussels, and Wilton carpets. To apply these inventions the inventor was compelled, in 1848, to set up a factory of his own. This establishment, at Clinton, Massachusetts, has grown to be the largest in the world for the manufacture of Brussels and Wilton carpeting, in which the several processes of worsted spinning, dyeing, and weaving are united in one concern. We may also set it down to the credit of Mr. Bigelow's inventions largely that the United States now leads the world in carpet production.

Mr. Bigelow was born in West Boylston, Mass., April, 1814, and died at his home in Boston, Saturday, Dec. 6.

REMARKABLE FLY WHEEL EXPLOSION.

On the night of December 5, 1879, the Rensselaer Iron Mill, at Troy, N. Y., was the scene of a most remarkable accident. The newspaper report says:

"It was about 10 o'clock, and the 200 workmen were busily engaged at their various tasks. Suddenly the large flywheel, 35 feet in diameter, and weighing 60 tons, exploded, it being separated into 10 pieces of about 6 tons each. Each of these pieces was hurled for some distance, several of them being forced through the roof. One passed through the air about 200 feet, and descended through the roof of a neighboring mill. Striking upon the iron floor, it bounded for a distance of 30 feet, settling within three feet of a nest of two boilers. Several workmen were about passing when the ponderous fragment entered, and their escape from death was narrow. James Wallace, a heater, was buried beneath a five ton piece of the wheel, and when extricated was still alive. He cannot recover, however, his skull being fractured, and he having been injured internally. In places the roof was completely destroyed. The damage will not fall short of $10,000. Work will be necessarily suspended for two weeks or more. The escape from a boiler explosion was exceedingly narrow, a piece of the bursted wheel, weighing six tons, falling between two of another nest of boilers, and destroying a portion of the brick work. Had the mass crashed through the boilers, the loss of life would have been large. Another fragment descended through the roof, breaking a steam pipe and burying itself through the floor at a spot where a workman had been standing not five seconds before. The wheel had been in use 11 years, often subjected to inspection, and the cause of its explosion is a mystery."

We trust that the causes of this extraordinary accident will be investigated by competent mechanical engineers, and the whole matter explained for the public benefit. We should be glad to receive full particulars with drawings for publication, if any of our friends can supply them.

A somewhat similar occurrence took place in this city in June, 1876, at the Kuntz Brewery, Third Avenue. In this case the fly wheel was only 9 feet in diameter, weight 3,600 lb. We gave at that time an extended report of the affair, with drawings, which showed beyond all question that the accident was due to carelessness and botching in the original fitting together of the wheel.

If there is any one part of a machine that requires more intelligence, skill, and minute care in its construction than another, it is the fly wheel. And after the wheel is put into use no other portion of an engine needs more frequent, careful inspection, and tapping, for the detection of flaws or the incipient loosening of parts, than the fly wheel. But we fear that both in the use and in the construction, carelessness is apt to be the rule and carefulness the exception.

THE SCIENTIFIC AMERICAN FOR 1880.

Like all the rest of American institutions, the SCIENTIFIC AMERICAN closes the year with the most assuring prospects of prosperity in the year to come. There never was a time when our patrons in the scientific and industrial world were more numerous or more successful in their undertakings, or had more solid grounds for looking back with satisfaction, or forward with confident expectation of increasing prosperity. The country has entered upon a period of successful activity which has made the past year profitable beyond precedent; and the coming years bid fair to surpass it in solid gains. Having taken possession of the vast and varied markets of our own land, our farmers, manufacturers, and merchants are reaching out to the earth's remotest ends, with every prospect of retaining and increasing their hold upon the world's most profitable trade.

From its intimate connection with all the great and growing material interests of the country the SCIENTIFIC AMERICAN cannot but share largely in the country's general prosperity; and the publishers are determined to make it more and more worthy of its position as the most popular scientific and industrial paper in the world. With a circulation of 50,000 copies every week, among the most intelligent and active men of the country, the men who are doing the country's best work and contributing most to its industrial and commercial activity, the SCIENTIFIC AMERICAN has a basis of permanent prosperity unrivaled among newspapers, and can offer to advertisers a medium for reaching customers unequaled in scope and directness. In addition, its monthly EXPORT EDITION, with a guaranteed circulation in all the principal cities and commercial centers in the world, is probably doing more to spread a knowledge of American pro ductive industry throughout the world than all other periodicals combined. An examination of any issue of our EXPORT EDITION will show how widely its advantages as an advertising medium are appreciated by our great manufacturers and merchants engaged in foreign trade.

With reference to matters more strictly personal, it may not be improper to say that the increasing favor with which the SCIENTIFIC AMERICAN is received by intelligent readers at home and abroad is the surest guarantee that the work it is doing is approved by its numerous friends.

As its circulation increases the possibility of adding to the scope and value of the matter it offers from week to week increases proportionally; and it is the purpose of its publishers not to slacken their efforts to make the paper increasingly worthy of its name and reputation. One great advantage of its widening circulation is the wider range of information it receives with regard to scientific discoveries, trade prospects, and commercial changes, from its friends in all parts of the world; and just here we may properly express our thanks for such communication from United States consuls, travelers, the heads of foreign business houses, and others, who have thus added materially to the interest and value of our pages. It is enough, in the way of promise for the future, to say that the coming volume of the SCIENTIFIC AMERICAN will not be inferior to those of the past, and will be as much better as experience, increasing facilities, and strenuous effort can make it.

Among a number of valuable and interesting subjects in hand for early issues, we may mention an article fully illustrating the central office system of telephonic communication, which is becoming so important a factor in modern social and business life. The illustrated articles on amateur mechanics, which have been so favorably received during the past year, will be continued; so, also, will the valuable series describing and illustrating our great manufacturing industries, and a larger share of attention will be given to practical mechanics and improvements in the various arts and other productive industries.

The SCIENTIFIC SUPPLEMENT will, as heretofore, give, in addition to many valuable original papers on scientific and mechanical subjects, a careful selection of all the more important discussions in the various departments of science and art made in all parts of the world. As hitherto the SCIENTIFIC AMERICAN will publish every week a full table of the contents of the SUPPLEMENT, so that those who are not subscribers to both papers may learn whether the SUPPLEMENT contains matter which is of especial interest and value to them.

THE FUTURE OF AFRICA.

What the eighteenth and nineteenth centuries have done for America the twentieth is likely to do for Africa. Civilization is attacking her ancient fastnesses from all sides. Europe is especially alive to the enormous capacities of the continent for trade. A score of more or less powerful missionary societies are bent upon the evangelization of its swarming millions; and with the facilities for rapid progress furnished by steam and electricity the speedy conquest of the interior by Christianity and the arts of peace is all but assured. Unlike the Americas, when first discovered, Africa is well peopled by nations for the most part well advanced in civilization, and ready to become important factors in the industrial and commercial world. They are far enough advanced to be large producers of many things that the industrial world has need of, and are equally well calculated to become large consumers of industrial products.

What with telegraphs along the coast, steamers and railways pushing inward along its ancient lines of traffic, the suppression of its external slave trade, the pluck and energy of scientific, missionary, and commercial explorers, and the great wealth of the national and international societies bent upon the early evangelizing of the African peoples and the commercial development of the enormous natural capacity of the country, we may reasonably expect in the near future an awakening in Africa as marvelous as anything the world has yet witnessed. Dark as its present condition is, Africa is a land of splendid possibilities.

It is not surprising, therefore, that commerce is studying its newly opened regions with keen interest; or that the ecclesiastical world is showing the liveliest concern for the future of regions which promise to be the seats of great Christian nations.

For a comprehensive, exact, and trustworthy survey of the real condition of this vast continent, its physical and ethnological characteristics, the recent work of its numerous explorers, the prospects of the various missionary enterprises on foot there, and the most suitable places for new undertakings, nothing could be more satisfactory than the paper read by the careful and learned recording secretary of the American Board of Christian Foreign Missions at the late meeting of the board of commissioners of the society at Syracuse. The paper is published in full in the current number of the SUPPLEMENT, in connection with an excellent map of Africa, embodying the results of all recent explorations.

STAMPS FOR TRADE MARKS.

In another column a correspondent proposes a method by which Congress might give protection to trade marks incidentally, under its power to levy and collect taxes.

Briefly stated, the plan is for the Bureau of Internal Revenue to make and issue to each manufacturer, who should want protection, a special stamp bearing his trade mark, as is now done in the case of patent medicines; these stamps to be sold nominally for revenue, but really for that protection to the manufacturer which might be provided under existing laws against the counterfeiting of revenue stamps. The tax thus levied would be uniform throughout the United States, thereby conforming to the requirements of the constitution; but the payment would be optional with those who desired its indirect protection.

The suggestion is a clever one, but open, we think, to several serious objections. The stamps would be expensive, even were the government to furnish them at cost. The labor of attaching them to each article to be protected would add another large item to the expensiveness of the proposed method. And still worse, it would be quite impossible to make the stamp permanent. The trade mark on a piece of chinaware, for example, would lose half its value if it could not be wrought into the material or imprinted upon its surface so as to stay. The same may be said of most lines of metal manufactures, woodenware, and so on. A stamp for revenue purposes, on the contrary, is intended to be quickly, surely, and easily destroyed. The existing system of State registration, imperfect as it is, would seem to be less troublesome, cheaper, and more efficient.

Henry Crawshay.

Not six months ago we had occasion to notice the death of Robert Crawshay, the great iron master of Merthyr Tydvil, Wales. About a year before, his brother, Francis Crawshay, died; and now we have to note the death of Henry, the last remaining son of William Crawshay, the great iron king of Cyfarthfa. A full account of the vast establishments built up by the elder Crawshay and his sons was given in this paper last June. When he died he left the whole of his valuable property in the Forest of Dean to Henry Crawshay, Cyfarthfa to Robert Crawshay, and Treforest and Hirwain to Francis Crawshay. From the time he came into possession of this property until the depression in the iron trade Henry Crawshay continued to increase and improve his inheritance, the total amount of ore worked between 1860 and 1870 reaching nearly 400,000 tons. At the time of his death he was preparing to enter extensively into the tin plate trade. He was the nearest likeness to his father among the three sons, and had all his father's perseverance and intuitive power. He was rugged in manner, but generous hearted, and won the hearty reliance of all by his unswerving probity. He died November 24, aged seventy-six.

Long Range Telephoning.

In a recent issue of this paper an exchange was credited with the statement that Mr. Robert Packer, "superintendent of the Pennsylvania Railroad," while traveling in Nebraska had conversed with his wife and friends at his home in Sayre, Pa., two thousand miles distant, by means of a telephone.

We now learn on good authority that, though Mr. Packer's friends received his communication by telephone, it was not so sent by Mr. Packer. The message was sent from Nebraska to Mauch Chunk, Pa., by telegraph; thence it was telegraphed to the Sayre office of the Pennsylvania Canal and Railroad Company (of which Mr. Packer is superintendent), and from there it was transmitted to Mr. Packer's house by telephone—falling short of the newspaper report of the telephone's performance by some nineteen hundred and ninety-nine miles and a fraction.

Our Sons Need Good Reading.

"I wish that my son had more of a taste for useful reading and study." Such is the lament one often hears from anxious fathers. To interest their children in things that are beneficial, thus to save them from bad company and pernicious habits, is the constant aim of every faithful parent. One excellent means to this end consists in making the SCIENTIFIC AMERICAN a regular visitor at your dwelling. Let it be in sight on your bookcase or table, and notice how quickly it attracts the young. Its pages are full of the most interesting, varied, and useful information, the study of which insensibly excites the mind with a desire for more; and this desire, once fairly kindled, endures through life, expanding and ennobling the intellect. A new volume of the SCIENTIFIC AMERICAN commences next week. Fathers, subscribe for your sons if not for yourselves.

Recognition of American Merit.

IN the Transactions of the Institute of Naval Architects, London, England, 1879, are the names of John A. Tobin, Engineer Corps, U. S. Navy, J. B. and N. G. Herreshoft, United States America, all of whom were elected members at the last meeting.

Mineral Oil and Electricity for Lighthouses.

The annual report of the Lighthouse Board says that the substitution of mineral oil as an illuminant has been made in many of the fourth, fifth, and sixth order lights. All of these orders of lights would have been supplied except for the fact that it is found that the oil deteriorated when placed in the ordinary large oil butts in use, and many small cans have had to be made, into which the supply of each station is placed. The great superiority of mineral oil as an illuminant over all other oils has induced the board to try the experiment of using it in the lightships. The oil used for this purpose is 300° of the flash test. It is thought that such oil, used in the Funck lamp, will much increase the usefulness of the lightships, and a great saving in the cost of oil will be made.

The board is desirous of making experiments to test the relative merits of the electric light and other illuminants. These experiments must be made in some lighthouse and on a sufficient scale to exhaust the subject. There are many machines for generating electricity, several of them of American invention, and the board wishes to test the principal ones. An appropriation of $50,000 is asked for the purpose of making these experiments.

An appropriation of $50,000 is asked for the construction of a first-class lightship, fitted with a powerful steam fog signal, to take the place of the lightship now off Sandy Hook, entrance to New York harbor. This is regarded as one of the most important light stations on our coast; and as an immense commerce flows past it, it should be marked by a vessel having all the modern improvements, to make it a more certain guide to the mariner. Should an appropriation be granted, the present lightship could be moved to a less important station.

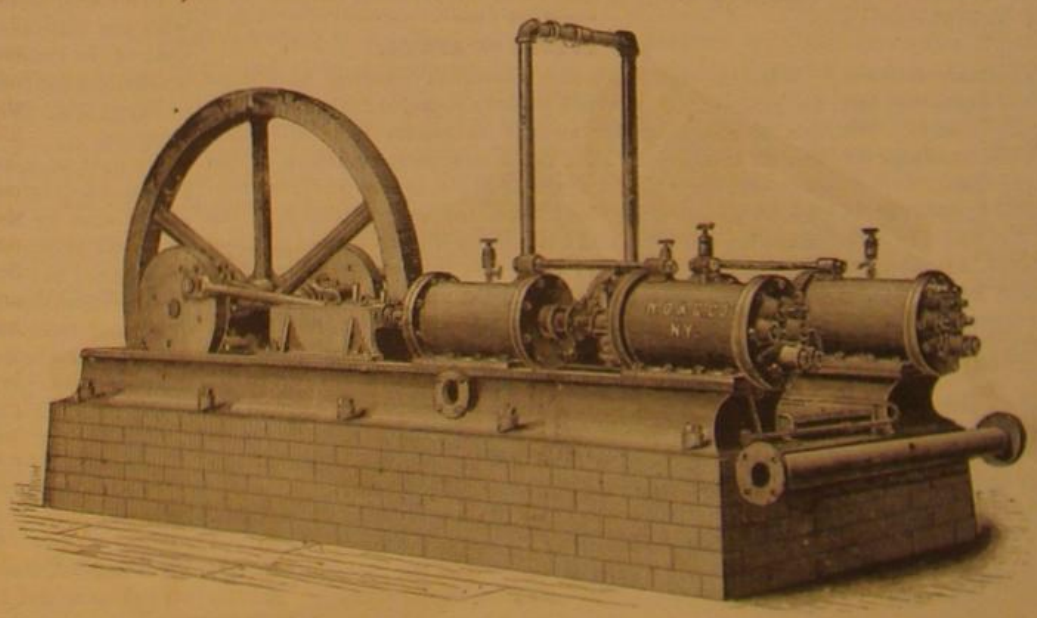
The Earth's Day Increasing.

In a recent lecture on "Eclipse Problems," Professor Charles A. Young, of Princeton, said, with reference to the observed increase in the rapidity of the moon's motion, that the discovery led at first to the opinion that the moon's orbit was growing shorter, and that ultimately the moon would come down upon us. More accurate calculation, however, shows that there is no danger of so disastrous a result. The moon is not coming nearer, but our day is growing longer, owing to the friction of the tides upon the earth's surface. The tides act like a brake, and slowly diminish the speed of the earth's rotation.

THE DUPLEX AIR COMPRESSOR.

Although compressed air cannot, under ordinary circumstances, compete with steam as a motive power, the machinery necessary to its use has been perfected to such a degree that it has been extensively applied to mining, quarrying, and engineering purposes, and it seems to be the only available motive agent for such uses. Compressed air as a motive power has been the subject of a great deal of practical investigation and experiment, and the losses arising from increase of temperature by the compression of the air and the cooling by expansion, also losses due to the resistance of the valves, and dead spaces at the ends of the compression cylinders, have all been reduced, if not avoided altogether.

The annexed engraving represents the duplex air compressor manufactured by the National Drill and Compressor Company, of 76 and 78 Center street, New York city. This machine, though quite plain in appearance, is of unusual strength and efficiency. We are informed that the performance of this engine is fully equal to that of the best engines in market. The dimensions of the compressor are as follows: Length of bed, 12 feet 6 inches; height of center of cylinders from floor, 18 inches; diameter of steam and air cylinders, 10 inches; stroke of pistons, 18 inches; length of connecting rod, 52 inches; diameter of wheel, 5 feet 6 inches; number of revolutions per minute, 133; cubic feet of free air compressed per minute, 436; weight of machine, 11,400 lb.



DUPLEX AIR COMPRESSOR.

Steam is admitted to the steam cylinders by a slide valve having an automatic cut-off. The air cylinders are lined with composition, and kept cool by water which passes spirally around the cylinder from the center toward the ends. By this arrangement the air cylinder is kept cool without having water in the cylinder. The air piston is adjustable, and travels to within one thirty-second of an inch of the cylinder heads. The induction and eduction valves are made so that they can be removed without disturbing other parts of the machine.

The National Drill and Compressor Company build single and duplex compressors of different sizes, which may be run by direct connection with steam engines, as in the engraving, and others which may be run by belts or gearing from the shafts of water wheels or other motors; they also make a variety of rock drills and mining machines which are in use and well known in all parts of this country, and are widely and favorably known in foreign countries.

A NEW TELEPHONE.

In the telephone shown in the annexed engraving the inventor has made use of Jamin laminated U-magnets to secure great magnetic power with little weight. The ends of the magnet are cut off diagonally, and the poles are each surrounded with a helix of fine insulated copper wire connected as in an electro-magnet. Two of these magnets are attached to an elliptical hoop, which surrounds the head and supports

NOVEL TELEPHONE.

the diaphragms and ear pieces. Each diaphragm carries a light triangular armature, which fits the poles of the magnets and nearly touches them. The telephones are connected with each other and with the line. The operation is similar to the Bell telephone. The instrument shown in the engraving is arranged as a receiver to be used with any of the ordinary transmitters, but it may be arranged as a transmitter.

Mr. Andrew C. Hubbard, of Danbury, Conn., is the inventor of this telephone.

A NOVEL system of insurance for girls has existed for several generations among the Danish nobility of Copenhagen. A nobleman, upon the birth of a daughter, enrolls her name with the insurance society, paying at the time a fee, and subsequently an annual sum, until she reaches twenty-one. She then becomes entitled to a fixed income from the society, and to apartments in the large building of the association, which is surrounded by gardens and a park. Should her father die in her childhood, she may immediately occupy the apartments. Should she die or marry, the income and the right to entail the home both lapse.

MEN of science, students, inventors, and every other class of persons desirous of keeping up with the times should become regular subscribers to this paper. They will find it a paying investment, for the SCIENTIFIC AMERICAN not only contains a record of all the important discoveries and inventions of this country, Great Britain, and other English speaking countries, but translations from the French, German, and other foreign scientific and industrial publications.

MISCELLANEOUS INVENTIONS.

Mr. Judson S. Corbin, of Clinton, Iowa, has patented an improved gate, which is so constructed that it may be opened and closed by the wheels of passing carriages. It is simple, convenient, reliable, and not liable to be obstructed or get out of order.

An improved water closet cistern has been patented by Mr. Hugh Houston, of Pittsburg, Pa. The object of this invention is to provide an improvement in that class of automatic overflow cisterns for water closets, whose discharge is so regulated, by means of an overflow compartment or chamber and float and valve connected therewith, that the discharge occurs at regular intervals, and each time gives the water closet bowl a sudden flush and thoroughly washes it out.

An improvement in letter boxes has been patented by Messrs. Wauhope Lynn, of New York, and Gottfried Clasen, of Brooklyn, N. Y. It consists in providing the box with a tube extending from the slit at the top inward and downward, and closing the lower end with spring doors having arms in position to be operated upon by a plunger connected with the hinged door covering the slit at the top on the outside, whereby, when the outer door is opened to put a letter in the box, the doors at the end of the tube are closed, thus cutting off communication through the tube with the interior of the box; but when the letter is slipped through the slit and the outer door allowed to close, the inner doors open and permit the letter to fall within the box.

Mr. Theodore L. Wiswell, of Olathe, Kan., has patented a combined buckle and trace carrier, consisting of a metal skeleton buckle frame having hooks located opposite each other, and having their ends bent inward, then forward and downward, to adapt them for holding the cockeyes of the traces securely when the latter are not in use, and yet permitting convenient detachment of the cockeyes when required.

An improvement in grooving irons has been patented by Mr. John W. Ammons, of Columbia, Mo. The object of this invention is to provide a plane iron which will chamfer off the outer corners of the groove simultaneously with the planing of the groove. It consists in a plate with beveled cutting edges combined with a grooving iron.

An improved swinging gate that is to be placed across a railroad track to keep cattle and other animals off, has been patented by Messrs. David A. Walker and John R. Smith, of Fort Benton, Montana Ter. It is to be opened by the contact of the pilot or cow catcher of the locomotive, and will close automatically immediately after the passage of the tram.

An improved combination tool, patented by Mr. Morgan H. Sly, of Shepardsville, Mich., combines several tools in one for the convenience of the mechanic, farmer, housekeeper, and others. It consists of a screwdriver, nail puller, wrench, nail hammer, wire cutter, riveting hammer, and pinchers combined in one tool.

An improved feed bag for horses, patented by Mr. Edwin Forbes, of Brooklyn, N. Y., has means for supporting feed bags in a convenient position for horses to eat from without interfering with the natural movements of the head. It consists in a spring arm adapted for connection upon the hames, with its outer end extending over the horse's head, and from which outer end the feed bag is suspended.

Mr. Patrick Gallagher, of Eureka, Nev., has patented an improved fire escape for attachment to buildings, which is so constructed that people can readily escape from the upper stories of burning buildings when the stairways may be rendered impassable by the fire.

Mr. Samuel H. Gregg, of Crawfordsville, Ind., has patented a fence panel formed of a long and short post, twisted wires, and hook headed bolts, arranged and applied in a novel way to form an inexpensive yet substantial fence.

An improvement in vises has been patented by Mr. Fortonato C. Zanetti, of Bryan, Texas. It consists in providing the clamping-jaws, which are secured to the lower end of the fixed jaws of the vise, with a spherical socket and adjusting-screw, to adapt the said jaws to embrace a ball on a standard attached to the bench, to form a ball-and-socket connection between the vise and bench.

Mr. Joseph Seiler, of Norwalk, Conn., has patented an improved device for connecting the mirror standards or supports with a bureau, in such a way that they can be easily attached and detached.

Mr. Charles F. Harvey, of Van Buren, Ark., has invented an improved attachment for the dashboard of wagons, and other vehicles drawn by horses, for holding the reins. It consists of an adjustable frame attached to the dashboard, supporting a horizontal bar, composed of two parts, the upper part being divided so that the reins can be slipped down between the two parts.

Mr. Samuel V. Kennedy, of New Haven, Conn., has patented a device for removing the metallic primer from an exploded cartridge shell, for applying a new primer, and for closing the shell tightly about the ball after it has been reloaded.

An improved implement for browning coffee, popping corn, and roasting peanuts has been patented by Mr. Stephen M. Poff, of Omaha, Neb. It consists in a pan made with a close top, having a hole in its top closed with a close cover having a perforated slide, three ribs or flanges upon the bottom, and a handle attached to the rear end.

An improvement in gates has been patented by Mr. Alonzo O. Dean, of Bethel, Vt. It consists in a gate post with an iron socket sunk into the ground and braced by extending arms; the gate is hung on rollers pivoted in a frame attached to the post, and provided with a ratchet bar which engages a toothed wheel connected with a helical spring. When the gate is opened the spring is wound up, and retracts when it closes the gate.

Mr. Philip W. Cassil, of New Athens, O., has patented an improved weather strip for doors. The invention consists in the combination with a main strip and the cap strip of bent straps engaging with hooks or staples, and serving to hinge the strip eccentrically to the door.

THE CLIMAX SAFETY HAMMERLESS GUN.

There can be very little doubt now that it is only a matter of time when the hammerless gun, or gun with internal

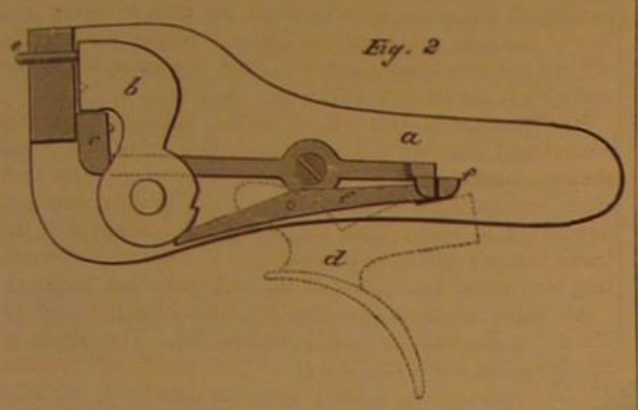


Fig. 2

hammers, will entirely, or almost entirely, supersede the ordinary gun with external hammers. The doubt with regard to hammerless guns has been whether they were as safe to use and as free from accidental discharge as the old style; and this doubt has had some foundation, for many of the hammerless guns are made with a locking bar which secures the triggers only, and allows the hammers to be jarred off and charge exploded when the locks have become worn or light in the pull off.

With the Climax hammerless gun such an accident appears absolutely impossible, for not only are the triggers bolted automatically, but, as may be seen by reference to the engraving, there is a strong block, *c*, which rises in the front of the hammers, *b*, as the gun is opened, which block interposes between the hammers and the strikers, *e*, and thus prevents any chance of the former reaching the striker, and thus exploding the cap. This block, *c*, is operated upon by the trigger, *d*, the pulling of which removes the block, and allows the gun to be fired. So that not only is the gun secure when the triggers are bolted, but even when the gun is placed at full cock ready for firing. No jar or fall can explode the gun, for should the locks be jarred down, the hammers would simply fall upon the safety block instead of upon the strikers.

Too much importance cannot be given to this principle of making a gun secure from accidental discharge when placed at full cock. Probably more than half the accidents that occur with guns occur through some blow or fall, causing the hammers to fall and thus fire the cartridge.

The principle of the Climax hammerless is also particularly well adapted for rifles of various kinds, there being no hammer to catch into anything when deer stalking or pushing through thick brushwood.

The breech fastening of this gun has not only the double grip bolt under the barrels, but also a very powerful grip formed by the top lever engaging a projection at the end of the rib. The lock is made upon the principle of an ordinary side lock, and is so arranged that the locks can be taken off like the locks of an ordinary gun. The rods which force the locks to full cock are completely under cover, so that there is no chance of water reaching the lock work. In this gun the jar given when firing heavy charges from one barrel cannot fire off the other barrel. This is an advantage which will be appreciated by sportsmen who have used large rifles with heavy charges. Fig. 1 in the engraving shows the exterior of the breech and the locks. Fig. 2 shows the internal construction of the lock, and Fig. 3 shows the hammer, *b*, cocked, and the safety block, *c*, in position.

Fig 1

HOLLAND'S CLIMAX SAFETY HAMMERLESS GUN.

These superb guns are manufactured by Messrs. Holland & Holland, 98 New Bond street, London, England, a description of whose fine workmanship we gave an account in a recent number of the SCIENTIFIC AMERICAN.

The Life of Railways and Rolling Stock.

The report of the Illinois Railroad Commissioners contains the following data concerning the average life of the rolling stock and superstructures of twenty-six roads: Locomotives, 15¼ years; passenger cars, 15¾ years; stock cars, 10 years; freight cars, 11½ years; iron rails, 7 years; steel rails, 14 years; oak ties, 7 years; pine ties, 4¾ years; cedar ties, 5½ years; truss bridges, 9½ years; trestle bridges, 8 years; pile bridges, 9 years; joints and fastenings, 7 years; fencing, 8½ years. One road gives the life of its locomotives as 8 years, and of passenger cars 15; another road reports the former at 24 years, and the latter at 20. Only one road puts the life of passenger cars as high as 20 years, and the lowest reported life rate of such cars is 8 years. The shortest life of iron rails is 3 years, and the longest 12; four roads report it as 10 years. Only four roads report the life of steel rails, and they give it as 9, 12, 15, and 20 years respectively. These data differ considerably from those of roads in other sections of the country.

Alizarin Blue.

G. Auerbach recently read a paper on this subject before the Chemical Society, London. He states: About eighteen months since a blue coloring matter was brought into the market as a substitute for indigo. It is now disused on account of its high price and its unstable nature when exposed to sunlight. The researches contained in this paper were finished in May, 1878. The author gives a résumé of previous work on the subject, and recommends the following method of preparation: 1 part of dry mono-nitro-alizarin, 5 parts concentrated sulphuric acid, and 1½ parts of glycerine (sp. gr. 1·262), are mixed and heated gently. Reaction commences at 107° C., becomes violent, the temperature rising to 200°. Much frothing takes place, with evolution of sulphurous acid and acrolein. The whole mass, when frothing has subsided, is poured into water, boiled up and filtered, the residue being boiled out three or four times with dilute sulphuric acid.

The mixed filtrates are allowed to cool, and the blue separates in brown crystals. These are purified by mixing with water and adding borax till the solution becomes brownish violet, the blue with the boric acid forming an insoluble compound. This residue is washed, decomposed with an acid, and the pure blue obtained as a violet silky paste. If required perfectly pure, it must be crystallized successively from its various solvents, high boiling naphtha, amylic alcohol, and glacial acetic acid. When pure it forms brown shining needles, melting 268-270°. It has the formula $C_{17}H_{11}NO_4$. Salts were prepared and analyzed, but the results were not satisfactory, as it was difficult to obtain them quite pure. Bromine derivatives were also prepared and examined. The action of chlorine, zinc dust, acetic anhydride, etc., have also been studied. The author discusses the constitution of the blue, and thinks it must be closely related to the aldehydines discovered by Ladenburg, which are formed when aromatic orthodiamides act upon aldehyds.

Ammonia on Brass.

John Y. McLellan, of Glasgow, writes to the *Chemical News* as follows:

While experimenting on the action of liquor ammonia on various metals and alloys, with a view to determine the most suitable for the contraction of a certain part in an ammonia plant, I have met with a reaction on brass which, so far as I know, has not before been recorded and of which this note is a preliminary notice. If a small piece of brass or a few brass turnings be covered with liquor ammonia, sp. gr. 0·880, in a closely fitting stoppered bottle, and placed aside for a few days, it will be found that the ammonia has acted on the copper of the brass to such an extent as to produce a solution of a more or less characteristic violet color, due to the presence of oxide of copper held in solution by ammonia. If this solution be still allowed to remain undisturbed for a few days longer free from contact with the air, this violet color will gradually disappear, leaving a colorless solution, which, however, is no sooner brought into contact with the air by removing the stopper than the violet color is reproduced, and by again stopping the bottle and leaving it aside the same reaction occurs and may be reproduced over and over again.

The production of the violet color from a colorless solution on exposure to the air does not seem to be the result of oxidation, as on opening the bottle in an atmosphere of carbonic acid the same reaction takes place.

I am at present working up this subject in the hope of finding in what state this colorless solution of copper exists.

Household Perils.

Under this head the Boston *Journal of Chemistry* names several dangerous substances which find their way into households. There are two or three volatile liquids used in families which are particularly dangerous, and must be employed, if at all, with special care. Benzine, ether, and strong ammonia constitute this class of agents. The two first named liquids are employed in cleansing gloves and other wearing apparel, and in removing oil stains from carpets, curtains, etc. The liquids are highly volatile, and flash into vapor so soon as the cork of the vial containing them is removed. Their vapors are very combustible, and will inflame at long distances from ignited candles or gas flames, and consequently they should never be used in the evening when the house is lighted. Explosions of a very dangerous nature will occur if the vapor of these liquids is permitted to escape into room in considerable quantity. In view of the great hazard of handling these liquids, cautious housekeepers will not allow

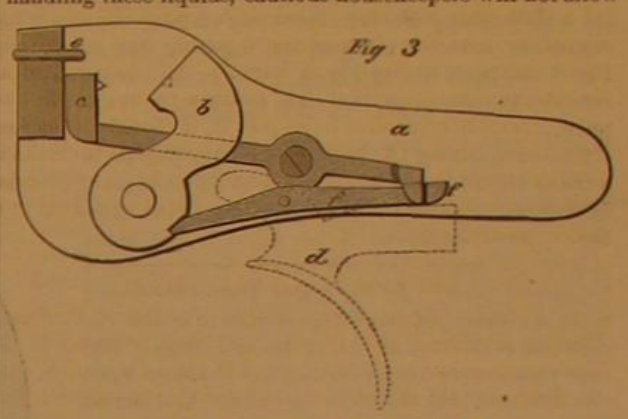


Fig 3

them to be brought into their dwellings, and this course is commendable.

As regards ammonia, or water of ammonia, it is a very powerful agent, especially the stronger kinds sold by druggists. An accident in its use has recently come under our notice, in which a young lady lost her life from taking a few drops through mistake. Breathing the gas under certain circumstances causes serious harm to the lungs and membranes of the mouth and nose. It is an agent much used at the present time for cleansing purposes, and it is unobjectionable if proper care is used in its employment. The vials holding it should be kept apart from others containing medicines, etc., and rubber stoppers to the vials should be used.

Oxalic acid is considerably employed in families for cleaning brass and copper utensils. This substance is highly poisonous, and must be kept and used with great caution. In crystalline structure it closely resembles sulphate of magnesia or Epsom salts, and therefore frequent mistakes are made and lives lost. Every agent which goes into families among inexperienced persons should be kept in a safe place, and labeled properly and used with care.

Congress of American Potters.

The sixth annual convention of the Potters' Association of the United States began in Cincinnati, Ohio, December 2. About a hundred manufacturers were present, representing all the prominent centers of the industry. The secretary reported that the past year had been an eventful one in the history of the ceramic art in this country. Never before had more rapid advances been made in any department of industry. Additions and improvements have been made to nearly every pottery in the United States. Several new ones have been built, and others are soon to be erected. Each manufacturer has seemed determined to succeed, and, bending all his energies to that end, the result has been a success far surpassing the most sanguine anticipations. With increased knowledge has come increased power, and the result may be seen in the quality and beauty of our productions, which are rapidly taking rank with the best products of other lands, and the old prejudice against American ware is now nearly a thing of the past. Especially in the decorative department has the improvement been marked. The demand for this class of goods has rapidly increased, and American artists have succeeded in producing results never before accomplished in this country. Some of the lady artists of Cincinnati are fast gaining a national reputation for their beautiful work. We need in this country more art schools. The success of our industrial and commercial interests depends largely upon this. A cultivation of taste and a love of art would create a demand for wares of higher artistic order, and thus build up an industry which might in time rival the most beautiful productions of Europe. This holds good not only in the ceramic, but every department of industrial art.

FIVE SUNDAYS IN FEBRUARY.—It is interesting to note that in February next there will be five Sundays. This occurs but three times in a century.

AGRICULTURAL INVENTIONS.

Mr. Reuben Graves, of Hope Town (Lostant P. O.), La Salle County, Ill., has invented an improved jointer for plows, which is so constructed that it may be adjusted to throw its furrow slice forward or sidewise or rearward. It may be leveled however its standard may be attached to the plow beam, and it may be adjusted to cut its furrow slice loose from the ground.

An improvement in grain planters has been patented by Mr. John W. Rykard, of Abbeville, S. C. The object of this invention is to furnish a simple, inexpensive, and effective seed planter or dropper for attachment to a plow, to be operated by the plowman.

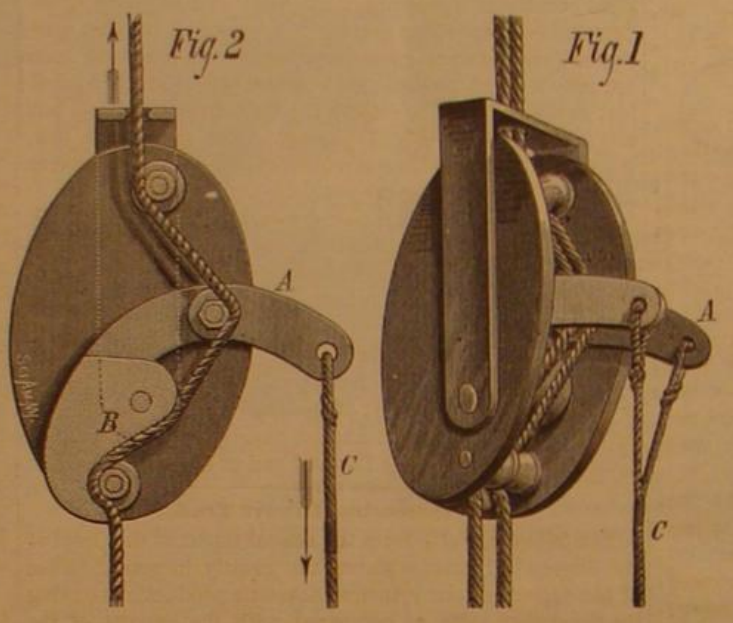
Mr. William W. Sauls, of Denison, Texas, has patented an improvement in cotton choppers, which consists in combining a chopper with mechanism for operating it, and a brake and hand lever. In order that this machine may work properly it is necessary that the seed should be planted or drilled in a straight line. To insure this the inventor has constructed a planting attachment for the machine.

BOAT-LOWERING AND DETACHING APPARATUS.

The engraving represents an automatic brake for tackle used in lowering ships' boats, and for other purposes requiring a self-acting brake for controlling running ropes. The engraving shows the apparatus in perspective in Fig. 1 and in section in Fig. 2. The brake is operated by the strain of the rope to which it is applied.

The curved lever, A, is pivoted on the pin, B, in a frame resembling that of a pulley block. A sheave, having one or more grooves, according to the number of ropes employed, is journaled in the lower part of the frame, and the curved lever carries a hexagonal roller. In the upper part of the frame there is a sheave of small diameter, over which the rope passes on its way out of the apparatus. The rope passes over the upper and lower sheave upon one side, and over the roller carried by the lever on the opposite side, so that any strain on the rope tends to move the lever so that its lower end acts as a brake on the rope passing over the lower sheave. The device is supported by the external stirrup, and the pressure of the lever upon the rope is lessened by pulling on the rope attached to its outer end.

The apparatus is the invention of Mr. William A. Brice, of Paris, France.



BRICE'S BOAT-LOWERING APPARATUS.

Steam on Pennsylvania Canals.

For several years efforts have been making to find an acceptable substitute for mules in hauling coal barges on the Pennsylvania canals. A new attempt will be made next spring. A steam canal boat is now in course of construction, to be put on the Lehigh and Delaware canal between Mauch Chunk and this city. The craft is to be entirely of iron, except the cross beams and deck. It will be eighty-eight feet in length, ten feet seven inches in breadth, and will be propelled by a ten-horse power steam engine with a screw wheel. It is said that, by a new invention to be applied to the screw, there will be but little agitation to the waters, and the washing out of the banks will consequently be avoided. The boat will have a carrying capacity of 105 tons of coal when drawing five feet of water. If it works satisfactorily a number of them will be constructed.

Tobacco.

BY T. B. SPALDING, M.D., OF TROY, ILL.*

In a recent essay before this society, I considered the action of alcohol within the human system, and on this occasion I am pleased to respond to your courteous invitation with observations on the action of tobacco. These agents might be profitably presented as almost identical in action, and shown to be largely accessory to each other's sins, but the *temperance* is waived for the *physiological* phase of the argument.

Of tobacco's origin, its introduction, its composition, its cost, the extent of its consumption, and the processes of its preparation, I purposely pass, to deal more directly with it in its physiological relations to the functions and forces of human life.

Eminent authority in every country and in every department of science, concur in classing tobacco among the narcotic poisons, than which none are more deadly; indeed, like Aaron's rod, it has secure within itself the most magical and worst of all its rivals. Nicotia, sulphureted hydrogen, hydrocyanic acid! What a den of deadliest poisons, all having their *habitat* in this colossal curse, termed tobacco!

A poison is declared to be "anything whose natural action is capable of producing a morbid, noxious, and dangerous effect upon the organization of anything endowed with life." Thus we perceive the definition is the perfect picture of tobacco's action. Acquainted with this agent for over two hundred years, medical science, speaking with the tongue of every science, declares tobacco wholly innutritious, and further still, declares it nauseous; not only that, but noxious; and further yet, a repository of deadliest poisons. From this dictum there is no appeal; in its truth medical men are forced, by their culture, to concur. But even then they dandle with Delilah till shorn of strength, and science must still be summoned and held aloft for the healing of the nation. If tobacco is a poison, it ought to act as such, and it may be safely affirmed it *has no other action!*—no other use in medicine, than to depress vitality. Thus it nauseates, it paralyzes the nerve centers, producing relaxation of the muscular system, and produces such dreadful prostration that medical literature is full of warning, and abounds with reported cases of fatal poisoning by this agent. When medical science was in her cradle, and chloroform in the embrace of chaos, ere anæsthetics had come, as the olive leaf dove, to the ark of Æsculapius, surgeons soothed their suffering patients with powerful potations of tobacco, and thus they utterly prostrated the vital powers, relaxed the muscular system, and then proceeded to reduce laxations! How direful must have been a patient's difficulty, if half so dreadful and distressing as the remedy.

It may be affirmed and demonstrated of tobacco, what is strikingly exceptional, namely, that it alone of all the vegetable kingdom possesses two active principles—the one an alkaloid, and the other oil, and both the deadliest of poisons.

It has been urged in support of fashionable poisons, that because multitudes use them, therefore they can't be especially dangerous; but professional science and experience teach that there isn't an agent in the entire armory of toxicology, but the human system, by continued use, may at length be brought to tolerate it.

One-fifth grain of strychnia, or one grain of morphia, will destroy life, yet, by constant and long continued use, the blunted susceptibilities of the nerve centers may be made so to tolerate these and like poisons that eventually enough may be taken to destroy fifty men. It is demonstrated in the observation of every one that the use of noxious agents, especially tobacco, begets a morbid appetite which demands that continually more of it *may* and *must* be employed to produce the same impression.

Such we know are facts respecting what is noxious, but is not the case with what is nutritious. Medical science is not satisfied with *statements*, but sounds the depths in search of a *philosophy* for asserted facts, and she declares, in this regard, that nutritious agents create and renew nerve cells and structures, and endow them with the finest physiological sensibilities, while noxious agents disturb the conditions essential to their renewal, and so benumb and paralyze their normal sensibilities, and produce inevitably the pathological and characteristic condition of requiring continually more of the disturbing poison to produce the same impression. With these truths we enter the most fascinating field in nature to consider the conduct of this agent in the laboratory of life. Nowhere has Deity evinced such evidences of an intelligent, divine supernatural as here presented in the adaptation of means to ends—in the perfect play of affinities and forces ever operative in the construction and destruction, the waste and renewal, of this physical citadel that enshrines an immortal soul. The whole sublime but sensitive train of transition involved in the conversion of solid food, first into fluidity, and under the auspices of vital force, transformed upward through intricate gradations till it attains the climax of its course in other solid forms, either of flesh or bone or brain, and then the oxidation of these and the evolution of heat and force, is the perfect process of what we term digestion. The brain is the depot of life's dynamics! It is the sun of the physiological system which, with its accessory centers and nerve cords, receive and transmit to the system a force that propels the mightiest and minutest processes of physical life.

But the ability of these organs—as instruments of the mind—thus to receive and transmit this vital force, depends essentially on their structural health and perfection. Paralyze or impair the perfection or structural integrity of the brain, disturb the subtile harmony of those changes of waste and renewal ever operative and essential to its structural perfection, and at once its power is impaired to forcibly and healthily perform its functions; and this adverse influence is precisely the action of tobacco as a depressing poison. The proposition is plain, the truth is self-evident and irresistible, that, with the nerve centers thus benumbed and blighted, and the vital force impaired, then every digestive process dependent on the harmonious action of vital force is weakened and discordant, and the physical and mental man is deranged to the extent that the physical machinery is injured.

The noxious influence of tobacco is more actively operative upon one class of persons than upon others. I may, therefore, for convenience, divide the victims of tobacco into two classes, assigning to the first class all those who do manual labor. These suffer least from fashionable poisons, because the deadening influence of noxious agents upon the nervous system is largely counteracted by physical toil, which strengthens the entire system and conduces to health; and thus it is that active poisons are thought to "kill slowly," and laboring people live long, apparently uninjured, and practice poisonous indulgences. In all this great and glorious class of humanity, however, may be found the fruits of tobacco's use, in the form of cancer on the lips and tongue, dyspepsia, constipation, and hemorrhoids. But let us consider the other class, wherein are included ladies and gentlemen of wealth, of fashion, and of leisure, those who live idle as well as those devoted to literary pursuits and purely sedentary occupations. Physicians, ministers, and lawyers are of this class, and in all these we find paralysis very prevalent, and that diversified and interminable train of nervous derangements whose name is legion. With constitutions enfeebled by physical inactivity and sensibilities heightened by social and literary culture, consider for a moment the effect upon these highly nervous natures. To all of this priceless portion of humanity the use of tobacco is unmixed evil and rapidly ruinous.

Again, it is affirmed by eminent authority that tobacco is the most prolific, if not, indeed, the only source of delirium tremens.

First, the ancients were entirely unacquainted with these terrible terrors of the inebriate, and the records beyond the discovery of tobacco (1560) reveal no case of *mania a potu*.

Second, the normal action of tobacco is the production of tremens, and the most frightful forms of delirium tremens are daily produced by the use of tobacco alone.

Third, it is rarely possible to find an inebriate who does not use also tobacco, and careful inquiry will confirm the statement that, with 90 per cent of such cases, the tobacco habit was first formed. Its influence deranged the nerve centers, an initial tremens was entailed upon the nervous system, which suggested to the morbid taste of the sufferer the soothing, sedative action of alcohol, and thus the allied agents forge for each other and fasten more firmly the chains of the servilest slavery.

I have employed professional science to loosen the pillars of tobacco's position, and with authority and with argument have carefully criticised its action and influence on the functions and forces of organic life. Earnestly in this direction I invoke the sober judgment of scientific medicine, and when you shall have ordered tobacco to abdicate, then only will it fall from popular use and favor, and with that will end the ruin it has wrought.

In view of these truths, scientific and self-evident, in the name of science that classifies all knowledge, in the name of science that seeks the essential nature of things, in the name of science that truthfully interprets the teachings of nature, issue the edict of your eminent authority and drive from popular use and favor this poisonous plague, and when this is secured a heavenly halo of light, an ineffable effulgence, will open up over the poisonous wastes of the world a broad and bright and beautiful pathway of crimson and of gold, wherein garlanded angels will gladly gather, proclaiming "peace on earth and good will toward men," and from highest heaven all over the earth shall you cause to be heralded God's emancipation proclamation to a world that is wasting its highest and holiest possibilities in the ruinous, depressing practice of popularized poisons.

* An address before the Madison County Medical Society.

Fish Killed by Electricity.

A correspondent of *Land and Water* says: A curious incident of the whole of the occupants of a small fish pond being destroyed by a flash of lightning, is reported from Seck, Grand Duchy of Nassau. The *Nassauer Bote* states that during a very heavy thunder and hail storm at night time, a flash of lightning struck a small pond, well stocked with various kinds of fish, the property of the pastor of the parish. The following morning the whole of the fish were discovered dead upon the surface of the water. They had all the appearance of having been half boiled, and crumbled to pieces at the least touch, just as is the case with fish after being boiled. Neither any external nor internal injury could be observed, the scales being intact and the swimming bladder filled and well preserved. The water in the pond was still muddy and dull the morning after the storm, as if the lightning had only then struck it.

Our Chief Cities Eighty-five Years Ago.

The South Carolina and Georgia Almanac for 1794, a copy of which has fallen into the hands of the Charleston, (S. C.) *News*, contains a table in which the populations of the chief cities of the United States are set down as follows: Philadelphia, 42,520; New York, 30,000; Charleston, 20,000; Boston, 18,000; Baltimore, 13,503; Newport, 6,000. At that time the entire population of the country was less than 4,000,000.

AMERICAN INDUSTRIES.—No. 27.

THE MANUFACTURE OF LEATHER.

The industry which forms the subject of this article is of very ancient origin, and it is doubtful if there exists to-day a line of manufacture whose processes have suffered so little change in the course of time as that of leather making. It cannot be said that the leather of to-day is superior to that of a hundred years ago: it is true the processes have been improved, so that less time is required than formerly, but there is no radical change in the materials or methods of leather making. The machinery used in handling hides during the process of tanning, and the methods and machinery for treating the hides after they become leather, have been greatly improved, so that the manufacture of leather is now conducted in accordance with the spirit of the times.

The leather interest is one of the most important of our day, employing a greater number of hands than any other mechanical industry excepting carpentry and other wood working. The yearly product of the combined leather interest exceeds three hundred millions of dollars ($300,000,000). Agriculture and the railroad interests alone surpass the leather interest in values created and involved.

It is not the purpose of this article to trace the history of leather making, nor to give all of the details of its manufacture, but to briefly describe one of the oldest, largest, and most successful leather manufactories in the country. We refer to the establishment of Messrs. T. P. Howell & Co., of Newark, N. J., whose works we illustrate on our title page.

This house dates its existence from the time when Newark, now a city of 130,000 inhabitants, was but a village of 8,000 inhabitants, and New York city was no larger than Newark is at present. The establishment was then small, and engaged principally in the manufacture of patent leather, then a comparatively new article in this country. In 1848 the buildings of S. M. & T. P. Howell having been destroyed by fire, new ones were built on the site of the present works, and in 1855 the style of the firm was changed to T. P. Howell & Co. Since that date new buildings and improved machinery have been added as required, until the establishment ranks as one of the largest and best appointed in this country, and in the production of patent and enameled leather it is the largest in the world.

The buildings of the Newark tannery cover about four acres, and there is a tannery in Middletown, N. Y., owned by the same firm and doing the same kind of business.

In this establishment none but the choicest hides are used, of which they have a regular daily supply, received by special train, and transferred to the hide house shown in one of the upper views in the engraving, where the horns and tails are removed, and they are trimmed and otherwise prepared for future operations. In preparing a hide for tanning, the first operation is that of soaking in water. For this purpose they are placed in large numbers in pools; from the pools they are taken to the beams, where fatty substances are removed; they are then placed in vats containing a lime solution and allowed to remain for a week. The lime dissolves the hair sheath and combines with the fat of the hide to form an insoluble soap. When the hair and the epidermis yields to the touch the skins are taken out and scraped on the beams, with a curved two-handled scraper called the unhairing knife. After the removal of the hair the flesh is removed by means of a knife similar to the unhairing knife.

After these operations, and before subjecting the hide to the tanning process, the lime as well as dirt and animal impurities must be removed. This is accomplished by first submitting the hide to a process called bating, and then working out the bate by means of washing and by the use of a sort of burnishing tool or rubber that is brought to bear upon the hide as it is laid over a beam. The washing is accomplished by beating the hides in a machine resembling a fulling mill, and tumbling them in huge wooden cylinders supplied with a stream of water. When the hides are removed from these cylinders they appear very clean and white; they are now ready for the process of tanning, and are conveyed to the tan vats, where they are immersed in a strong liquor prepared from the bark of oak and hemlock. Here the hides remain, with the exception of short intervals of handling, for a period varying with the purpose for which the leather is intended—from two weeks to two months.

To hasten the process the liquor in some of the vats is constantly agitated by large paddle wheels, seen in one of the middle views, which not only revolve the liquor but the hides also. After the tanning is completed the hide is transferred to the curriers, who shave it on the rough flesh side, reducing it in thickness, removing irregularities, and making the rough side smooth and even. The skin during this process is supported on a beam, the workman preventing the skin from slipping by pressing his body against the portion hanging over the end of the beam. The knife used for this purpose is wide and straight, having at one end a T-shaped handle, and at the other a straight one. It has a peculiar wire edge, kept in order by a burnisher. After shaving, the skins are thrown into fresh liquor, retanned, and then scoured. For this purpose they are placed upon large tables and worked with a tool called a slicker. The department in which this work is carried on is shown in one of the middle views, and the "slicker" is represented in detail in the upper portion of the view.

The leather made in this establishment is split into three parts. The grain side is enameled in various colors, and is used for carriage tops and upholstering. The middle is japanned for carriage and harness use, and the flesh side is used in shoe manufacture and for other purposes.

The portion of the skin which is japanned is stretched on a wooden frame, and after receiving a black groundwork—which is allowed to dry—a coating of japan varnish is applied and baked on. Patent leather is made in different colors for different purposes, and although this particular article is a specialty with this house, we are informed that with the exception of sole leather, there is nothing in the line of leather that is not made here.

It is gratifying to add that the vast product of this immense concern is not only used in the United States and Canada, but is also shipped to all parts of the world. The firm commands a very large trade in England and her Colonies, South America, and all the principal foreign countries. They are as well acquainted with the demands of the foreign markets as with the requirements of their home trade.

Messrs. T. P. Howell & Co.'s New York house is located at 77 Beekman street.

MECHANICAL INVENTIONS.

A machine for hot-pressing cloth, in which the cloth is made to pass between a hollow press box heated by steam and an adjacent pressing cylinder, has been patented by Mr. Ernst Gessner, of Aue, Saxony, Germany. The improvement consists in the combination, with two or more cylinders and corresponding press boxes arranged to give a repeated pressure upon one side, or successive pressures upon opposite sides of the cloth, of a carrier belt, roller, or equivalent device, adapted to receive the cloth from one press box and prolong its travel in its passage to the next press box, whereby a sufficient time is allowed for the goods to become cooled before receiving the second hot-pressing.

An improved steam generator, patented by Mr. Dan Abell, of Carson City, Nev., consists in combining with a steam generator feed water pipes extending through the flues and projecting through an opening at the front and a cap for covering the ends.

Mr. Rosseel Payne, of Ox Bow, N. Y., has patented a plow that will remove the snow from a railroad track and deposit it either to the right or left of the track, as may be desired, by means of a wheel with cutters revolving in the vertical plane and attached to the forward end of a platform car.

Our Increasing Export Trade.

The following table from the annual report of the Chief of the Bureau of Statistics shows the greatly increased values of the exports of our principal domestic productions during the fiscal year 1879, as compared with the exports of the same articles during 1868 and 1878. It should be remembered that the increase in the value of the exports has been attended by a considerable fall in the market price of certain of the articles named in the table:

Commodities.	Value exported, 1868.	Value exported, 1878.	Value exported, 1879.
Agricultural impl'mnts..	$673,381	$2,575,198	$2,933,388
Animals, living	733,395	5,844,653	11,487,754
Bread and breadstuffs..	69,024,059	181,777,841	210,355,528
Coal	1,516,220	2,359,467	2,319,398
Copper and brass, and m'n'f's of, not including copper ore.....	196,329	2,909,357	3,031,934
Cotton, m'n'f's of....	4,871,054	11,438,660	10,853,950
Fruits of all kinds	406,512	1,378,106	1,916,382
Iron and steel and m'n'f's of, exclusive of firearms, but including scales and balances, sewing machines, and fire engin's	5,401,396	13,784,307	12,766,294
Leather of all kinds	607,105	7,093,020	6,800,070
Mineral oil (illuminat'g)	19,752,143	41,513,676	35,999,862
Provisions	30,436,642	123,556,323	116,858,650
Sugar, refined.....	313,378	4,508,148	6,164,924
Tallow.....	2,540,227	6,695,377	6,934,940
Total.....	$136,861,751	$405,433,828	$428,422,164

The total value of domestic exports during 1879 was $698,340,790, making a balance of trade in our favor of over $269,000,000.

The Ebb of the Chinese.

The Chinese in California have begun to go. The steamer that sailed from San Francisco for Hong Kong on the 15th, took 901 of them to their native land. The port statistics of San Francisco show that the arrivals of Chinese during the year ending November 1, were 6,128, and departures 8,746—of whom 6,229 went to China, and 2,517 to Honolulu—the excess of departures over arrivals being 2,618. It is estimated that there are 62,000 Chinese on the Pacific coast, which shows that this population is decreasing instead of increasing, for when the anti-Chinese agitation was begun, a few years ago, the estimate was 100,000. The total number of Chinese arrivals for the twenty years ending December, 1878, was 230,430, and the departures and deaths 133,491. At this rate the Chinese cheap labor will soon be unknown in California.

Trade Marks.

The Committees of Congress have lately reported in favor of an amendment to the Constitution providing for the legalization of trade mark registrations, and it is expected that the necessary bill will be promptly passed by the required majority—two-thirds in each branch. The constitutional amendment will then be submitted to the consideration of the legislatures of the thirty-eight States, and when adopted by three-fourths of the States, the new provision will form a part of the organic law of the republic. Thereafter Congress will have power to make a general law for the registration of trade marks.

A Proposed New Trade Mark Law.

To the Editor of the Scientific American:

I believe it is admitted that the failure of the trade mark law to give protection is a misfortune to the manufacturing interests of the country.

I suggest that Congress has a right to give incidental protection to trade marks under the power to levy and collect taxes.

Let the Bureau of Internal Revenue print and sell, to every manufacturer who desires it, an internal revenue stamp, bearing the trade mark of that manufacturer, the same as is now done to proprietors of patent medicines. The cost of these stamps should be merely nominal, but their forgery should be visited with all the penalties now inflicted for counterfeiting revenue stamps. Fines could be divided between the owner of the trade mark and the United States, or otherwise, as found best.

This imposition of a tax would be uniform throughout the United States, and therefore conforming to the requirements of the Constitution, but the payment would be optional with those who desired its protection. Such protection could be made almost absolute under the revenue laws.

I would like this idea, which I have here crudely outlined, to be criticised by your readers.

W. A. BARTLETT.

Washington, December, 1879.

The Inspection of Steam Vessels.

In his annual report the Supervising Inspector-General of steam vessels makes the encouraging statement that notwithstanding an increase of 400 vessels to the steam merchant marine of the United States since 1875, and notwithstanding the largely increased passenger capacity of the steamers built since then, there has been a steady falling off in the number of fatal casualties. These were, during the past five years, as follows; 607 in 1875, 398 in 1876, 224 in 1877, 212 in 1878, and 177 in 1879.

Attention is called to the necessity of legislation in the matter of taxation for license fees for small steam pleasure vessels or yachts, which, even though they may be no larger than a common sloop's yawlboat, are compelled to pay the same fees for license as commercial vessels of 100 tons burden, which excessive tax has in many cases actually prohibited their use, as many persons desirous of owning such vessels for their own pleasure feel unwilling to pay a fee of $25 yearly for inspection. In this connection Mr. Dumont says:

While I think it would be improper to exempt such vessels from the general requirements of the steamboat laws, however small they may be or however employed on waters open to competitive navigation, both for their own safety and for other vessels governed by said laws, I think that a fee of $5 for the inspection of such vessels, say of twenty tons burden or under, would be ample, and would encourage the building of many more than are now used, thereby benefiting one of the great industrial interests of the country.

Osage Orange Timber for Railroad Ties.

A correspondent sends a transverse section of Osage orange wood cut from a stick which, to his certain knowledge, had been lying for twelve years partly covered with earth in an old meadow. The heart wood is in perfect preservation. This timber, he says, is a rapid grower, and seems to be nearly imperishable in the ground; and he suggests that it would pay railroad companies to cultivate it for ties. Osage timber large enough for narrow gauge roads would grow, he thinks, in from twelve to fifteen years from planting. Whether it would hold spikes well does not appear

Uranium in California.

A dispatch from Fairplay reports the discovery of uranium in the Sacramento mining district. This mineral is found in Bohemia, but never before has been discovered in this country as far as known. The present discovery was made by H. L. Rice. The ore runs 60 per cent. Uranium is worth $1,000 per ton. One of its principal uses is as a coloring substance in the manufacture of glass.

Chemical Nomenclature.

The reports of the *Berliner Chemische Gesellschaft* of October 13, 1879, contains a note on the production of tetramethyldiamidodiphenylmethan and naphthyldimethylamidophenylsulphon. If the latter is heated with nitric acid pentanitrodimethylanilin and nitronaphthalinsulphite are produced.

Ifthissortofthingiskeptup chemistry willsoonberesolvedintooneword.

Extending its Use.

The flexible shaft, which so much resembles a snake, and which is used for operating drills and other instruments used in dental offices for operations on the teeth, has proved to be capable of doing heavy work, such as the boring of wood and iron. It is used also in the brushing of horses and cattle, cleaning and polishing plate glass, finishing morocco leather, and in boot cleaning. As described by a machinist, it "leads mechanical power into the more intricate ways and remote corners heretofore only approachable by the human arm, and it is apparent that manifold applications of the flexible shaft will be made in the future that are not now thought of."

The Solano—The Largest Ferryboat in the World.

The projection of this great ferryboat for the transportation of passengers and freight across the Straits of Carquinez, from Port Costa to Benicia, California, was noticed in this paper some months ago. Now that it is completed and afloat California may boast of the biggest ferryboat in the world. The dimensions of the Solano are:

Length over all, 424 feet; length on bottom—she has no keel—406 feet; height of sides in center, 18 feet 5 inches; height of sides at each end, from bottom of boat, 15 feet 10 inches; moulded beam, 64 feet; extreme width over guards, 116 feet; width of guards at center of boat, 25 feet 6 inches; reverse shear of deck, 2½ feet. She has two vertical beam engines of 60 inch bore and 11 inch stroke, built at Wilmington, Del. The engines have a nominal horse power of 1,500 horses each, but are capable of being worked up to 2,000 horse power each. Upon the deck of the Solano are four tracks extending her entire length, with a capacity for carrying forty-eight loaded freight cars, or twenty-four passenger-coaches of the largest class. The rudders are worked by hydraulic steering gear, operated by an independent steam pump. These rudders are connected with the ordinary steering gear, so that in case of any disarrangement of the hydraulic apparatus the vessel may be guided by it. The advantage of this improvement is that the immense craft can be handled with ease by one man, whereas, if the ordinary wheel and system of steering were used, six men would be required at the wheel.

Lake Erie Vineyards.

The islands at the western end of Lake Erie and the neighboring shores of Sandusky Bay are largely devoted to the production of grapes and wine. The Sandusky *Register's* annual report, just published, for 1879, shows that there are in this district 4,000 acres planted with vines, the yield for the year being in round numbers 16,000,000 pounds of grapes. The wine houses report a production of 1,526,400 gallons. Of this by far the greater part is Catawba, which holds its own as the favorite American wine in spite of the efforts to popularize native red wines made from the Concord grape, the Ives seedling, and other varieties.

The *Register* estimates that not more than one million gallons of pure juice has gone with the million and a half gallons of wine. Some of the dealers, it says, make no secret of the fact that they use spirits, sugar, and water largely, and claim that this doctored stuff is more acceptable to their customers than pure wine.

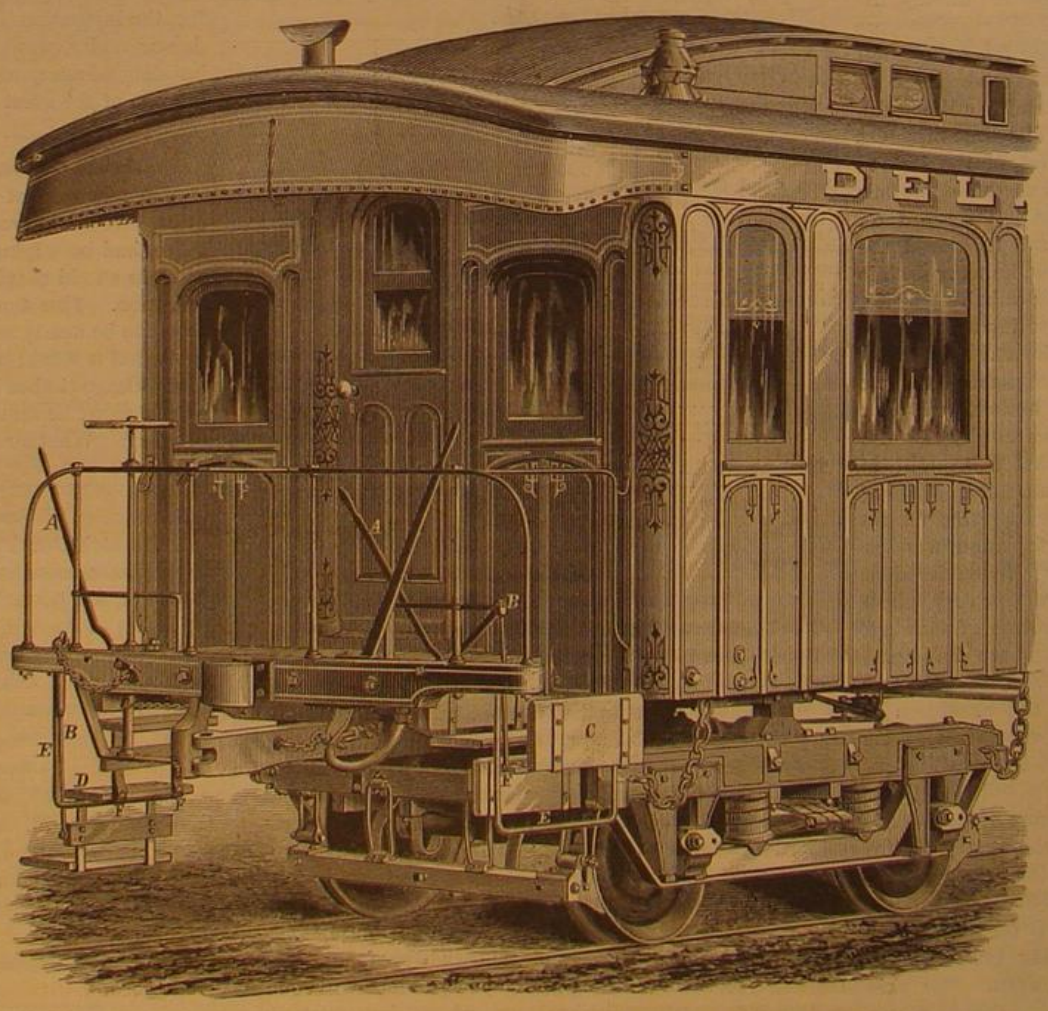
NEW CAR STEP.

The annexed engraving shows an improved folding step applied to passenger cars to facilitate the ascent and descent of passengers from the platform, and to avoid climbing and jumping in getting on and off the cars. The folding step is connected with the lower car step, and when in position for use it is supported, when let down, by a yoke that passes under the fixed step.

The folding step comes within a foot of the ground, and permits of making the risers of all of the steps shorter, and the steps are of course much easier than the ordinary ones. When the train is ready to start the steps are turned up out of the way by means of a lever, which also holds them. In this position the steps cannot be injured or broken off by obstructions on the road or by snow or ice in the winter. Another important feature is that the step when folded up forms an effectual barrier against jumping on or off the train while it is in motion, and prevents a class of accidents that have been alarmingly frequent. Another advantage is that the step may be let down at one end of the car only, thus compelling passengers to enter at that end, and admitting of a more thorough scrutiny of the passengers and a complete inspection of the tickets.

This invention has been thoroughly tested, and the steps are now in use by the Delaware and Hudson Canal Company.

Further information may be obtained by addressing M. E. Skerritt, No. 4 High street Albany, N. Y.



IMPROVED CAR STEP.

Ballasting for Railways.

With reference to "Roadmaster's Difficulties," a correspondent writes that there is no material for ballasting so good as the screenings of coal from mines or yards, either alone or mixed with some hard stone.

NEW STONE-DRESSING TOOL.

The dressing-tool shown in the accompanying engraving was recently patented by Mr. Louis C. Gilmore, of Shearman, Texas. Fig. 1 represents the upper side, and Fig. 2 the under side of the tool, showing the radial and angled grooves. The tool consists of a circular plate having in its upper surface a cavity or basin communicating with the grooves in its under surface by a central aperture. A handle is fixed to the upper surface of the tool at one side of the center. When the tool is in use the cavity in its upper surface is filled with sand or emery and water, and it is moved

GILMORE'S STONE-DRESSING TOOL.

by the handle in an elliptical path, giving it a gyratory motion. This double motion of the tool greatly facilitates the operations of sand rubbing and polishing, and the grooves are of suitable form to distribute the abrasive material to the best advantage, and to retain it until it is used.

This tool is inexpensive, and may be used for the successive operations of sand rubbing, gritting or honing, and polishing.

Where the Cold Waves Come From.

Meteorological observations have now become so extended that evidence is rapidly accumulating to enable us to determine positively the source of the cold aerial waves which sweep across our country during the winter season. The indications are that we owe them to the great area of high barometer in Northeastern Siberia, where the pressure sometimes exceeds 31·50 inches, and the temperature falls as low as 76° below zero. The pole of greatest cold is in the neighborhood of Yokutsk, on the Lena, where the average thermometric reading in January is 41° below zero, and where the severest cold exceeds by ten degrees that experienced by explorers in high arctic regions. This is also the region of the highest barometric pressure known in winter; and from it, doubtless, proceed the waves of intense cold which play so large a part in our winter experiences.

The International Dairy Fair.

The second international dairy fair was opened in the American Institute building, December 8, with a fine display of dairy products, cattle, and machinery. The exhibits included butter, cheese, dairy cattle, implements and machinery for butter and cheese making, and agricultural designs and models for creameries, cheese factories, dairy buildings and farms.

In his opening address Mr. Francis B. Thurber gave the following facts and statistics collected by him during a recent visit to Europe:

The number of milch cows in Germany, as given by the latest statistics, is	8,961,221
In France	4,513,765
Great Britain and Ireland	3,708,766
Denmark	800,000
Sweden	1,356,576
Norway	741,574
Switzerland	592,463
While in the United States the latest statistics and estimates make the number of milch cows about	13,000,000

The quantity of butter and cheese per cow produced in the different countries varies so largely that no trustworthy average can be made, and the statistics, which embody only the quantities exported and imported, give but little idea of the total production. Some idea of the magnitude of the interest, however, may be formed from the fact that in this country alone, during the year 1878, three hundred and forty million pounds of cheese were produced, and nine hundred and sixty million pounds of butter. Of this but 3·9 per cent of the butter was exported, while of the cheese 41·6 was exported. Denmark, with but sixty million pounds total production of butter, exports thirty millions, or 50 per cent.

These export figures illustrate an important fact—namely that American dairymen have appreciated and catered to the tastes of cheese consumers in the great market of the world, Great Britain, while they have neglected to study the wants of the same consumers of butter. There is undoubtedly a difficulty in transporting butter long distances and delivering in perfect condition, but this is a difficulty which can be overcome, at least in a great degree. The great difficulty has been that so small a proportion of the immense production of butter in the United States has been of good quality, that really fine butter has commanded higher prices at home than abroad, and there is quite a sufficient quantity of poor butter to be found in most of the foreign markets.

Butter makers in other dairy countries have, however, made great progress in improving their product, and the average quality is much better than it was five, or even three years since. Improved dairy appliances and machinery, much of it of American origin, have been extensively introduced both on the Continent and in Great Britain; more attention has been paid to using the best salt; governmental dairy schools have been established in the continental dairy countries, even Russia having the enterprise to take this step, and scientifically educated dairymen are furnished by these schools to the principal dairy districts of their respective countries. Margarine butter, or oleomargarine as it is called here, has also assisted in bringing about this result, as it competed successfully with the poorer grades of ordinary butter, and obliged European butter makers to make an effort to produce a superior article.

In Great Britain, the amount of intelligent effort which is being directed toward the improvement of dairy products, especially butter, is surprising, and if American butter-makers would enlarge their foreign market, they must in the same manner strive to increase the supply of good butter which is produced, and thereby lower prices to a point which will enable us to compete in the principal butter markets in the world. That we have the ability to do this no one can doubt who knows the progressive spirit of the American people. Touching the scope for profitably enlarging the variety of cheese made in this country, Mr. Thurber remarked that a prominent English dairy authority has said that "cheese is made in the dairy," meaning thereby that almost any variety of cheese can be manufactured in countries other than those in which it originated. This has been proved by the successful manufacture in the United States and in France of the Gruyère, which, as we all know,

originated in Switzerland. It has also been proved by the successful manufacture in Russia of the English Cheddar and the Dutch Edam cheeses, and even the odorous Limburg confirms this assertion, for its manufacture has been so successfully domesticated in the United States by our German fellow-citizens that, as suggested by a member of the Paragraphers' Association, "the difference from the imported article cannot be told unless you are off to the windward three miles."

THE SEA SERPENT ACCOUNTED FOR.

BY DANIEL C. BEARD.

The New York Sunday *Sun* of November 30 gives the following description of the Sandy Hook monster, as related by eye witnesses, who are all members of a Sandy Hook life saving crew:

Samuel Kittell was the first to see it. He says: "I looked out and saw a large head and portions of the body of a most terrible looking monster. It was wriggling slowly along like a snake, the head and several portions of the body showing above the water. It was not a whale, as there was not more than twelve feet of water where it was, and a whale as large as that would necessarily have been in view all the time. But this thing would disappear altogether at intervals. No fin could be seen anywhere on the back. The body looked round and much larger than a pork barrel. It was of a blackish-brown color. I am sure it was not a whale, but cannot say what it was. It was a stranger to me."

THE SANDY HOOK SEA SERPENT.

George Lohsen makes the following statement: "I took the glasses and ran down to the water's edge and leveled the glasses at the monster's head. The front of the head was square, with a projection about two feet long extending from the top of the head. The eye was seven or eight inches in diameter, of a shiny black, and it appeared bulged out considerable. There looked to be a white rim around it. The animal's length was at least 300 feet from the head to the tail, as seen by us, not making allowances for the crooks in the body."

Harry Foster, another of the crew, says: "I got up and looked out, and saw the devilishest looking fish I ever put my eyes on. It was moving along about as fast as a man could walk. I took a pair of strong glasses and followed it along the beach. It was not more than 300 yards from the shore. With the glasses the head looked as large as a hogshead. The front of the head looked square, and was about three feet high, with a projection two feet long extending from the top of its head. The eye toward the shore was as large as the top of my hat, was shiny black, and had a white edge. It had a very fierce look. . . . From the head to the tail it was at the least calculation 300 feet long. It was moving along the water the same as an eel. The head and several parts of the body were constantly out of the water. It was some species of serpent. It was certainly not a whale. . . . This thing did not spout, and showed no fins on any part of its body excepting on the tail, which was formed like that of an eel."

Well authenticated facts now prove that nature produces monsters as wonderful and startling as the most vivid imaginations of the romancer can invent. Victor Hugo's devil fish has its counterpart in the great cephalopod which was for a long time on exhibition in the New York Aquarium.

There is no doubt, in my mind, that the monster lately seen off Sandy Hook by the crew of the life-saving station was no other than a large cephalopod. That these animals often attain enormous dimensions is a well established fact, but that this one was "three hundred feet long" is scarcely probable.

One seen in the neighborhood of Van Diemen's Land is described as resembling a cask, its long arms having the appearance of snakes wriggling upon the surface of the water. This creature, says Kent, was probably a large poulpe or octopus. In December, 1861, the crew of the French corvette Alecton, engaged in battle with a calamary, whose body alone was estimated to be twenty feet in length, and its weight 4,000 pounds! It escaped, leaving a portion of its flabby body in the possession of the brave sailors, who were only restrained from following it in small boats by the officer in command, Captain Boyer.

October 26th, 1863, two fishermen noticed off Great Bell Island, Conception Bay, what they supposed to be a large bale of goods from some wreck. It was not until they actually struck it with a boat hook that they saw the terrible staring eyes of an immense poulpe; two of its numerous arms were thrown across the boat; one of the men severed these with a hatchet, the creature then moved off backwards. The amputated arms left in the boat were brought to St. Johns. The Rev. Mr. Harvey, who was the first to examine and describe these limbs, found that one fragment measured nineteen feet, although a large portion of it had been destroyed before it was rescued from the fishermen, and there is no way of determining how much more remained attached to the body of the animal.

Many other well authenticated instances could be enumerated to prove the immense growth of this family of marine monsters, but those given are sufficient to establish the fact that these "monarchs of the ocean," as Kent calls them, do exist, and that their main characteristics are as follows:

1st. The body is large and round, and described as resembling sometimes a cask, and again a bale of goods.

2d. The eyes are large and staring.

3d. The arms or tentacles are of great length, and have a snake-like appearance and motion.

On comparing these peculiarities with the descriptions of the Sandy Hook leviathan, as obtained through the enterprise of the *Sun* from eye witnesses, the similarities, even to the expressions used, will be apparent.

The fin, or what was supposed to be the serpent's tail, can be readily accounted for by the fact that in some species of the cephalopod the longest tentacle widens and flattens at the end, and might easily be mistaken for a caudal fin. When moving through the water these animals bring their many arms together in a line, thus affording the least possible resistance, and propel themselves by ejecting water from their siphons.

Imagine one of these horrible creatures, with its sac-like body half submerged in the shallow water, its large protruding eyes above the waves, swimming with its long snake-like arms or tentacles trailing far behind, and you have a very fair picture of the wonderful gigantic hydrophidian or marine serpent of which we have had such thrilling accounts.

A Singular Specimen.

Mr. E. L. Wood, of Eastland City, Texas, sends us a drawing and description of a curious bone, through which passes an iron ring, now on exhibition in a drug store in that town. It appears to be a shank bone, the iron band being so interlocked with it that to separate them one or the other would have to be cut or broken.

Mr. Wood says: "The side of the bone encircled by the band has a smooth appearance, while its opposite side is rough and serrated. The band is about 12 inches in circumference, 2 inches wide, 3/8 of an inch thick, and is beveled from its upper edge downward. At the square opening near where the bone is supposed to have joined the hoof, and extending upward several inches, is a porous formation, of the appearance and consistency of bone. Did the iron band pass through the foot and ankle, and is this linking together the result of ossification?"

The Last Number.

This issue closes another volume of this paper, and with it several thousand subscriptions will expire.

It being an inflexible rule of the publishers to stop sending the paper when the time is up for which subscriptions are prepaid, present subscribers will oblige us by remitting for a renewal without delay, and if they can induce one or more persons to join them in subscribing for the paper, they will largely increase our obligation.

By heeding the above request to renew immediately, it will save the removal of thousands of names from our subscription books, and insure a continuance of the paper without interruption.

New Tanning Materials.

We translate the following paper from the *Chemiker Zeitung:*

The number of the tanniferous matters introduced into trade has been of late decidedly increased. This result is due in part to the penetration of travelers into uncultivated lands, and partly to the fact that the old traditional astringents have become scarcer and dearer. The oldest known and formerly almost exclusively used wares, such as oak bark and sumac, are now insufficient for the demand, so that many substitutes have been found necessary, both in dyeing and tanning. These have almost exclusively been derived from foreign lands. Many were to be found at the Paris Exhibition of 1878, and have excited the attention of practical men. Some of them have since taken a place in the market, and others deserve to be brought into use. This induces us to make a brief mention of some kinds.

Species of Acacia.—These trees, natives of Australia and Africa, are known for their tanniferous bark, their pods, and their gum. The tanning barks known in commerce are nearly all derived from Australia, and are known as mimosa bark. Their percentage of tannin ranges from 15 to 32, but the kinds generally imported average 28 per cent, or two and a half times as much as good oak bark. The Australian kinds are: *Acacia harpophylla*, a very rich sort, from Queensland; *A. cunninghami*, the black wattle, from Queensland; *A. mollissima*, likewise known as black wattle; *A. retinoides*, from Victoria; *A. pycnantha*, or gold wattle; *A. subporosa*, from Victoria and New South Wales, one of the poorest sorts; *A. penninecis*, the hickory acacia, with about 20 per cent of tannin; *A. decurrens*, also called wattle tree; *A. melanolylon*, the black wood of Tasmania and New South Wales; *A. dealbata*, the silver wattle of Tasmania; and *A. leiophylla*. All these species are in use in Australia, and are imported into Europe, and especially into England, under the name of mimosa bark. Those preferred on account of their large proportion of tannin are: *A. harpophylla, mollissima, pycnantha, leiophylla*, and *cyanophylla*, the four latter of which average from 24 to 32 per cent.

The writer remarks that as no German merchant obtains these barks except *via* London, it may be important for German merchants to know that there is a nearer and more convenient source of these valuable barks in Algeria. [Not surely nearer than London?] In this French colony the Australian acacias, and especially the four last mentioned, have been cultivated for some years. The seed pods of the acacias, with the exception of *A. leiophylla*, are very rich in tannin. The production in Algeria is very trifling in comparison to that of Australia, but the plantings are being extended, and the trees grow quickly.

Algeria is a land very suitable for tanning materials; *Pistacia lentiscus* grows there in quantity, especially in the department of Oran. The rind is poor in tannin, but the leaves contain 12 to 15 per cent. This tannin has little color, and might be used by dyers in place of sumac. The leaves are oval, pointed, and are easily ground and extracted.

The rind of the cork tree (*Quercus suber*) is a rich Algerian tanning ware containing from 12 to 16 per cent of tannin. It forms in Algeria extensive woods, but the true bark is never stripped till the trees are too old to yield cork, when they are cut down. This applies also to the cork trees of Sardinia and Spain. The bark is chiefly sent to France, Italy, and England.

The evergreen oak (*Quercus ilex*) is being rooted out wholesale in Algeria to make room for the cultivation of wheat. The kermes oak (*Quercus coccifera*) is being treated in the same way. The root bark is very rich in tannin, and is extensively used for tanning in the south of France.

A bark which at the Paris Exhibition excited some attention by its high percentage of tannin is the suobar. It contains 24 per cent, is obtained from *Pinus halepensis*, and grows in Tunis. It occurs in pieces, which in form and color (?) resemble potsherds. It dyes a brown-green with iron mordants.

Besides the quebracho wood, South America furnishes four other important tan wares. The algarobilla of Chili is the pod of *Balsamo carpum brevifolium*, a tree which grows wild in rocky districts of Chili. The natives gather the fruit before it is perfectly ripe. When they are fully ripe the epidermis breaks easily, and the tannin, which forms a yellow, crumbly layer under it, is lost. The pods are nearly cylindrical, and resemble those of the locust tree. They contain 40 to 60 per cent of tannin, and a small quantity of a yellow coloring matter. The tannin is readily soluble in cold water. The present price is about £28 per ton, but the production does not exceed 200 to 300 tons. The harvest takes place in February. Valparaiso is the center of the trade. It is used in Europe, especially in North Germany, for tanning, and is preferred for uppers and harness leather, as it imparts a peculiar softness. Its importation is at present suspended owing to the war between Chili and Peru.

Chili furnishes two other tanning materials, one of them very important and the other capable of becoming so. The bark of *Persea lingay*, a tree belonging to the family of the Laurineæ, serves in South America, and especially in the Chilian province Valdivia, for tanning the so-called Valdivia leather, which is now imported in quantities. Some years ago attempts were made to introduce this interesting and useful bark into Europe, but unsuccessfully. Now it is imported by way of Hamburg, and has given very good results everywhere. The bark is red-brown, soft, and very porous, and can, therefore, be easily extracted with water. It contains 20 to 24 per cent of tannin, as well as a considerable quantity of a slimy matter, which is very important in tanning operations, as it promotes the swelling of the hides. There is also a small quantity of soft fatty matter of a peculiar odor. In the south of Chili there are inexhaustible forests of the *Persea lingay*, so that we may hope there may soon be found more importers of this useful bark, which by its rapid action in tanning, and by the weight of the leather produced, may assist the European tanners to withstand Chilian competition. While this bark is used for sole leather, the rind of *Laurus peumo* is used in Chili for tanning uppers. This latter bark has not yet been imported into Europe on the large scale.

Another Chilian bark is that recently imported under the name of Churco bark, *Oxalis gigantea*. In the first place this bark is not derived from any species of *Oxalis*, and an *Oxalis gigantea* does not exist. It is now known that this bark is obtained from the roots of a large species of fuchsia (*Fuchsia macrostemma*). The percentage of tannin is on the average 24 per cent, and the color of the watery extract is a dark brownish yellow.

Several other South American barks were to be seen at the Paris Exhibition, which were really worth importation, though they are at present neglected. We mention in the first place the Nancite bark, from *Malpighia punicifolia*. This bark, known also as Manquitta bark, contains from 20 to 30 per cent of a very light colored tannin, and comes from Nicaragua. The same region exhibited the Nacascolo bark, obtained, according to some, from Pernambuco wood (*Cæsalpinia echinata*), and according to others from the divi-divi tree (*Cæsalpinia coriaria*). It contains only about 3 per cent of tannin.

In Venezuela there are also several barks rich in tannin. That of the "roble colorado" (*Tecoma pentaphylla*) contains 27 per cent of tannin, accompanied by a considerable quantity of an orange-red coloring matter, which is also soluble in water. It is met with in large, thick pieces. The mangel bark (*Rhizophora mangel*) comes likewise from Venezuela, and contains, if obtained from young stems, 24 to 30 per cent of tannin, and much red-brown coloring matter. The old, thick bark is poorer in tannin. The cuspa bark, also from Venezuela, is poor in tannin. Peru yields the pods of a shrub, locally known as pay-pay (*Inga fenillei*). They are large, thick, and deep reddish brown, and contain 24 per cent of a tannin, which is almost colorless, and admirably adapted for the uses of the dyer. It deserves to be imported. —*Chemical Review.*

Health at Home.

At the recent Sanitary Congress at Croydon, England, the president, Dr. B. W. Richardson, F.R.S., gave an address on "Health at Home." That there was no place like home was a saying peculiarly appropriate to his subject, for the river of national health must rise from the homes of the nation. He would lay down a few golden rules for securing health at home. First he would put sunlight. Whether your home be large or small, give it light. In a dark and gloomy house one could never see the dirt that polluted it; unwholesome things got stowed away and forgotten, the air became impure, and soon some shade of ill health was engendered in those persons living in the house. Not only was the mind saddened in a home that was not flushed with light, but sunlight was of itself directly useful to health. The practice of placing sick people in dark and closely-curtained rooms was alike pernicious to body and spirit; and, moreover, he had found by experiment that certain organic poisons analogous to the poisons which propagate epidemic and contagious diseases were rendered innocuous by exposure to light.

He would next refer to the allied topic of night and hours of sleep. If it were good to make all possible use of sunlight, it was good equally to make as little use as possible of artificial light. Artificial lights, so far, had been sources of waste, not only of the material out of which they were made, but of the air on which they burned. In the air of the closed room the present commonly-used lamps, candles, and gaslights robbed the air of a part of its vital constituent, and supplied in return products really injurious to life. Gaslight was in this respect most hurtful, but the others were bad when long kept burning in one confined space. The fewer hours after dark that were spent in artificial light the better, and this suggested, of itself, that within reasonable limits the sooner we went to rest after dark the better It was of the greatest importance in a healthy home to let every person have a separate bed, and the clothes should be light and warm. As the bedroom was the room in which one-third at least of the whole life was passed, that ought to be the room on which most trouble after health should be bestowed. The rule followed was the reverse of this. The bedroom should be so planned that never less than 400 cubic feet of space should be given to each occupant, however good the ventilation might be. The walls should be colored with distemper or with paint, that, like the silicate paint, could be washed three or four times a year. The windows should have nothing more than a blind and a half muslin curtain. The floors should have carpets only round the beds, without valances from the beds. The furniture should be as simple and as scanty as was possible, the chairs free of all stuffings or covers that could hold dust. Of all things, again, the room should be kept clear of vestments not in use. From time to time a fire should be made in every bedroom, that a free current of atmospheric air might sweep through it from open doors and windows. Dry scrubbing was by far the best mode of cleansing the floor. An equal temperature of about 60° F. should be maintained, as far as possible, throughout the house, a free access of air, and, above all, dry.

His last rule he would take from the more strict of our Jewish fellow-subjects, that of a complete household-cleansing once a year; the cleansing of every article, great and small; of every wall and floor, door and lintel; and the removal and destruction of all organic refuse, however minute.

The Treatment of Diphtheria.

Dr. Thomas Gurney, senior physician to the City Dispensary, London, makes the following contribution to the *Lancet:*

"Since I have held the position of physician to the City Dispensary I have had considerably more than one thousand cases of disease of the throat under my care, many of which, both in public and private practice, have been cases of diphtheria. About this, by far the most serious disease of the throat, we have much to learn. The stiffness in the neck, the disturbance of the circulation, the rapid rise of temperature, before any affection of the throat is observed, all point to its being a blood poison calling for prompt and decisive treatment.

"The two questions that arise when called to a case of diphtheria, as, indeed, in all diseases, are: How does the disease tend to kill the patient? and, How does nature endeavor to rid herself of the disease?

"Diphtheria tends to kill by suffocation and by its poison exhausting the vital energy. Suffocation may be either accidental, or as a natural result of the throat affection—accidental if, when the membrane is thrown off, it becomes lodged in the larynx; natural if the swelling inside the throat shuts off the supply of air to the lungs. Nature will attain the mastery over her enemy if the strength be kept up and the deposits arrested. With these points to guide us we know that the arrest of the disease and nutritious support are our great aim. To succeed in this I have adopted a respirator made of the ordinary shape and size, the front being minutely perforated. Inside of the respirator I have two or three perforated plates inserted, between which I place common tow (not cotton wool); I then drop on each of the layers of tow ten to twenty drops of a solution of carbolic acid, creosote, and glycerine. Should the patient tire of these, I use turpentine or iodine. I place the respirator over the mouth, and keep it continually applied. My next idea is to provide the patient with warm moist air. To do this I have two kettles of water kept boiling on the fire; attached to the spouts of the kettles I have an elastic tube of an inch caliber, at the end of which is a spray-like nozzle, which I put immediately under the mouth of the patient. By this means I get my disinfectant remedies carried moist to the throat. As a sedative to the pain I know nothing so comfortable to the patient. Previous to this I take care to give an active purge, which usually removes offensive stools of effete, poisonous matter. Internally I give aconite in frequent small doses—two to four minims of the tincture; at the same time freely supporting the strength with milk, cream, and eggs, with or without brandy, and beef tea *ad libitum*. As a drink I recommend patients to take as much chlorate of potash in solution as they can without vomiting. I have found chlorate of potash highly beneficial in all cases of a low typhoid character. If this is objected to, I advise the juice of lemon to be taken—by many thought to be a specific for diphtheria. Should the system be very weak, I prescribe belladonna instead of aconite; but I find better results from the latter. As soon as the urgent symptoms have subsided I order strychnia, with or without nitro-hydrochloric acid—this not only being the best tonic, but also preventing the paralysis which so often follows diphtheria. I have found this treatment to be highly beneficial, but, knowing the tendency there is to rheumatism after this terrible disease, I never forget our friend the bicarbonate of potash."

Zymotic Contagion.

Professor Tyndall asserts that diseases are propagated not by effluvia or sewer gas, but by solid particles discharged into the atmosphere by currents of air or gas. This he proved by the following experiment: He cut up a piece of steak, steeped in water, heated it at a little above the temperature of the blood, then strained off the liquid; in a short time this fluid became turbid, and when examined through a microscope was found to be swarming with living organisms; by the application of heat these were killed, and when the solution was filtered he obtained a perfectly pure liquid, which, if kept free from particles of dust, would remain pure for an unlimited period; but if a fly were to dip its leg in fluid containing living organisms and then into the pure liquid, the whole would be swarming with animalcula in forty-eight hours.

Table Salt an Aperient.

Physicians have for a long time known that common table salt is an efficient aperient in ordinary cases of constipation. In a lecture on a case of nervous affection, Dr. Weir Mitchell, of Philadelphia, said that he had recommended the patient to take each morning on rising a tumblerful of water—cold, to prevent nauseating—in which was dissolved a teaspoonful of table salt.

"This simple aperient," the doctor adds, "I frequently employ in cases of constipation, and generally find it efficient There is great advantage in starting the bowels and in keeping them in a soluble condition, particularly in cases of nervous disorder in women, as it sometimes clears up obscure points in the case, and at all events eliminates one source of error."

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

Fire on the Hearth.—Open grate and warm air furnace combined. Circulars by O.S.& V.Co.,78 Beekman St.,N.Y.

Toulmin's Ellipsograph.—Only instrument that will draw a true ellipse; adjustable to any size. Liberal cash discount. Davis & Watts. M'f'rs, Baltimore, Md.

A Rare Chance to Invest.—A complete outfit for either planing mill or furniture factory. Plenty of power, buildings, land, etc. Price $6,000. Inquire of E. Keeler & Co., Williamsport, Pa.

Direct Castings of Crucible Steel, of perfect integrity, solid, weldable, tough, strong, durable. Superior in quality to any made in America. Special facilities and skill in plow castings. Agricultural wrought steels and irons of every description. Read, McKee & Co., limited, Pittsburg, Pa.

Shafting, etc., a specialty. P. Pryibil, 467 W. 40th, N. Y

For Pat. Quadruple Screw Power Press, see adv., p. 405.

Telephones repaired; parts of same for sale. Send stamp for circulars. P O. Box 205, Jersey City, N. J.

Hub Mortisers; latest improved. Witherby, Rugg & Richardson, Worcester, Mass.

Hand Fire Engines, Lift and Force Pumps, for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y., and 93 Liberty St., N. Y. city, U.S.A.

Machine Drawing Copies, 10 cents each. Descriptive list and catalogue of scientific books sent free by mail on application. E. & F. N. Spon, 446 Broome St., N. Y.

Hangers, Pulleys, etc. P. Pryibil, 467 W. 40th St., N. Y.

The Steam Pipes, Boilers, etc., in the buildings of the New York Tribune, New York Herald, and Harper & Brother, are protected with H.W Johns' Asbestos Boiler Coverings. H. W. Johns Manufacturing Co., 87 Maiden Lane, sole manufacturers of genuine Asbestos Liquid Paints, Roofing, etc.

Millstone Dressing Diamonds. Simple, effective, and durable. J. Dickinson, 64 Nassau St., New York.

Moulding Machine Wanted.—Manufacturers send full description, with price, to T. Reid, Brush Handle Manufacturer, W. Arlington, Vt.

Forges, for Hand or Power, for all kinds of work. Address Keystone Portable Forge Co., Phila., Pa.

Blake Crushers, all sizes, with all the best improvements, at less than half former prices. E. S. Blake & Co., Pittsburg, Pa.

The Friction Clutch Captain will start calender rolls for rubber, brass, or paper without shock; stop quick, and will save machinery from breaking. D. Frisbie & Co., New Haven, Conn

You can get your engravings made by the Photo-Engraving Co. (Moss' process), 67 Park Place, N. Y., for about one-half the price charged for wood cuts. Send stamp for illustrated circular.

Presses, and Dies that cut 500,000 fruit can tops without sharpening. Ayar Machine Works, Salem, N. J.

For Sale.—One Horizontal Steam Engine, 20″ x 48″; one 18″ x 42″; one 16″ x 36″. Atlantic Steam Engine Works, Brooklyn, N. Y.

Empire Gum Core Packing is reliable; beware of imitations called Phœnix. Greene, Tweed & Co., N. Y.

The Baker Blower ventilates silver mines 2,000 feet deep. Wilbraham Bros., 2318 Frankford Ave., Phila., Pa.

Steam Excavators. J. Souther & Co., 12 P.O. Sq. Boston.

Park Benjamin's Expert Office, Box 1009, N. Y. Recipes and information on all industrial processes.

To stop leaks in boiler tubes, use Quinn's Patent Ferrules. Address S. M. Co., So. Newmarket, N. H.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

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

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 406.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Noise-Quieting Nozzles for Locomotives and Steamboats. 50 different varieties, adapted to every class of engine. T. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Eclipse Portable Engine. See illustrated adv., p. 389.

For best Fixtures to run Sewing Machines where power is used, address Jos. A. Sawyer & Son., Worcester, Mass.

Sheet Metal Presses. Ferracute Co., Bridgeton, N. J.

Solid Emery Vulcanite Wheels—The Solid Original 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, N. Y.

Valve Refitting Machine. See adv., page 405.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery. Send for catalogue to Rowley & Hermance, Williamsport, Pa.

Portable Railroad Sugar Mills, Engines and Boilers, Atlantic Steam Engine Works, Brooklyn, N. Y.

Silent Injector, Blower, and Exhauster. See adv. p. 406.

The Paragon School Desk and Garretson's Extension Table Slide manufactured by Buffalo Hardware Co.

Planing and Matching Machines, Band and Scroll Saws, Universal Wood-workers, Universal Hand Jointers, Shaping, Sand-papering Machines, etc., manuf'd by Bentel, Margedant & Co., Hamilton, Ohio. "Illustrated History of Progress made in Wood-working Machinery," sent free.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien M'f'rs, 23d St., above Race, Phila., Pa.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

For Superior Steam Heat. Appar., see adv., page 406.

All makes and sizes of Steam Hammers bored out. L. B. Flanders Machine Works, Philadelphia, Pa.

Brass or Iron Gears; list free. G. B. Grant, Boston.

For best Belt Lacings, use Blake's Belt Studs. The strongest fastening for all belts. Greene, Tweed & Co., New York.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in SCIENTIFIC AMERICAN of this week.

The E. Horton & Son Co., Windsor Locks, Conn., manufacture the Sweetland Improved Horton Chuck.

Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See ad. page 405.

Linen Hose, Rubber Hose, Steam Hose; all sizes. Greene, Tweed & Co., 18 Park Place, New York.

Power Hammers. P. S. Justice, Philadelphia, Pa.

Metallic Pattern Letters to put on patterns of castings, at reduced prices. H. W. Knight, Seneca Falls, N. Y.

For Reliable Emery Wheels and Machines, address The Lehigh Valley Emery Wheel Co., Weissport, Pa.

Steam Engines; Eclipse Safety Sectional Boiler. Lambertville Iron Works, Lambertville, N. J. See ad. p. 406.

Pays well on small investments; Magic Lanterns and Stereopticons of all kinds and prices; views illustrating every subject for *public exhibition and parlor entertainments*. Send stamp for 80 page Illustrated Catalogue. Centennial medal. McAllister, 49 Nassau St., New York.

Patent Steam Boiler Damper Regulator; most reliable and sensitive made. National Iron Works, New Brunswick, N. J.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Electro-Bronzing on Iron. Philadelphia Smelting Company, Philadelphia, Pa.

Improved Steel Castings; stiff and durable; as soft and easily worked as wrought iron; tensile strength not less than 65,000 lbs. to sq. in. Circulars free. Pittsburg Steel Casting Company, Pittsburg, Pa.

The New Economizer, the only Agricultural Engine with return flue boiler in use. See adv. page 405.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Surveying Instruments. G. S. Woolman, 116 Fulton St., N. Y.

Nellis' Cast Tool Steel, Castings from which our specialty is Plow Shares. Also all kinds agricultural steels and ornamental fencings. Nellis, Shriver & Co., Pittsburg, Pa

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) A. D. writes: 1. The cistern water we have here, when tested with the permanganate of potassa (distilled water solution), is of a brick dust color instead of a rose color. What is the cause of this? Is it due to the tinned roof or to the cement of the cistern? A. Probably the latter. 2. Do you know any method of restoring the red color which has faded on my Russian leather portmanteau? A. No.

(2) C. B. asks for a recipe for making a composition that would be hard enough to make pool balls, that would not be expensive, and also a recipe for coloring. A. Melt together over a gentle fire in an iron pot: pitch, 1 part; guttapercha, 2 parts; orange shellac, 5 parts; add to this 6 parts of white lead (lead carbonate) in impalpable powder, and stir until a perfectly homogeneous mixture is obtained; then cast and turn out. Color with the aniline dyes mixed with dilute alcoholic solution of bleached shellac.

(3) G. R. asks how to blue gun barrels. A. This is best done by submitting the barrel to heat until the required color is secured; but it may be done in a manner by applying to the barrel a little nitric acid, and allowing it to act upon the iron until a blue film appears, then wash the barrel thoroughly and oil it.

(4) J. G. asks: 1. Is there an ink that will dry quickly, or if there is not, can there be one compounded that will dry quickly, and print as nicely as that used in printing bank notes? A. Try the following: Shellac, 6 ounces; borax, 1 ounce; water, q. s.: boil together until perfect solution is effected, and triturate with this enough good iron black or nigrosin, to produce the desired color. A little alcohol will make the liquid flow more readily and dry quicker, but an excess must be avoided. 2. Please explain the principle of the steam injector? A. For a full explanation of the injector, see p. 99, Vol. 40, of SCIENTIFIC AMERICAN.

(5) E. P. M. asks: What would be the proper distance to place a bell from the ground, in order to convey its sound the greatest distance? A. A bell should be placed well above surrounding buildings, and if possible above trees. This subject is fully treated on p. 299 of current volume of SCIENTIFIC AMERICAN.

(6) P. B. asks: 1. What should I use to give a white and smooth surface to statues of plaster of Paris, after coming from the mould? A. Warm the cast and suspend it in melted white wax. The operation should be repeated until the wax is no longer absorbed. It is then allowed to become perfectly cool, when it may be polished. 2. How long should plaster of Paris be mixed with water before casting into the mould? A. Sprinkle the plaster into the water with which it is to be mixed. As soon as it settles to the bottom pour off most of the water, stir the mixture, and pour it immediately. 3. Please state what kind of stuff is used to make the plaster figures have a yellow tint (straw color)? A. Mix a little finely ground yellow ocher with the plaster, or stain the dry cast with a tincture of annatto or turmeric.

(7) "Woodworker" asks: Is there any danger of explosion from fire coming in contact with the fine dust of poplar and hard wood, blown through a Sturtevant blower into a shaving receiver or room? Can you give an instance of explosion of fine wood dust? A. There was an explosion of fine wood dust in the Pullman Palace Car Works in Detroit, Mich., a few years since. It occurred under about the same circumstances as you describe.

(8) C. F. C. asks what is the equivalent of a horse power. A. 33,000 lb. raised one foot high per minute.

(9) C. R. P. asks: Can you give us a substitute for alcohol for heating shoemakers' tools? It must heat well and not smoke the iron. A. There are several heaters in market using kerosene as fuel.

(10) W. W. S. asks: Is a building roofed with tin, corrugated iron, or other metal covering, less liable to be struck by lightning than if shingled, and if so, why? A. A building roofed with tin is not less liable to be struck by lightning than a shingle roofed building. If neither house were provided with a lightning rod, the tin roofed building, if struck, would be the safer, because the lightning would be likely to divide and spread over the metal, and find its way to the earth by several different paths on the exterior of the building, water leaders, gutters, etc. The wooden roof offers no such facility as metal for the spread or division of the electric charge, but is apt to tear its way through the building to the ground in one path.

(11) S. H. writes: 1. I have a spring which has 20 feet fall, with 500 feet of ¾ inch pipe running to my house; how much pressure have I? A. 9 lb. per square inch nearly. 2. Will it run a 6 gallon churn, and what kind of a wheel would be best? A. Address makers of water motors who advertise in our columns.

(12) O. J. H. asks: 1. Will the painting of wrought iron steam pipes with one coat of asphaltum varnish diminish permanently the heat-radiating power of such pipes. A. No. 2. Is there any other painting material preferable to asphaltum varnish for the purpose of giving the steam pipes a better appearance and making it easier to keep them clean? A. No. 3. Considering only the economy in fuel consumed for heating by steam, would it be advisable to use no paint of any kind at all? A. All radiating surfaces should have a dark color. Paint will do no harm provided it is dark and not too thick.

(13) J. A. M. asks how to calculate the proper thickness for cast iron head for wrought iron boiler, 36 inches diameter, 75 lb. pressure per inch. I fail to find it in Haswell or any other work of that kind which I have. A. You will find rules in "Wilson on Steam Boilers." In practice the thickness is more the result of experience than calculation, as much allowance must be made for possible defects in casting; the usual thickness is 1⅛ inch to 1¼ inch.

(14) J. N. H. asks: Are graphite, plumbago, and blacklead one and the same thing? A. Yes.

(15) D. R. asks for a method by which to deodorize some pistachio nut hair oil, held by me in bulk, bought in London in 1872. There is only about a quart left, but it has become rancid, and can undoubtedly be deodorized. A. Try the following: agitate the warm oil with about one per cent each of caustic lime and calcium sulphite (sulphite of lime) in powder, defecate, and draw off the clear oil. Repeat the treatment, if necessary.

(16) H. W. writes: I am melting a great deal of pig tin and lead, and soon accumulate a large pile of oxide and dross. Can you give me any information in regard to a proper furnace for smelting this dross, so as to recover the metal in a shape for reusing? A. The metal cannot be recovered from the dross in the way suggested. This dross, which consists chiefly of a mixture of tin oxide and finely divided metal, is usually calcined and sold in this condition as putty powder. The metal can be recovered from the dross by mixing the latter with, say, one third its weight of fine coke or charcoal, and heating the mixture in large luted crucibles gradually to full redness. The reduced metal remaining with the unconsumed carbon may be separated by pounding the mass and sifting out the carbonaceous matters, and remelting the granular metal at a low heat.

(17) F. A. B. asks for the receipt for making what are called Chinese rods, and which upon being burnt diffuse a delightful odor. A. 1. Gum benzoin, 6 parts; balsam of tolu and powdered sandal wood, each 4 parts; powdered tragacanth and labdanum, each 1 part; powdered niter and gum arabic, each 2 parts; cinnamon, 12 parts; light charcoal (linden), 48 parts. Form into a smooth ductile mass by aid of heat, mould and cool. 2. Gum benzoin, olibanum, and storax (tears), each 12 oz.; niter, 9 oz.; charcoal, 4 lb.; moistened with solution of 2 oz. tragacanth in a quart of rose water. To this may be added, if desired, essence of roses, pure neroli or orange powder, 1 oz. Oils of cloves and nutmeg, essence of vanilla, cascarilla, etc., are sometimes added in addition to the foregoing.

(18) G. L. D. asks: What is the greatest depth the sea has been sounded—actual, not supposed? A. 4,655 fathoms by Commodore Belknap, U. S. N., and 4,575 fathoms by the Challenger (English) expedition.

(19) P. C. B. asks: 1. How can eggs be preserved so as to keep good for the winter? A. Pack the eggs in a brine consisting of a saturated solution of salt in lime and water. The lime water is prepared by agitating soft water with enough lime to impart to it a milkiness, allowing this to settle in a covered vessel, and drawing off the clear lime water. 2. How can apples best be kept good from fall to the winter and spring? A. The apples to be preserved should be selected with due regard to their time of ripening. A Rhode Island greening, for instance, which ripens in January, can by the following method be preserved in good flavor until March or April, but not longer, whereas a northern spy, golden, or Princess Russell, or any late ripening variety, can be preserved in full flavor until the following August or September, though they must be promptly used after opening. The method of preserving the fruit is as follows: Select only perfect fruit, envelope each tightly in two separate wrappings of any thin paper, pack them in clean firkins or air tight barrels, and head them in securely, air tight. Thus packed apples may be preserved in a perfectly sound condition for a year or more, though, as before remarked, if kept much beyond their regular time of ripening they will lose in flavor. 3. Which is the best way to preserve whole heads of cabbage so as to keep good in the winter and spring? A. Keep them in a dry place, in well aired barrels. 4. I have a copper ore which assays as follows: Copper, 63·76; iron, 10·50; sulphur, 25·37; gangue, 0·10; total, 99·93. The ore carries about 1 3-5 ounces gold per ton (=0·005 per cent) and some silver. How can I best and cheapest smelt it, say 75 or 100 lb. ore at a time? A. It will probably be necessary to chlorinize the ore and submit it to the amalgamation process. Consult Phillips' "Metallurgy of Gold and Silver."

(20) A. C. writes: I have been trying to make some varnish, but have failed so far, and want to know what is wrong. I put two ounces of bleached lac into a bottle, and covered with alcohol; it swelled, and I added alcohol till it filled a pint bottle. It is now a curdy mass with some fluid on the top of it. I warmed it and stirred without effect. What is the matter? A. Try 95 per cent alcohol.

(21) C. R. asks: Could I convey ground tan bark from the mill to leaches by means of a blower; if so, how should it be applied? A. The tan bark can be propelled by a blower if it is dry. If it is mixed with water, a centrifugal pump should be used. If you employ a blower, the bends in the pipe which conveys the tan bark should be of long radius.

(22) S. B. F. writes: We have a machinist that says a belt will slip less on a pulley that has not been turned than on a very smooth pulley. Is he correct? A. According to the experiments of Hoyt & Co., a belt will drive about 50 per cent more on a polished face iron pulley than on one with a rough face.

(23) A. E. F. asks: Why is it that the light side of the new moon appears larger to the naked eye than that portion made visible by the earth's light? The line of the moon's surface is seen in the bright position, corresponding in size to the outlines of the dark side. It being supposed that the moon has no atmosphere, how do the sun's rays produce this effect? A. The phenomenon observed by you is called irradiation. It is due to the fact that impressions of bright objects on the retina extend beyond the outline of the image. Irradiation differs in different people, and even in the same person it is different on different days. It also increases with the luminosity of the object. The electric light affords a marked example of this phenomenon. The source of light, which is scarcely more than a mere point, appears a miniature sun. An incandescent platinum wire looks many times larger than its actual size.

(24) A. B. C. asks for the best compound or simple substance with which to impregnate baked wood for insulators for telegraph lines. A. Plunge the wood for a few minutes in hot paraffine.

(25) E. H. S. asks: Is a telegraph wire a protection to a building if the wire is well insulated and has good ground connection? A. It might be a protection, but it would be very limited, as a telegraph wire of the usual size is not large enough to conduct a heavy lightning discharge.

(26) J. E. K. asks: 1. Does the density of the atmosphere affect the velocity of falling bodies? A. Yes. 2. To illustrate: Suppose a cup of water or oil to be suspended in the top of an air receiver in which there is a pressure of 60 lb. per square inch, if the cup was upset, would it require a longer time for the fluid to reach the bottom than it would if the air was of ordinary atmospheric density? A. It would.

(27) B. A. asks: Which is preferable for bolting foot blocks to joists, overhead—¾ bolts extending through block and joist with nut on end, or, ⅝ wood screws extending through block and into joist 6 or 8 inches, sound hemlock joists—*i. e.* I mean which would be the easier drawn down or out—joists 12 inches thick? A. Through bolts and nuts are to be preferred; but if you use wood screws they should be at least ⅛ inch larger than the bolts.

(28) B. F. T. asks: 1. How can I make a paint for crockery, etc., that hot water will not wash off? A. Porcelain (or white ware) may be painted in enamel, that is, the design painted in metallic oxides and burned in (see Spon's Practical Receipts). Any ordinary paint that can be applied will not stand much washing, especially if hot water and soap are used. 2. How can I paint on cloth without sizing it and not have the paint spread? A. It is necessary to use size, unless the cloth is waxed.

(29) G. E. W. asks: What mode of measurement do you get the tonnage of a ship? A. You will find rules for tonnage in "Haswell's Engineer's Pocket Book."

(30) S. A. S. asks: How can I clean rust from the iron plates of a hydraulic press, so as to leave the plates perfectly clean and free from chemical odors? A. Try dilute sulphuric acid, say 1 part of acid to 10 of water. Wash the plates thoroughly after the application of the acid.

(31) S. E. W. asks (1) if lump lime will slake in oil. I want it for painting a large ice house as an improvement on whitewash. A. The slaking of lime is due to the formation of a hydrate of lime—to which reaction water is essential. Lime may be made into an emulsion with oil, but this emulsion is very different from the hydrate formed by water. 2. Also please send me the number of your paper that contains a description for making rubber stamps. A. See p. 1226, No. 83, SCIENTIFIC AMERICAN SUPPLEMENT.

(32) M. B. S. B. writes: My engine cylinder is 3½ inches long by 1½ inches in diameter. What sized boiler do I require? A. Your boiler should have from 10 to 15 feet fire surface, according to the pressure you wish to carry and speed of engine.

(33) E. A. D. P. asks: 1. What is meant by aperture? Is it the diameter of the object glass, or the opening of the diaphragm in the eye piece? A. It is the diameter of the clear or exposed portion of the objective. 2. For an object glass of 2½ or 3 inches diameter, how many lenses, of what size, and how far apart (measured perpendicular to their plane sides), will form the best eyepiece for ordinary astronomical purposes? A. You do not give focal length of your objective. It is probable that the answer to J. W. S. (14), p. 408 of current volume, will assist you.

(34) L. P. B. writes: I desire to send a stream of oxygen through water. Please inform me how I may do the same? A. Pass a glass tube from the oxygen reservoir to the bottom of the vessel. When the gas is placed under a light pressure it will force its way through the liquid.

(35) C. R. M. writes: I have an 80 horse power boiler, carrying 65 lb. of steam, runs a 65 horse engine, also supplies jacketed kettles, coils in tanks for heating water, steam tables, etc.; they are all connected to a narrow steam trap that discharges into a tank. Near the tank I have a double connection, by which I can shut the water from the tank and catch it in a pail and weigh it. Now, how many pounds of water per hour discharged by said trap ought to constitute one horse power? Can you give me a standard and reliable rule? A. There is no rule which will apply; a fairly good steam engine will furnish one horse power by consumption of 23 lb. steam. We think you might assume 22 to 24 lb. water per horse power.

(36) A. P. asks: 1. What tension will ½ inch boiler stand? A. It depends upon the diameter of the boiler and quality of the iron. 2. At what density does sea water form a deposit? A. Deposits of lime will commence, say, at 1½ densities by salinometer, and of salt at about 2½ densities. 3. How far from the first row of tubes must the gauge cocks be? A. 3 to 4 inches. 4. How will salt and fresh water act when being mixed in boilers? A. The mixing will tend to make the water foam.

(37) F. W. D. asks how photographers prevent the disagreeable odor from collodion, etc., from becoming prominent? I cannot use it without scenting up all the surroundings. A. The odor cannot be diminished or cloaked; the annoyance is obviated by using the collodion only in a well ventilated closet.

(38) M. E. H. asks for the process of treating ships' sails so as to preserve them from mildew and decay. A. Saturate the fabric with a boiling solution of curd soap 3 lb., water 5 gallons. Press out excess of the solution between rolls, and digest for two hours or more in a solution of lead acetate 3 lb., water 2 gallons. Finally rinse well in water and dry rapidly without over-heating.

(39) H. K. & J. O B.—Ordinary so called washing fluid is prepared by warming together one part of washing soda (commercial carbonate of soda) and two parts of lime in about 30 parts of soft water, and after the suspended carbonate has entirely subsided decanting the clear liquid for use. Aqueous solutions of water glass, soap, starch, chlorinated soda, borax, etc., are often added in various proportions.

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

N. B.—No 1, feldspathic rock containing crystals of hornblende. No. 2, mica schist. Nos. 3 and 4, hornblende schist. No. 5, quartz and hornblende. No. 6, feldspar.—D. D. B.—Magnetite; if free from phosphorus and titanium an excellent iron ore.—A. S. T.—It is an impure ferruginous clay of little value.

[OFFICIAL.]

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FOR WHICH

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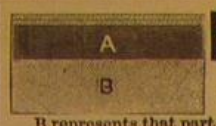

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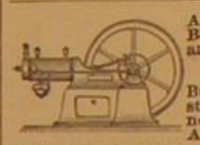

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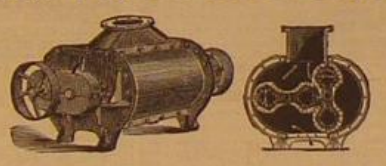

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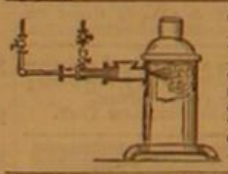

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