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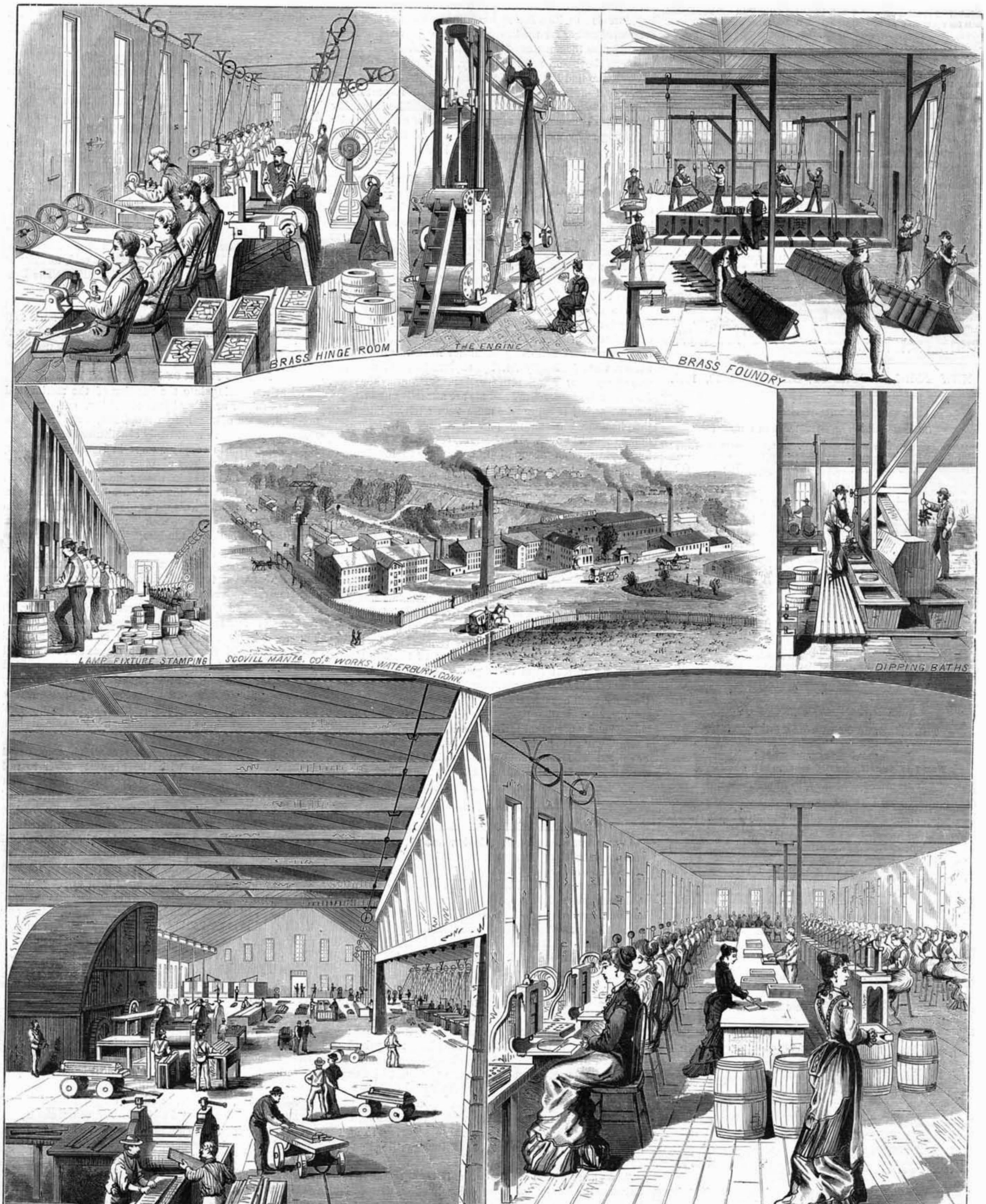

BRASS WORKS OF THE SCOVILL MANUFACTURING COMPANY.—[See page 380.]

Scientific American.

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NEW YORK, SATURDAY, DECEMBER 13, 1879.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 206,

For the Week ending December 13, 1879.

Price 10 cents. For sale by all newsdealers.

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 staunchest 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, however, 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.

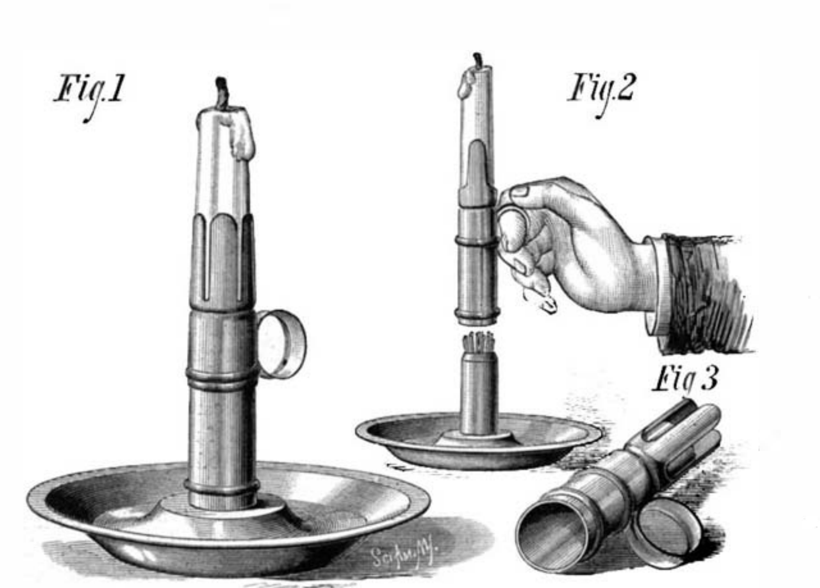
NEW CANDLESTICK.

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.

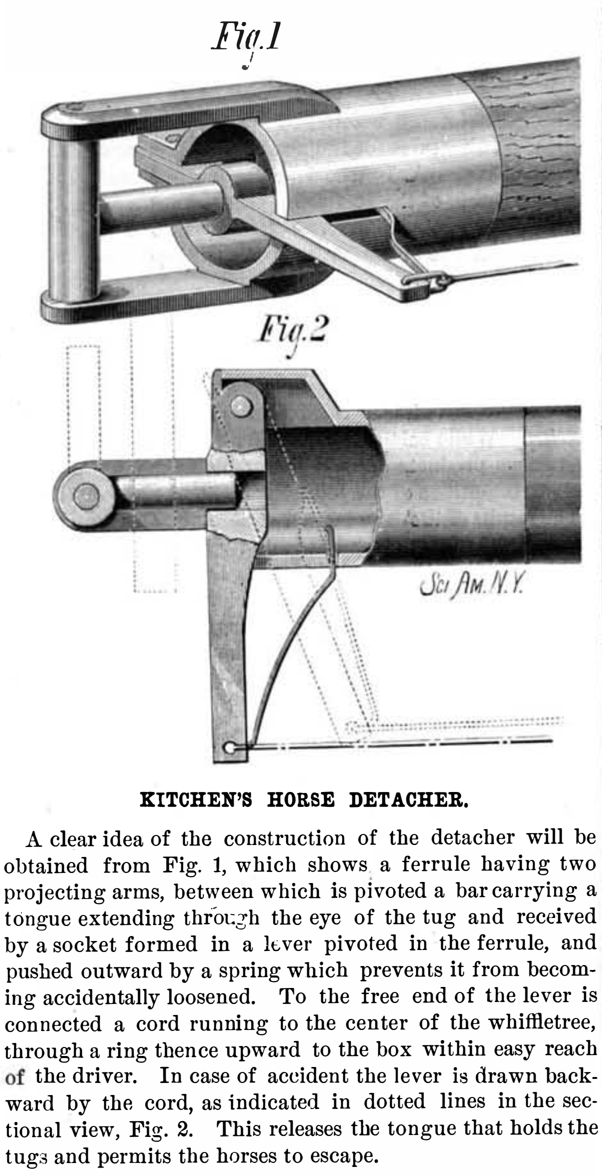
TO NEUTRALIZE the sting of a gnat or mosquito, French sportsmen rub the part affected with a little *cerumen*, that is, the wax of their ear, extracted by the little finger.

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 1869—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.

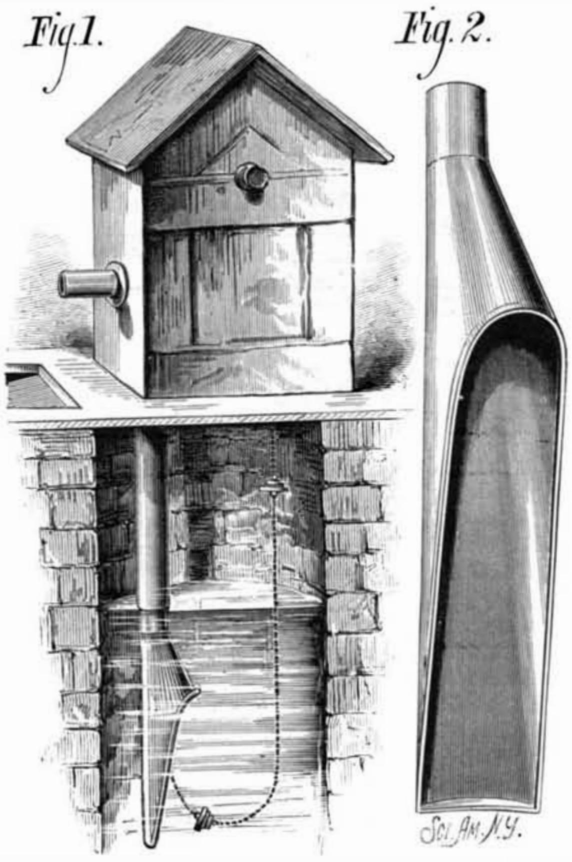
THE ST. LOUIS BRIDGE.

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	253,968	39·4

GRAMME 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.
0·675	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).

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.
0·973	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	839,454	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 " $\frac{130 \times 130}{1 \times 1} \times 5 \times \frac{44 \cdot 3}{33000} = 11$ H. P.," and in the second, " $\frac{130 \times 130}{5 \times 5} \times 4 \cdot 5 \times \frac{44 \cdot 3}{33000} = 4$ 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 co-efficient 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, $H = C^2 Rt$, 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 $26^2 \times 5 \times 60 \times \frac{\cdot 73726542}{33000} = 4 \cdot 53$, or about 4½ H.P. in the entire circuit, while in the external circuit we shall have $26^2 \times 4 \cdot 5 \times 60 \times \frac{\cdot 73726542}{33000} = 4 \cdot 077+$, 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.

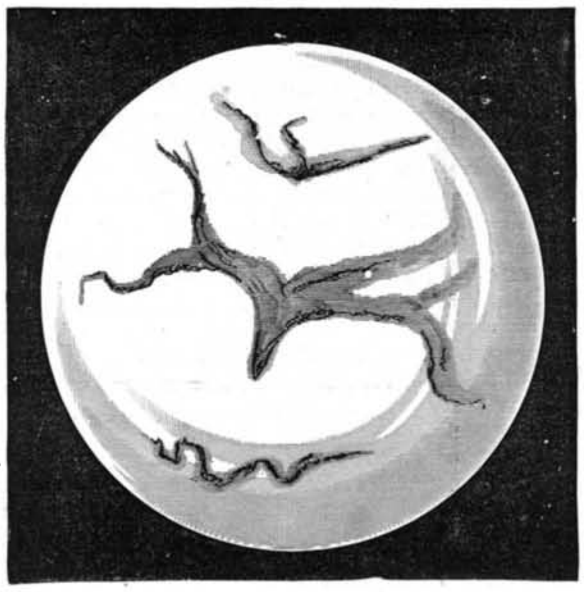
There is no doubt but Philadelphia will at some future day draw its supply from the Perkiomen by gravitation, and were it not for the traditional slowness of the city it would have done so before this time. The improvements in the supply of New York, by the construction of large impounding reservoirs 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.

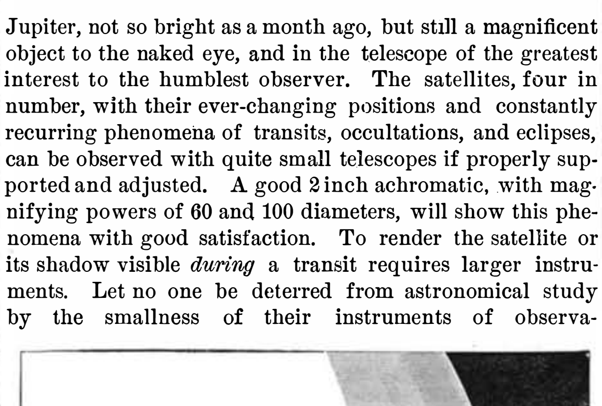
To the Editor of the Scientific American:

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.

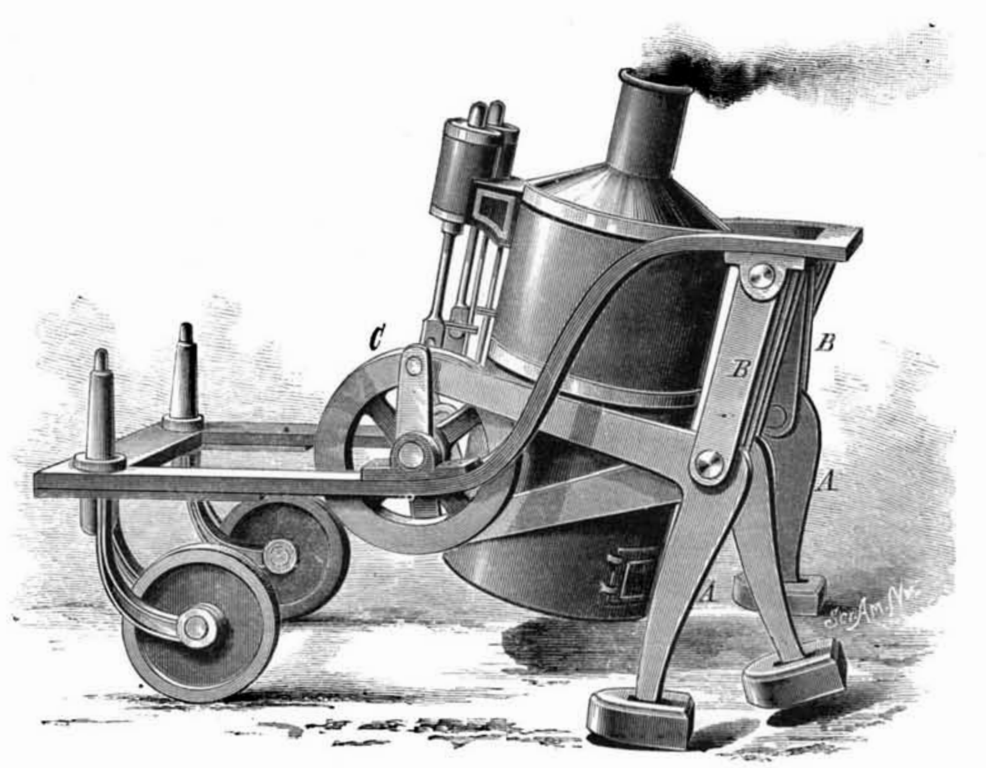
Mr. George E. Passage, of Nunda Station, N. Y., has patented an improved device for adjusting the shoe to give any desired inclination to the sieve or screen, and which shall be so constructed that the said shoe may be adjusted while the machine is in motion, so that the operator can see the effect of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

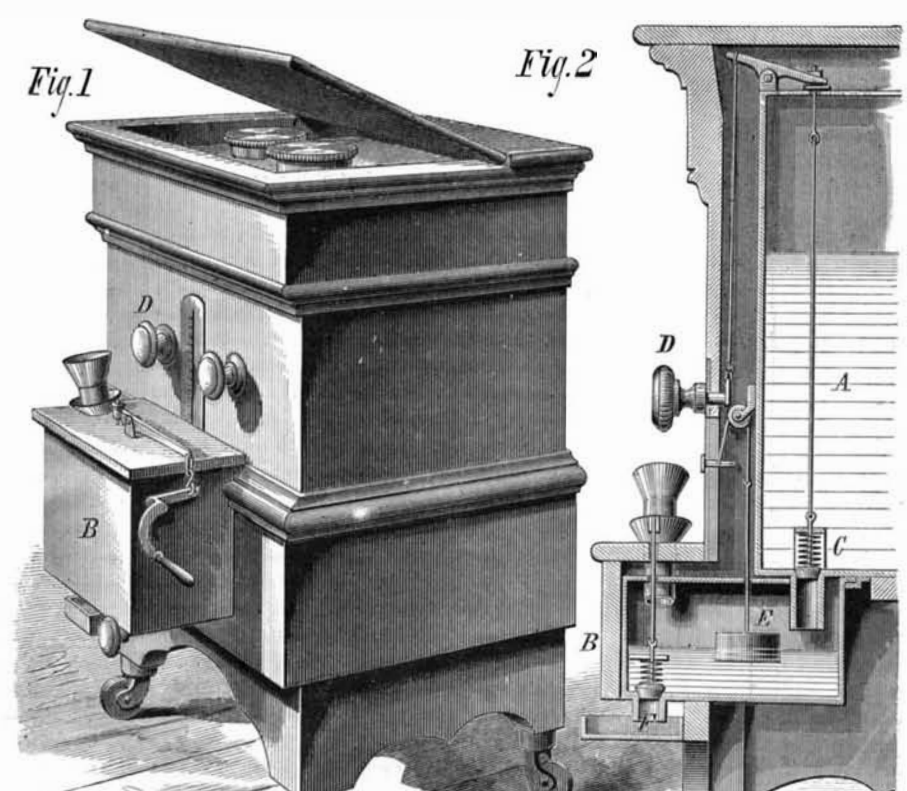


PRAUL'S TRACTION ENGINE.

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 mosses 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.

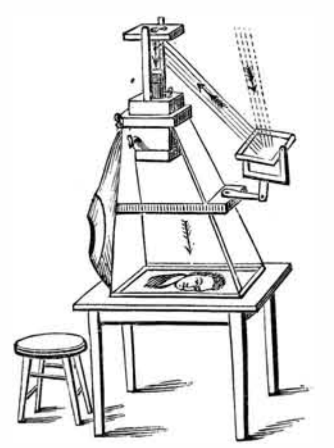
PLATT'S TRACING APPARATUS.

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.

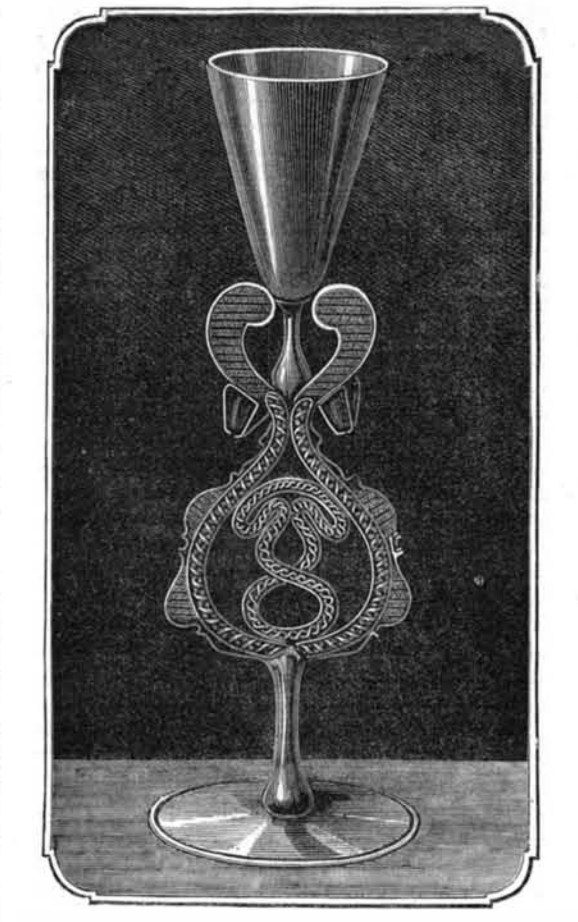
Some time since the Académie des Sciences offered a prize of 2,500f. for a method of satisfactorily and permanently silvering mirrors, and which should save the workmen the danger of exposure to the effect of mercurial vapors. The prize has been awarded to M. Lenoir, whose process is substantially as 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.

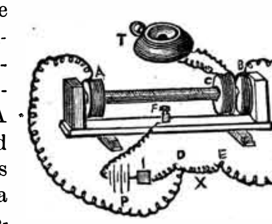
The most celebrated Venetian mirrors that have been preserved are those presented by the republic to the kings Henry III. and Francis I. of France. They are slightly convex, very thick, and set in frames of solid silver, gold, and damascened steel, about 30 inches high, 25 inches wide, and decorated 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 ℥ 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.*

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 flourishing 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, 75×2×2½feet=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.

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1880. 1880. 1880.

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