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AN IMPROVED MOUNTAIN RAILWAY SYSTEM.

The construction, maintenance, and operation of mountain railways have long occupied the attention of engineers. Many methods of climbing steep inclines and of rounding curves of small radius have been proposed, and several of these methods have been reduced to actual practice. The systems of Fell and Riggenbach are very well known, and the ancient system of rope tramways is in use in many places. A distinguished engineer, M. L. Edoux, has conceived a project which is based upon the application of a system of hydraulic elevators to the lifting of cars to any height. This system may be applied to great advantage, when an abundance of water under high pressure is available. These conditions will be frequently met in a mountainous country. Although this project has not yet been realized it seems to possess sufficient merit and novelty to render it interesting to our readers. The illustrations have been specially arranged for the SCIENTIFIC AMERICAN from the author's plans, elevations, and sectional views.

The particular railway under consideration is intended to establish communication between Cauterets and the baths of La Raillère, France. Cauterets is situated in a narrow valley, at an elevation of more than 900 meters. It is a noted water-

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IMPROVED SYSTEM FOR MOUNTAIN RAILWAYS.

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NEW YORK, SATURDAY, JANUARY 29, 1881.

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 265,

For the Week ending January 29, 1881.

Price 10 cents. For sale by all newsdealers.

THE TENDENCY OF RECENT COURT DECISIONS WITH REGARD TO REISSUED PATENTS.

The patent laws provide for the reissue and correction of patents when the original is inoperative or invalid by reason of a defective or insufficient specification, or by reason of the patentee claiming as his invention or discovery more than he had a right to claim as new, provided it is shown that the error arose from inadvertence, accident, or mistake, without any fraudulent or deceptive intention on the part of the patentee.

The matter to be introduced into the amended specification is limited strictly to such as was clearly indicated, described, or suggested in the original specification, drawings, or model, and such as might have been lawfully claimed, but was not, for the reasons mentioned.

The practice of the Patent Office has been less exacting on this point than the rules prescribe, so that in many cases the reissue specifications have contained substantially new matter; sometimes matter which the patentee might lawfully have inserted and claimed originally, but failed to, through ignorance or oversight, and sometimes matter which had been disallowed by the Office or voluntarily disclaimed by the inventor to secure the issue of his patent. By means of such reissues the inventor's afterthoughts and discoveries have been covered, and too frequently the subsequent inventions of others, or processes and machinery which others may have brought into profitable use, knowing them to be not patented. In this way much injustice has been wrought, and occasion given for many if not most of the more serious complaints against the patent system.

At first the courts were inclined to hold that the decision of the Commissioner of Patents in granting the reissue was final and conclusive, and could not be revised. More recently there has been a manifest disposition to go behind the Commissioner's action to inquire whether he may not have exceeded his jurisdiction or improperly performed his duty in granting a reissue for more than was covered by the original patent. Thus in the case of Leggett *et al. vs.* Avery *et al.* (U. S. Supreme Court, October, 1879), it was held that no error had arisen through inadvertence, accident, or mistake, but that the Commissioner had committed manifest error in allowing the reissue for more than was included in the extended patent, and for what was expressly disclaimed therein. In this decision Mr. Justice Bradley remarked that the allowance of claims once formally abandoned by the applicant in order to get his patent through is the occasion of immense frauds upon the public, and is to be discountenanced. In the same connection he said:

"It is doubtful whether a reissue patent can be sustained in any case where it contains claims that have once been formally disclaimed by the patentee, or rejected with his acquiescence in order to obtain his patent. In such case the rejection (omission) of the claim can in no just sense be regarded as matter of inadvertence or mistake, and even if it were such the applicant would seem to be estopped from setting it up on application for a reissue."

In the case of the Giant Powder Company *vs.* the California Vigorite Powder Company *et al.* (U. S. Circuit Court, District of California, October, 1880, Field, J.), the right of the court to review a decision of the Patent Commissioner was clearly stated. In this case a reissued patent was declared invalid because its specification contained an invention of broader scope than the original. The court said:

"As the power to accept a surrender and issue new letters is vested exclusively in the Commissioner of Patents, his decision in the matter is not open to collateral attack in a suit for the infringement of reissued letters. His action, like that of all officers specially designated to perform a particular duty of a judicial character for the government is presumed to be correct until impeached by regular proceedings to avail or modify it. He must judge, in the first instance, of the sufficiency of the original specification whether the same is defective in any particular, whether such defect was the result of an unintentional error, and if so, to what extent a new or additional specification should be allowed to describe correctly the invention claimed; and it is to be assumed in every case that he has done his duty. The decisions of the Supreme Court to this effect are numerous, and the doctrine is one of the settled rules of patent law. But it does not preclude the examination of the original and reissued patents, to see whether or not they disclose on their face a case in which the Commissioner had authority to act or whether he has exceeded his authority in issuing letters for an invention different from that described in the original patent."

The Commissioner's authority to reissue being limited strictly to those cases in which the original patent is inoperative or invalid from unintentional error, or where the inventor's claim exceeds his invention, the fact that the patent does not cover all that the patentee could have claimed if his specification had come up to his invention, furnishes no sufficient ground for a reissue.

"The statute authorizing a reissue," the court said, "was intended to protect against accidents and mistakes, and it is only when thus restricted that it can be regarded as a beneficial statute. If the patentee does not embrace by his specifications and claim all that he might have done, and there has been no clear mistake, inadvertence, or accident in their preparation, the presumption of law is that he has abandoned to the use of the public everything outside of them, or at least has postponed any additional claim for further consideration."

The same principle was laid down even more specifically by the United States Supreme Court, in the case of the Swain Turbine and Manufacturing Company, appellant, *vs.* Ladd. This was another instance of expanded claims in a reissued patent. The original specification was as perfect, so far as it went, as the new one, the pretended corrections having been introduced to widen the scope of the patent to give its owners a large and valuable monopoly of an important class of waterwheels. In the Circuit Court of the United States for the District of Massachusetts, the claims of the reissued letters patent had been restricted to the distinct limitation of the invention in the original patent, and that decision was sustained by the Supreme Court. In the opinion of the court, delivered by Mr. Justice Bradley, it was pointed out that "the mistake of the patentee or his assignees seems to have been in supposing that he was entitled to have inserted in a reissued patent all that he might have applied for and had inserted in his original patent. The appellants produced on the argument exhibits tending to show that the patentee before obtaining his original patent had made and done all those things which are embraced in or covered by the reissued patent. If this were true it would be nothing to the purpose. A reissue can only be granted for the same invention which was originally patented. If it were otherwise a door would be opened to the admission of the greatest frauds. Claims and pretensions shown to be unfounded at the time might, after the lapse of a few years, after a change of officers in the Patent Office, the death of witnesses, and the dispersion of documents, be set up anew, and the reversal of the first decision obtained without an appeal and without any knowledge of the previous investigation on the subject. New light breaking in upon the patentee as the progress of improvement goes on, and as other inventors enter the field, and his monopoly becomes less and less necessary to the public, might easily generate in his mind an idea that his invention was really more broad and comprehensive than had been set forth in the specification of his patent. It is easy to see how such new light would naturally be reflected in a reissue of the patent, and how unjust it might be to third parties who had kept pace with the march of improvement. Hence there is no safe or just rule but that which confines a reissued patent to the same invention which was described or indicated in the original."

If an unswerving adherence to this rule can be secured in the practice of the Patent Office it is obvious that a grave, perhaps the gravest source of objection to the patent system will be stopped. In the meantime the growing disposition of the courts to review the action of the Commissioner in reissuing patents, in cases of alleged infringement under them, and to construe the reissued patents rigorously, is a matter of much encouragement to manufacturers and the public at large.

OFFICIAL REPORT ON THE STEAMER ANTHRACITE.

We have received from the Bureau of Steam Engineering of the Navy Department, a copy of the full official report of the Board of U.S. Naval Engineers, relating to the tests of the machinery of the little British steamer Anthracite, made at the Navy Yard, Brooklyn, N. Y., August 13 and 14, 1880. The board was composed of three Chief Engineers of the U. S. Navy, namely, Chas. H. Loving, S. L. P. Ayres, and Geo. W. Magee, all gentlemen of ability and experience.

The Anthracite, it will be remembered, is an iron steamer, 86 feet 4 inches long, 16 feet 1 inch wide, 10 feet 2 inches deep, draught loaded, 9 feet. The total weight of engines, boiler, shaft, propeller, and all fittings was 25 tons. Her propeller was worked with three steam cylinders, the first, single acting, 7¾ inches diameter; the second, single acting, 15⅛ inches diameter; the third, double acting, 22⅛ inches diameter. Stroke of pistons, 15 inches. The most novel feature—the Perkins system—was the high steam pressure intended to be carried, namely, from 300 to 500 pounds to the square inch. The pressure now usually carried on the best sea going vessels rarely exceeds 75 to 80 pounds.

In a previous running trial of the Anthracite in England, by Mr. F. J. Bramwell, C.E., May 22, 1880, with a boiler pressure of 360 pounds, the total horse power per hour was obtained by an expenditure of 16,719·1503 units of heat F. (1·35 pounds combustible used).

In the Brooklyn trial, made with the vessel tied to the wharf and with a boiler pressure of 316½ pounds to the inch, the total horse power per hour was obtained by an expenditure of 20,498·22 units of heat F. (1·92 pounds combustible used).

Mr. Bramwell's results were 18·35 per cent more economical than the Navy Yard results. The reasons for this difference are clearly shown by our engineers to be due to the differences in the conditions of the two trials. Thus, the coal used by Mr. Bramwell was superior; he did not lose heat by throwing open the furnace doors to remove clinker; he carried a lower water level, and consequently superheated the steam more, and had less cylinder condensation; he carried a higher boiler pressure, and so obtained a higher initial pressure in the first cylinder, etc. If the proper calculated deductions for these differences in the conditions were allowed our engineers find that there would be a discrepancy between their results and those of Mr. Bramwell of only 4 per cent; they are further of opinion that the difference of the results was wholly due to the difference in the cylinder condensations; these being greater in the American trials gave poorer economic results. Our engineers speak very highly of the Perkins system, as shown by their trials of the Anthracite. They think that her successful passage of the

Atlantic and the efficient condition of her machinery on arrival here ought to remove all doubt as to the practicability of the system.

THERMOMETERS.

The word thermometer means a heat measure, hence any instrument employed to measure heat should be called a thermometer. When very high temperatures are to be measured, the instruments employed are called pyrometers, or measures of fire. Thermometers do not, of course, measure the quantity of heat in a body, but only tell us the relative temperature. There are several forms of thermometers, all based upon the principle that "heat expands, while cold contracts." Some substances expand unequally for equal increments of temperature, others expand so slightly that they fail to indicate small changes of temperature; both are unfitted for thermometers. It is believed that air expands equally for equal changes of temperature, and as this expansion is quite considerable (1-273d part for each degree centigrade), and as it does not become either liquid or solid under ordinary pressure, at any temperature which we can produce, it is the substance employed for the most accurate measurements of temperature. Any of the difficultly condensible gases, oxygen, hydrogen, marsh gas, might be employed instead of air, but with no advantage and with much inconvenience in their manufacture.

Next to air, the best material we have is mercury, which expands very evenly, does not freeze readily, and boils at a comparatively high temperature. For temperatures below —40° alcohol is generally employed, although it is claimed that glycerine could be used. For temperatures above 300° C. air thermometers alone are admissible; and for very high temperatures, where glass begins to soften, they are made of platinum.

The mercury thermometer, being the one usually employed in the arts, in meteorology, in medicine, and in other sciences, a few words in regard to the manner of making one may be of interest. A glass tube with a very fine bore has a suitable bulb, of any desired form, blown upon one end. At the other end may be a bulb of larger size, blown merely for convenience in filling. Neither bulb can be blown with the mouth, but with a bellows, containing pure, dry air. A small capsule is filled with pure mercury, which is heated to boiling to expel both air and moisture. While still hot the second or temporary bulb is warmed to expel a portion of the air therein; the open end is placed in the mercury, which ascends into the bulb because the air contracts on cooling. When a sufficient quantity of the hot mercury has been introduced into this bulb, the tube and the other bulb are heated to expel a part of the air, and some of the mercury, which must always be kept hot to prevent its chilling and thus breaking the hot glass, enters the real bulb. By repeating the operation the bulb and stem are completely filled with mercury, which is then boiled to expel every trace of air. The tube is now drawn out close beneath the auxiliary bulb to a fine thread and cut off; the thermometer is placed in a bath heated a few degrees higher than the highest temperature which the thermometer is to show; the excess of mercury flows out, and the point is closed with a fine blowpipe flame. As the mercury contracts on cooling it leaves a perfect vacuum above it.

The graduation is effected by putting it into ice or snow, then in the steam from boiling water, marking each of these points, dividing the space between into 100 parts if it is to have a Celsius or centigrade scale, into 80 if a Reaumur, or 180 if a Fahrenheit. This graduation is carried on in each direction to the end of the stem. On the Fahrenheit scale the freezing point is marked 32, on each of the other scales it is marked zero.

Absolute zero is a term applied to a temperature 273° below zero on the centigrade scale, or —460° Fah. If we take 273 cubic inches of air, or any gas, measured at 0° C., it will become 274 at +1° C., or 283 at +10° C., or 373 at +100° C., and at —10° C. it is only 263, at —40° it is only 233, and at this rate it should become only 1 cubic inch at —272°, and at minus 273° it should occupy no space at all, or at least not be a gas any longer. As this temperature is not yet attainable, we cannot positively assert that such would really be the case.

Maximum thermometers are made by placing a little float of steel upon the mercury, and the thermometer placed horizontally or nearly so. As the mercury expands it pushes along the float, which does not, however, follow the mercury when it contracts; hence we are able to ascertain the highest temperature reached during any given interval. To reset the thermometer it is raised to a vertical position and a slight tap given to it, which causes the float to drop down on the mercury again.

A simple and more accurate form of maximum thermometer, employed by Bunsen in measuring the temperature of the Geysers, consisted of an ungraduated thermometer open at the top, such as could easily be made by a person of but little experience. When placed in the spring, of course, a portion of the mercury would flow out and escape. At any subsequent time the thermometer could be placed in an oil bath beside a standard thermometer, and heated until the mercury had entirely filled the tube and was about to flow over; at this moment the standard thermometer is read, and shows the temperature to which the other thermometer had been exposed. The ordinary minimum thermometer contains alcohol instead of mercury, and the float is either of glass or of steel covered with enamel, so that it is drawn back by adhesion, but cannot be pushed forward.

The most reliable form of self-registering thermometer is an upright mercurial thermometer behind which is passed by clockwork a strip of sensitized paper. In front of it is placed a light of sufficient actinic power to blacken the paper above the mercury column. This gives not merely the maxima and minima but all variations of temperature.

Metallic thermometers may be constructed by combining two metals which expand unequally into a spiral, which winds up when heated and unwinds when cooled. One end of the spiral being attached to an index which passes along a graduated arc, the slight motions are magnified so as to be distinctly visible. It is graduated by comparison with a good mercurial thermometer.

For measuring slight changes in temperature a thermo-electric pile, connected with a galvanometer needle, is employed. This is only applicable within very narrow limits and requires great care to obtain satisfactory results.

E. J. H.

HYDRAULIC MORTARS AND CEMENTS.

Certain limestones, which contain upward of 10 per cent silica, possess the property, when burned, of forming a cement or mortar which hardens under water. Such limestone is called hydraulic lime, and the mortar is called hydraulic mortar. This stone, before burning, consists of a mixture of carbonate of lime and silica, or a silicate, chiefly silicate of alumina. The latter is insoluble in hydrochloric acid, hence remains undissolved when the stone is treated with this acid, but in burning this silicate is fluxed by the alkaline carbonates and becomes soluble in acid, the carbonic acid being expelled. When common lime is slaked it swells enormously and develops a great deal of heat; this is not the case in slaking hydraulic lime, which absorbs water without any considerable increase of temperature of volume.

If ordinary lime be mixed with a suitable quantity of silica or sand, an artificial hydraulic mortar is obtained, to which we apply the name of cement. These cements may be either natural or artificial. The former are found in volcanic regions, having been produced by the terrestrial heat. Pozzuolana, found at Pozzuoli, near Naples, is a natural cement of the following composition: Silica, 44·5; alumina, 15·0; lime, 8·8; magnesia, 4·7; oxide of iron, 12·0 (with oxide of titanium); potash and soda, 5·5; water, 9·3; total, 100·8.

The quantity of lime is, however, so small that it requires to be mixed with ordinary lime to form hydraulic mortar. It was employed in combination with an equal quantity of lime in building the Eddystone Lighthouse.

Artificial cement, also called "Roman cement," because it is *not* made in Rome, has been manufactured in England on the Thames and in the Isles of Wight and Sheppey since 1796. It is made by burning the calcareous nodules which overlie the chalk in that country. A sample analyzed by Michaëlis contained: lime, 58·38; magnesia, 5; silica, 28·83; alumina, 6·40; oxide iron, 4·80. When mixed with water it hardens in fifteen or twenty minutes, and possesses great firmness and strength.

Portland cement was patented in England by Joseph Aspdin in 1824. He took the limestone of Leeds, pulverized and burned it, then mixed it with water and an equal weight of clay to a plastic mass. When dry this was broken up and burned again until all the carbonic acid was all expelled. It was then pulverized and was ready for use. Pasley made it from chalk or limestone with Medway River clay, which contains salt. Pettenkofer suggests that cement is improved by soaking the clay in salt water.

Portland cement is now made, says Wagner, by making bricks of an intimate mixture of limestone and clay, drying them in the air and burning them in a tall shaft furnace from 45 to 100 feet, 12 feet in diameter, with a strong grate 4 feet from the bottom. It is charged with alternate layers of coal and cement stone. The properties of the cement are largely dependent on the temperature employed in burning; a white heat is best, but if the temperature is too high it will no longer unite with water, and may even be melted to a glass. If the temperature does not exceed a red heat it unites readily with water and gets hot, like ordinary lime, but possesses very little strength. The color changes with the burning and forms a criterion for judging the quality. In normal condition it forms a gray, sharp powder, with a shade of green, but not glassy.

The manufacture of Portland cement is now carried on in every part of the world where limestone and clay are to be found. In order to obtain a good cement, not only must the proper heat be employed in burning, but the proper proportion of clay, usually 25 per cent, must be used, and the clay must have certain properties, such as a large proportion of silica, must be very finely divided, and must be very intimately mixed with the limestone. Analyses of Portland cement from various sources show the percentage of lime to vary from 55 to 62; silica, 23 to 25; alumina, 5 to 9; oxide of iron, 2 to 6; soda and potash, usually less than 1 per cent.

A calcareous marl found near Kufstein forms a natural Portland cement on burning without any other admixture. The analysis shows that it contains 21·77 per cent of insoluble substance containing 16 per cent of silica. The portion soluble in hydrochloric acid consists of 70·64 carbonate of lime; 1·02 carbonate of magnesia; oxide of iron, 2·58; alumina, 2·86. These figures lead us to expect that a marl containing from 20 to 25 per cent of insoluble matter, with 70 of carbonate of lime, will probably furnish a good cement when burned. The presence of much magnesia seems to have in all cases an injurious effect; all excellent hydraulic lime contains very little magnesia.

Erdmenger, who has studied the constitution of Portland cement very carefully, concludes that it is not a definite chemical compound. He considers it rather as water glass, in which the alkali is replaced by lime.

A consideration of the use of Portland cement in the manufacture of artificial stone would exceed the limits of our present article.

H.

GENERAL GRANT AS PRESIDENT OF THE WORLD'S FAIR COMMISSION.

General Ulysses S. Grant was chosen permanent President of the World's Fair Commission, at a meeting of the Commissioners held in this city January 13. It was announced that he had consented to serve.

General Grant's ability as an executive officer is known the world over; and probably no other name would have carried so much influence at home and abroad. With a leader so well known, popular, and capable, the Commission should be able to raise promptly all the money needed to secure at Inwood, in 1883, an exhibition worthily representing the progress of the world since 1876.

SOLAR CLOUDS AND SUN SPOTS.

Some recent studies of solar spectra in connection with sun spots and other features of the sun's envelope have led Mr. Charles S. Hastings, of the Johns Hopkins University, to form a somewhat novel theory of the sun's constitution and the conditions producing the more notable phenomena familiar to solar students.

Mr. Hastings finds, contrary to the received opinion, that the spectra of the center and the outer edge of the sun's disk are not precisely alike, though the differences are so minute as to escape all but the most perfect instruments and all methods which do not place them in close juxtaposition. Certain of the Fraunhofer lines, the thickest and darkest in the spectrum, notably those of hydrogen, magnesium, and sodium, which appear with a haze on either side in the spectrum of the center of the solar disk, are sharp and distinct in the spectrum of the limb. Certain very fine lines are stronger at the limb, while other very fine lines are stronger at the center. The ordinarily accepted theory of the solar constitution and the origin of the Fraunhofer lines fails to explain these phenomena. The probable reasons for this failure Mr. Hastings discusses at considerable length in the January issue of the *American Journal of Science*, and then proceeds to frame a theory of the sun's constitution, which, he thinks, will satisfactorily explain all the observed phenomena. The limit of our space forbids more than the briefest summary of his conclusions.

His theory differs from that of Faye chiefly in localizing the phenomena of precipitation instead of regarding it as proper to all portions of the photosphere, and in supposing the precipitation confined to one or two elements. He attributes the granular appearance of the solar surface to ascending currents directed generally from the center of the sun. About these currents are necessarily currents in an opposite direction, which serve to maintain a general equilibrium in the distribution of mass. The ascending currents start from a level where the temperature is probably above the vaporizing temperature of every substance. As they move upward the vapors are cooled, mainly by expansion, until a certain element (probably of the carbon group) is precipitated. This precipitation, restricted from the nature of the action, forms the granules. The precipitated material rapidly cools, on account of its great radiating power, and forms a fog or smoke, which settles through the spaces between the granules till revolatilized below. It is this smoke which produces the general absorption at the sun's limb, and the "rice grain" structure of the photosphere. The reasons for supposing the precipitated element to be of the carbon group (carbon or silicon) is simply that no other substances present the properties indicated by the cloud masses of the photosphere. It is pretty clear that the substance has a boiling point above that of iron, for iron vapor at a lower temperature exists in its immediate neighborhood. The element is not a rare one, and its molecular weight cannot be great, for though precipitated below the upper natural limit of its vapor there are few elements found in abundance above it, and those in general of low vapor density. It is possible that the light coming from the sun is radiated from solid or liquid particles of carbon just at the point of vaporization; but Mr. Hastings is rather inclined to suspect that the photospheric material is silicon. There is also good reason to suppose, he thinks, that carbon is precipitated at a higher level, possibly along with the less common element boron.

The clouds of carbon or other smoke would naturally be drifted into spaces of downward flowing currents, thus forming sun spots, the characteristics of which are readily accounted for by the necessary behavior of smoke clouds sinking into regions of higher temperature. This explanation of sun spots and their allied phenomena is certainly plausible, and we shall look with interest for what older students of the sun shall have to say about it.

THE MATANZAS INTERNATIONAL FAIR.—Mr. Benjamin Giberga, general agent for the United States of the approaching Cuban World's Fair, announces that the opening day has been definitely fixed for February 10, 1881.

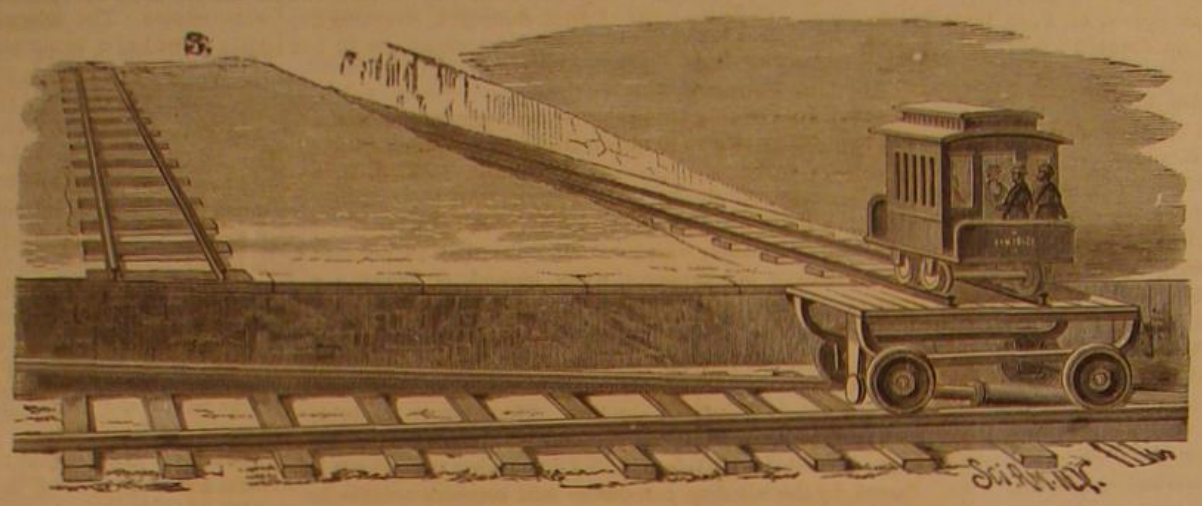
AN IMPROVED MOUNTAIN RAILWAY SYSTEM.

[Continued from first page.]

ing place, and during the season is filled with numbers of invalids, who go there in search of health. The hot sulphur springs for which this region is noted, are located at La Raillère, 125 meters higher up the mountain, and more than 915 meters distant.

To travel over this fatiguing route, to go and return, often twice in the same day, in the capricious weather of the mountains and in the crowded omnibuses, is uncomfortable and even dangerous for infirm persons. The waters cannot be conveyed from La Raillère to Cauterets without modifying their temperature and their chemical composition to which their therapeutic properties are due. It is, therefore, necessary to convey the sick to the springs that they may receive the full benefit of the water. This railway has been projected for the purpose of conveying the bathers from Cauterets to La Raillère rapidly and comfortably.

All systems, with the exception of that of M. Edoux, require the consumption of a large amount of fuel, which in this region is very expensive. This inventor utilizes the powerful waterfall at La Raillère, which, in connection with gravity, constitutes the motive power of the railway.



MOUNTAIN RAILWAY SYSTEM.—TRANSFERRING THE CAR.

The mode of operating the railway is as follows: The car is raised vertically by means of hydraulic elevators to a greater height than its destination, which, in the present case, is La Raillère, and is then allowed to descend as far as that place by its own gravity upon an inclined railway. To return, the car is transferred by its own gravity to a second railway inclined in the opposite direction. The cars are provided with efficient brakes, by means of which the speed may be effectually controlled.

In practice, the car is not raised the vertical distance of 125 meters at a single lift, but this distance is divided into five parts of 25 meters each. There are five towers at intervals of about 40 meters. In each one is placed a hydraulic elevator, similar to those introduced by M. Edoux into the hotels and houses of Paris. The top of each tower is a little more elevated than the foot of the next one, and is connected with it by an inclined bridge. The car is raised by the hydraulic elevator to the top of the first tower, runs by its own gravity to the base of the following one, is raised to the next level, and so on. Together they form a gigantic staircase with steps 25 meters high. The last landing place is 135 meters above Cauterets.

The return way, which is on the side of the mountain, terminates in the second tower. The cars descend vertically only in the first two towers, which contain two compartments, one for hoisting the car and one for lowering it.

At La Raillere the inclination of the car is reversed, and the car is transferred to the return track by means of a platform supported on wheels and provided with rails. The car on arriving from Cauterets rolls upon the platform. The latter moves by its own gravity on rails slightly inclined in opposite directions (see Fig. 3), so that when the rails of the platform join the return track their inclination will have been reversed, and the car will, of its own gravity, return to the second tower. The movement of the transferring car is controlled by a hydraulic piston. The gradient of the railway to La Raillere is 0·005125 per meter, and of the return road 0·043961 per meter.

The department engineers prefer this plan to all others. The question of construction will be taken up at the next session of the Chambers.

NEW MECHANICAL MOVEMENT.

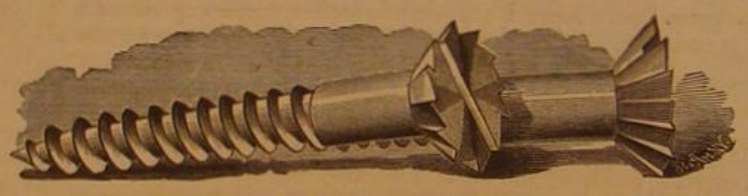
The engraving represents a novel mechanical movement for converting a continuous rotary motion into an intermittent rotary motion. The driving shaft carries a triple sprocket wheel, which is keyed on or otherwise fastened, and the driven shaft has three sprocket wheels, two of which are secured to it, while the third is movable on the shaft. The endless chain which connects the chain wheels of the two shafts is made of three separate sections —a median section alternating with two outer sections arranged parallel to each other and separated by a space equal to the width of the openings in the narrower section. This chain thus formed, as will be noticed, is double for a portion of its length, while the remainder is single.

When the driving shaft is revolved the chain is carried forward at a regular rate of speed. When the single portion of the chain comes into contact with the loose central sprocket wheel on the driven shaft, only the loose wheel is revolved, the shaft remaining stationary; but when the double portion of the chain engages the outer wheels, which are fixed on the driven shaft, the shaft is revolved until the double portion of the chain has passed over it, when it rests until engaged by another double portion. By means of this ingenious contrivance the driven shaft may be rotated either regularly or irregularly according to the relative proportion of double and single chain. This movement should find a ready application in textile machinery, and in fact in all classes of machines where intermittent rotary motion is employed.

This invention was recently patented by Mr. William P. Drew, of Preston, Minn.

IMPROVED WOOD SCREW.

The engraving shows a self-countersinking wood screw, recently patented by Mr. John Eckford, of San Antonio, Texas. It will work in all kinds of wood, and clears itself of the chips made in boring. The screw has on the underside or bevel a series of bits or cutting edges alternating with deep interspaces, which completely fill the under surface of the head. These notches increase in width and depth from the screw shank to the crown of the head. This form allows the chips to escape readily.

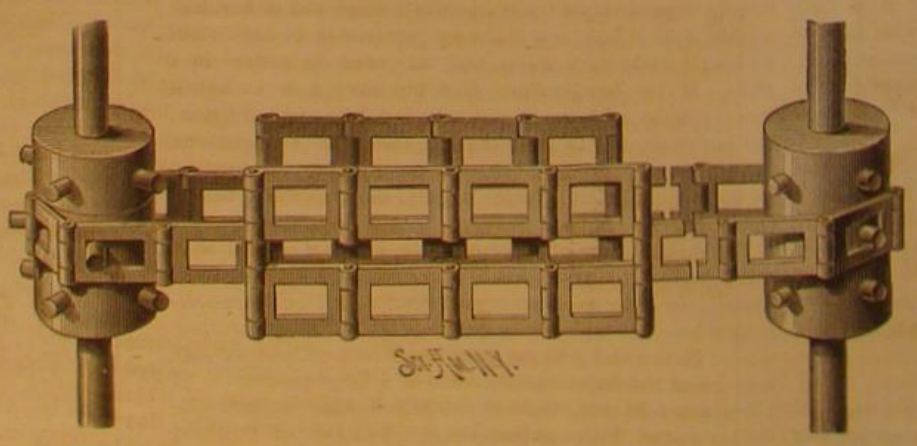


ECKFORD'S IMPROVED WOOD SCREW.

The cutters are formed on the screw head by forcing it while hot into suitable dies. In other respects the manufacture of this screw does not differ from that of the common form. In use, this form of screw saves a great deal of time and insures a good fit between the head and the wood in which it is bedded.

RECENT INVENTIONS.

An adjustable tension, with sufficient power for springs for folding or cabinet bedsteads, is secured by a spring patented by Mr. Herman A. J. Rickett, of New York city. This is a spiral spring sustained at one end and having a shaft connected with the opposite end and extending through the coil. On the free end of the shaft is a drum on which winds a belt extending to and connected with the hinged bed. Two of these arrangements for each bed are preferably used. The tension of the spring can be adjusted by shortening the belt.



DREW'S MECHANICAL MOVEMENT.

A rotary engine, patented by Mr. Gabriel Jasmagy, of Brooklyn, E. D., N. Y., is a cylinder with interior slotted cylinder half the diameter of the exterior cylinder, mounted on shaft journals in the end pieces of the outer cylinder. The slotted cylinder has overlapping sliding piston plates provided at the ends with a pin and pivoted curved guide bar fitting in an annular groove on the inside of the end pieces of the outer cylinder, which devices draw the piston plates inward and outward, forming a piston of variable size as the shaft rotates.

An improved machine for packing boned hams and shoulders has been patented by Mr. William Hoefjen, of New York city. The invention consists of a cylindrical receptacle, the upper half of which is pivoted on its longitudinal edge and is provided with a lever lock, by means of which the lid can be gradually closed, compressing the meat in the cylinder; the meat is then further compressed by closing the front of the cylinder by means of a suitable disk and driving a piston forward, after which the disk at the front of the cylinder is removed, and an envelope of suitable material is drawn over the front of the cylinder; into this envelope the meat is forced by the piston.

A gate that may be opened by an approaching vehicle or by a person on horseback without dismounting, and closed in the same manner, has been patented by Mr. Nathan Scarritt, of Kansas City, Mo. The invention consists of a gate made in two like sections that are pivoted on horizontal axes, and of novel mechanical devices for operating the gate sections.

A simple and amusing game that can be played by any desired number of persons, and does not require any special skill to understand its operation, has been patented by Mr. Niels C. Larsen, of New York city. The invention consists of a spirally-grooved cone contained within a figure with an aperture in its upper part, which figure rests upon a flat conical base having a spiral groove provided with a series of numbered recesses in its upper surface, so that a small ball that is passed into the aperture of the figure will run through the spiral grooves of the cone and along the spiral grooves of the base, and will finally stop in one of the numbered recesses a greater or less distance from the end of the spiral.

Mr. George O. Keiter, of Spring City, Pa., has patented a meat and vegetable cutter so constructed that the substance to be cut is fed to the cutter automatically. The cutters can be adjusted to cut thicker or thinner slices, and can be used to slice substances smaller than the cavities of the feed boxes.

An improved copybook, which prevents the scholar from copying his own writing as he approaches the bottom of the page, and enables him to see and study the original copy very distinctly, has been patented by Elmer P. Newman, of Dimondale, Mich.

A sand guard for car axle boxes, patented by Mr. Henry Roth, of New York city, consists in a band fastened upon the inner end of the journal box, and open at the lower side. The opening in the inner end of the box is thus protected from sand.

A fire escape, patented by Messrs. Eduard Kamin and Heinrich Egberts, of Bremen, Germany, seems to be simple, compact, and reliable. It is of the life rope variety. The velocity of descent is regulated by a vibrating balance mechanism.

Mr. Gorham N. Winslow, box 290, Newton, Mass., has patented an improved velocipede or tricycle in which the driving wheel is propelled by hand power, connection being made between the crank shaft and drive-wheel shaft by a shaft and bevel gearing.

An improved glass button and a mould for attaching the eye thereto, has been patented by Mr. August Hamann, of Hoboken, N. J. In this improved button the strain upon the eye is distributed through the cap, which is firmly attached to the glass at all parts of the circumference of the cap.

Mr. Erwin B. Newcomb, of Cumberland Mills, Me., has patented an improved machine for winding paper and similar materials from a loose condition into hard rolls, especially materials of a brittle nature—such as, for instance, enameled paper, which is usually wound by hand on account of its liability to curl at the edges and become broken.

A device for stretching and smoothing thread, more especially of silk in twists, sewings, embroidery, organzine, and tram, has been patented by Messrs. Lewis E. Leigh and Lewis Leigh, of New Haven, Conn., whereby through special construction of the bobbin stand and cap and correlated appliances, an even tension of any desired degree upon all threads in the different processes of manufacture is secured.

SIMPLE MAGIC LANTERN.

All that is required for this apparatus is an ordinary wooden packing box, A, a kerosene hand lamp, B, with an Argand burner, a small fish globe, and a burning glass or common double or plano-convex lens, C. In one end of the box, A, cut a round hole, D, large enough to admit a portion of the globe, E, suspended within the box, A, with the lamp, B, close to it. The globe is filled with water from which the air has been expelled by boiling.

Now moisten the surface of a piece of common window glass with a strong solution of sulphate of soda, or even common table salt, dissolved in water, and place it vertically in a little stand or clip, as shown at F, so that the light from the lamp, B, will be focused on it by the globe, which in this case answers as the condenser. The image of the glass will then be projected on the wall or screen of white cloth, W, providing the lens, C, is so placed in the path of the rays of light as to focus on the wall or screen. In a few minutes the salt solution on the surface of the glass, F, will begin to crystallize, and as each group of crystals takes beautiful forms, its image will be projected on the wall or screen, W, and as it is watched it will grow, as if by magic, into a beautiful forest of fern-like trees, and will continue to grow as long as there is any solution on the glass to crystallize. Then, by adding a few drops of any of the aniline colors to the water in the globe, the image on the screen will be illumined by shades of colored light.

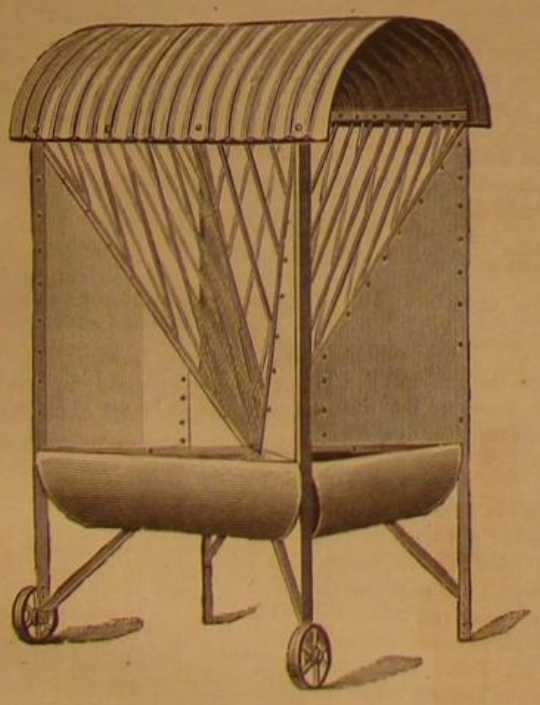
SIMPLE MAGIC LANTERN.

Powerful Pumping Machinery.

The San Francisco *Bulletin* announces the completion at the Risdon Iron Works of the largest pumping engine ever built. It is to be used in draining the Chollar, Norcross, and Savage shafts of the famous Comstock mines at Virginia City, Nevada. The engine occupies a space 65 feet by 20 feet, and weighs between 200 and 300 tons, which the underground machinery will increase to about 1,000 tons in all. The engine accumulates water at 1,000 pounds pressure to the square inch, in a reservoir at the surface 60 feet high, from which it will be conducted by a pipe 2,400 feet to the bottom of the shaft, there to operate a pump which will raise the seepage water 800 feet to the Sutro Tunnel, into which it will be discharged. The water which does the work returns to the surface by another pipe. The system can be extended to 3,000 feet in depth, or take water from mines half a mile away, simply by extending the pipes. The new system is intended to dispense with the heavy and cumbersome pump rods heretofore used. The engine is compound, with the Davey differential valve motion.

IMPROVED CATTLE FEEDER.

The engraving shows an improved cattle feeder invented by Mr. Wm. Griffiths, of Shrewsbury, England. It consists



GRIFFITHS' CATTLE FEEDER.

of four triangular troughs with racks above, fitted to a square frame having T-section iron uprights supporting a curved corrugated roof, troughed at the eaves for carrying the rain water to the corners. The racks run up from the center of the troughs to each upper angle, forming a triangle. It is fed from either end of the roof, and will hold as much fodder as a man can carry. The whole structure is of iron and mounted on wheels, two of which can be locked at pleasure should it be desired to make it a fixture.

TO DEADEN THE NOISE OF HAMMERING IN SHOPS, it has been suggested to place rubber cushions under the legs of the work-benches. We have found wool, felt, or any very thick loosely made woolen texture a much better material for this purpose than rubber. Pieces suitable for these pads can ordinarily be selected from tailors' clippings, and may be had for little or nothing.

An Interesting Railway Relic.

One of the most interesting relics we have seen in some time is a page from a Boston paper of 1825, containing a picture of the "Hetton Railroad," as designed by William Strickland, Esq., civil engineer. The stupendous line was to be seven miles five furlongs in length, and was to extend from the Hetton collieries, in England, to the town of Sunderland, on the River Wier. From the picture and the accompanying description, we find this railroad climbing hill and descending dale, and making no attempt to follow any grade. Several stationary engines are used to transport the coal wagons over these irregularities of the surface, and finally a locomotive, made of thick sheet iron, weighing five tons and possessing twelve horse power, takes them in tow and pulls them to Sunderland. These locomotives are able to pull ninety-ton trains.

Below the general view of the road is a cut representing a train. The engine is neither a graceful nor a complicated affair, and consists chiefly of boiler, smokestack, and piston. There is no cab for the engineer, who stands on a platform beside the boiler and takes the weather as it comes to him. The tender is equally primitive in its construction, and appears to be about the size of an ordinary box wagon. The coal carts look very much like the bobtail dumps of the present day.

The letter-press on this page contains a description of the Hetton Road; a general article on the value and utility of railroads; an extract from a letter from Hon. De Witt Clinton, comparing railroads with canals to the former's injury, and a series of answers to questions respecting railroads by Thomas Tredgold, an English civil engineer, who was advanced enough in his ideas to believe in railroads. The entire page shows that it appeared at a time when the question of railroads *vs.* canals was being agitated. The great expense of the former seemed to be the chief difficulty in the minds of the canal advocates, who could not realize the enormous profits which would go to pay those expenses and enrich railroad men to boot. Governor Clinton's arguments are rather amusing in the light of our present railroad facilities.

The relic is weather-stained and exceedingly old-fashioned in appearance. It is the property of Mr. F. H. Munsell, of the Central. And when we look at this picture and think of the great four-track line it seems as if the relic must be a thousand years old. One cannot believe so much had to be learned in the space of fifty-five years.—*Buffalo Courier.*

Apprentice System Reviving.

We are pleased to see that the Ames Manufacturing Company, of Chicopee, Mass., are doing something toward a return to the old apprentice system. The company have been very much troubled to get skilled help, and also by having men leave after they have learned enough to begin to be useful. They have now adopted a plan something like the former system, only the term of service is not more than three or four years instead of seven, and they are overwhelmed with applications. The men sign a contract to stay to the end of the term, and the company will teach them the different branches of the business, so that when they go out they will be masters of the trade instead of knowing how to run but one machine or to do one particular kind of work. The company keep 10 cents a day from their pay until it amounts to $100, which is given to them at the end of the apprenticeship.

The Yield of Wheat.

To test the bearing qualities of the leading varieties of wheat the Superintendent of the Ohio Agricultural College Farm sold seed wheat to farmers in various parts of Ohio and other States, requesting report of yield from each. The results are shown in the following comparison: Fultz, 24 reports average 25¾ bushels; Clawson, 10 reports average 23¾ bushels; Silver Chaff, 15 reports average 26¼ bushels; Velvet Chaff, 11 reports average 26 bushels; Gold Medal, 12 reports average 21⅗ bushels; Sandomicka, 7 reports average 24½ bushels.

Porcelain Manufacture in New Orleans.

A happy coincidence of enterprise and discovery has just occurred in the South. While Mr. Surgi, of New Orleans, was arranging for the setting up of a porcelain factory in that city, expecting at first to import the kaolin to be used, the Assayer of the Mint received from Texas, for analysis, samples of clay which proved to be kaolin of the finest quality. The deposit had been known for some time, but nothing had been done with regard to its development. The announcement of the proposed porcelain factory called the attention of the owners of the deposit to its possible value, and the two interests have recently been brought together. The kaolin occurs near Bremond, Texas, where a bed of eighty acres or more lies close to the surface. The depth of the deposit is not given.

Water Cresses in Winter.

The *Gardener's Magazine* thinks that many of the writers in the horticultural papers do not know that frost kills water cresses. The delectable *Nasturtium officinale* is properly classed as a hardy plant, for it takes care of itself as a weed, and who, therefore, shall accuse it of tenderness? Where cresses are fast rooted and flourishing in a brook or any other water, it will be found that after a coat of stout ice has been formed the crop is gone entirely. That is to say, all the succulent leafy stems that might have been cut before the frost came have been destroyed by ordinary freezing, if only to the extent of about seven to ten degrees. It follows, therefore, that to preserve cresses for winter use anywhere out of doors shelter of some kind is necessary. There are many ways of doing this. It is not unusual for the market growers to let in a flood of fresh water when a sharp frost is expected. This covers the plants, and the ice is formed so far above them that they escape its effects. Another plan is to lay planks or tree loppings over the bed, and rough contrivances of this kind will carry a crop through a moderate frost, but a continued and severe frost will find its way through such penetrable stuff. Where it happens to be convenient, a frame is the best protection, and those who have to supply the table plentifully in winter would do well to arrange their plans with a view to the use of frames ultimately. That many who should know do not know that frost is destructive in its effects on cresses is not surprising, because hitherto the subject has but rarely obtained any special attention.

Glass Making in Ohio.

Five new glass works were started in Ohio last year, and several more will be added this year. The latest official statistics give 19 firms employed in glass manufacture, with 32 furnaces, having 292 pots and employing 2,032 men. In the production of window glass there are employed 7 furnaces, with 66 pots; flint glass, 19 furnaces with 199 pots; green glass, 4 furnaces with 27 pots. The glass works are in Bellaire, Columbus, Ravenna, Kent, Zanesville, Steubenville, Martin's Ferry, Bridgeport, La Grange, and Newark.

NEW MILKING STOOL.

The combined milking stool and pail holder shown in the engraving is the invention of Mr. G. W. Williams, of Eau Claire, Wis. The seat or stool carries a support for the pail, and is provided with a circular guard rail for retaining the pail in its position. There are two apertures in the seat

IMPROVED MILKING STOOL.

forming a handle by means of which it may be easily carried. The pail support is pivoted and is capable of moving up or down to accommodate itself to inequalities in the ground surface.

Hard Soap by a Cold Process.

Mr. R. F. Fairthorn, Ph.D., has contributed the following recipe to the *Druggists Circular:*

A good hard soap can be easily produced if four pounds of olive or sweet almond oil mixed with two pounds of soda lye, of the strength 36° Baume, are stirred until of the consistence of thick paste, when it should be poured into moulds, covered by several folds of muslin, and kept in a warm room for twenty hours. By this treatment the process of saponification, or union of the acids in the oils with the alkali, is complete. When these materials are first mixed the temperature of the mass rises, and in order to effect the entire union of ingredients so as to form the compound called soap, it is necessary that the heat thus generated should be maintained for some time, hence the necessity for covering the moulds and keeping them in a warm room.

He has found that it is desirable to use oil that is slightly rancid, or, if free from rancidity, to add about ten per cent of oil that has become so. Oil that is perfectly sweet requires two or three days to effect saponification.

Correspondence.

Dangers of Electric Light Wires.

To the Editor of the Scientific American:

Absence at sea prevented me noticing sooner your observations on the death of the fireman on board the Livadia, who was killed by an electric light current. If not too long behind the time of the occurrence, I would like to add my experience on the subject, in connection with Siemens machines, which you presume would be equally dangerous under the same conditions.

I have myself received the current capable of giving four lights (each of 400 candle power) through the legs, trunk, left arm, thumb, and one finger, between which I had caught a wire. I do not say I liked the sensation, but could have endured it if necessary; the finger and thumb were rendered incapable of motion, and the wire was so firmly held by them that it took a good tug to drag the wire through by main force. The only resistance the current had to overcome was my shoes and some damp boards.

In another case I know of an operator who inadvertently took a wire in each hand, thus completing *across his chest* a current of same strength as in my case, but without any harm resulting. The muscles of the hand were strongly contracted, and he was unable to call out for help, although he was perfectly conscious it was close at hand; but by walking back until he could exercise a strain on the wires he dragged them from between his fingers as I did. This, I think, shows that currents such as are generated in Siemens machines are incapable of causing death to a person *not affected* with heart disease. If, however, passed through the brain or spine it might be more serious, possibly resulting in temporary unconsciousness.

As the Livadia's fireman seems undoubtedly to have been killed by the dynamo current, I can only suppose that the machines there used were constructed to give currents of high tension for sake of getting a considerable number of lights on one circuit.

Perfect insulation of the leads throughout the *entire* circuit should be deemed a necessity, especially in a ship or other structure of iron. This is best done by using covered wire, *not omitting to cover* any joints that may be made.

Your suggestion about protecting the lamps and terminals is a very good one, even where the insulation of the leads has been attended to, for the reason that a man in renewing the carbons may be up a ladder or in a position from which he might easily fall in case he got even a slight shock, which by startling him might cause him to lose his balance. I think it is better that the exact amount of danger attendant on any system may be known, so that it may be guarded against and so avoided, and also to prevent those who otherwise could inform themselves from forming exaggerated notions of what that amount really is

J. W. L.

S. S. City of Berlin, Pier 37, New York.
January 5, 1881.

The New Comet Pennule.

To the Editor of the Scientific American:

Telegraphic announcement was received by me December 17, 1880, of the discovery of a new comet by Pennule at Copenhagen, Denmark, on the 16th ult. Dense clouds prevented any observations of the object until the evening of December 31, when in a very few minutes I picked up the comet and secured a good observation. It was at discovery in right ascension 18 hours 49 minutes; north declination 10 degrees 37 minutes. When observed by me on the 31st, it was, by estimation, in right ascension, 19 hours 47 minutes; north declination 19 degrees 30 minutes. This brought the comet about midway on a line drawn from Albireo in Cygnus to Epsilon Delphinus—the last star in the tail of the Dolphin. Good observations were also obtained on the two following evenings.

The motion of the comet is northeast something more than one degree daily; so that its position is improving, and being quite a bright telescopic comet, it may be readily seen in moderate telescopes for some time. The present direction of its motion is toward Zeta Cygni.

It is nearly 3 minutes of arc in apparent diameter, has a considerable condensation not quite central, but no tail.

WILLIAM R. BROOKS.

Red House Observatory,
Phelps, N. Y., January 4, 1881.

Cutting Hard Steel with Soft Iron.

To the Editor of the Scientific American:

About forty years ago, having often heard that hard steel could be cut readily with a circular disk of sheet iron when driven at a high motion, I made a disk about ten inches in diameter out of a piece of heavy stove-pipe iron, having a round eye at the center about one and a half inches in diameter. I then put a stick of hard wood in the turning lathe, turned it off true, making a wooden mandrel for holding this iron disk, just as a circular saw is held true on a metallic mandrel. The periphery of the disk, after it was secured to the wooden mandrel swinging in the lathe, was ground and filed until it would run as true as a millstone. The disk was secured to the collar or shoulder of the wooden mandrel by putting four screws through the disk into the wood. While the disk was revolving at a high motion the soft sheet iron would cut off a ten inch cold-steel file in a few seconds. After we were satisfied that soft iron would cut cold and hard steel (no matter how hard), the disk was put on one of the journals of a circular saw which was driven at a very high motion; and that disk was employed for many years afterward to gum saws of all sizes.

During the past season, having occasion in a new shop to make a goodly number of cutters for the power moulding machine, we made another sheet iron disk, which was fitted to the mandrel of one of the little circular saws, which revolves about two thousand times per minute. After the periphery had been dressed off as true as practicable, that disk of soft iron would (and will) cut off a bar of cold steel four inches broad and one-fourth of an inch thick in one minute, making a kerf as true and smooth as a good saw will cut through a piece of timber. The disk will save an immense amount of filing when making cutters for moulding machines, as we can cut slots into the heel ends of the cutters, and cut and dress off the edge ends faster than twenty men can dress the steel away with chisels and files. One can "gum" an old cross-cut saw, or a mill saw, or drag saw, or large circular saw with such a disk in a few minutes, without any apprehension whatever of cracking or injuring the saw blade. After a large saw has been gummed by an iron disk, if one has a small emery wheel of the proper form he can dress up the teeth almost to a perfect cutting edge without a file, thus saving an enormous expense for files.

I have found in some instances, when gumming cross-cut two-men saws, that the steel of certain kinds of saws would be case-hardened a little on both sides of the kerf made by the disk. That very thin film of case-hardened steel would wear away a new file rapidly. But by employing an emery wheel instead of files until all the case-hardened steel had been removed, the expense for files is always small. Indeed, we use files only to fit up the very points of the teeth.

I may add, for the advantage of beginners, that the true way to fit up the periphery of a disk is to cut it with heavy shears as nearly round as practicable, after which hold a piece of a grindstone or sandstone so that the edge of the disk will strike it when in motion. We always use a stone and file, and then attempt to cut steel a little, thus working off the periphery until it is as smooth and true as it can be made. Then the cold and soft iron when in high motion will literally melt the hard and cold steel and drive the melted metal from the bar in a stream of white-hot sissing and burning steel dust.

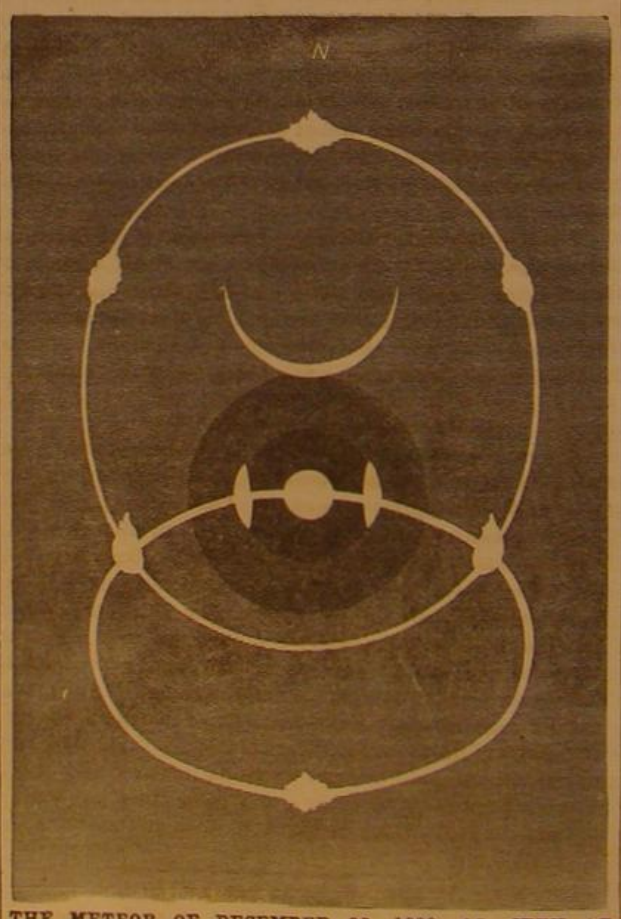
S. E. T.

Orange, N. J.

The Meteor.

To the Editor of the Scientific American:

I send you a diagram of a most singular atmospheric phenomenon witnessed here on the 30th ult. The display in the heavens of so peculiar a combination of reflection and



THE METEOR OF DECEMBER 30, 1880, AS SEEN AT SUNK CENTER, MINN.

refraction of the rays of light was of such rare occurrence I doubt if the like was ever before seen. You may the better understand me if I explain from the diagram. It was first observed at five minutes before eleven o'clock, A.M. The mercury registered at the time 5° below zero. The sky was clear, save that the air was full of floating frost crystals that gave a leaden aspect to the heavens around. The sun, as I have tried to represent, was surrounded by a double halo, both very perfect and distinct in outline. To the right and left of the sun and on the rim of the first halo were very bright parhelia or mock suns. Passing through the sun and these mock suns and around the whole dome of the heavens, seemingly, at about 20° from the horizon, was a great circle of light. This had the appearance of the large ring of Saturn—very bright and about ¼ of a degree in width. Again, about 15° from the rim of the outer or second halo, and in the path of this circle of light, were other parhelia on either side of the sun; and on the opposite side of it, from the sun, was another or third parhelion. This circle was very brilliant, describing a diameter of about 100°. Intersecting this bright circle, at the points of the two parhelia, passed a somewhat less brilliant ring of light in form of an eclipse, with its longest diameter some 130° and the short one 80. At the northern end of the ellipse were three parhelia, as represented in diagram. These mock suns were all very distinct and beautiful. To complete this phenomenon there was as perfect a rainbow as we ever see in midsummer, describing an arc of about 35°, with its crown resting on the rim of the second or outer halo, directly over the sun. In fact this rainbow was of such brilliancy that it was too dazzling for the uncovered eye to look at, unlike the soft mellow tints in our summer rainbow phenomena. The duration of this most rare spectacle was an hour and fifteen minutes.

F. M. MORGAN,
Assistant Principal, Sauk Center High School.
Sauk Center, Minn., December 31, 1880.

New Solvents for Nitrocellulose.

To the Editor of the Scientific American:

In the preparation of nitrocellulose compounds, which are known as celluloid, and are also used as varnishes, some new solvents have been patented in Germany by Parkes. Among others he suggests the use of a solution of tetrachloride of carbon and camphor, either alone or with gums, resins, oils, dyestuffs, etc. He also proposes to use the bichloride of carbon and camphor, when the solution takes place under the aid of heat and pressure. Camphor, too, is a good solvent when heated to its melting point; at this temperature and under pressure it dissolves the nitrocellulose as fast as it can be mixed with the melted camphor until it forms a stiff mass. This mass, to which other substances may be added, can be rolled and pressed into moulds. To lower the melting point he adds oil, paraffine, turpentine, alcohol, benzol, ether, etc., whereby thinner solutions are obtained.

Another powerful solvent for nitrocellulose can be made by conducting sulphurous acid gas through granulated camphor, or by dissolving camphor in sulphurous acid.

A solution of camphor in benzole of such quality that no unpleasant odor is left when the compound is done, works very rapidly with the aid of heat and pressure. Oils, gums, resins, and dyes can be added according to taste. Turpentine and camphor also dissolve it with heat and pressure very quickly. Nitrocellulose softens rapidly if sprinkled with alcohol, ether, or other solvents of gun cotton and then pressed into hot moulds.

Sometimes it is better to dye the nitrocellulose before it is dissolved instead of dyeing the compound, as brilliant and delicate colors are obtained in this way of greater beauty than by the usual manner. If the compounds are to be used as lakes, the above-named solvents can be used, but of course larger quantities of the solvent are required than for making solid bodies. The solvents can be used alone or mixed with gums, resins, pigments, and metallic bronzes, to obtain the greatest variety of waterproof paints for surfaces, as well as cement for capping bottles. The solvents of nitrocellulose above given, as well as the bisulphide of carbon mixed with benzole and alcohol, are likewise good solvents for shellac.

D. I. Z.

[The tetrachloride of carbon is a colorless liquid boiling at 170° Fah.; specific gravity, 1·56. It can be made by the action of chlorine gas upon bisulphide of carbon, or on chloroform; also by the action of pentachloride of antimony upon bisulphide of carbon; sells at $3 per pound.

The bichloride of carbon is a very mobile liquid; specific gravity, 1·62; boiling at 248° Fah. It is generally made from the terchloride. It is quoted at $17 per pound in Berlin; hence we find a strong objection to its use in the arts at present.—ED. SCI. AM.]

Easy Test for the Purity of Olive Oil.

When it is desired only to ascertain whether the oil is pure or not without precise reference to the nature of the oils used in adulteration, take equal quantities of olive oil known to be pure and the oil to be tested, place the samples in separate test tubes, into which a good thermometer may also be inserted, and heat each separately to a temperature of 482° Fah. The pure oil will become somewhat paler during the heating, while the adulterated oil will turn darker. The pure oil will emit a pleasant smell, while the adulterant oils will give off an offensive odor.

To Prevent Clouding of Mirrors by Moisture.

A writer in the *Manufacturer and Builder* says that by coating over the surface of glass mirrors with glycerine their clouding by the accumulation of condensed water vapor will be prevented for a considerable time. The attraction of the glycerine is so great for the water as to absorb the latter as fast as deposited. This hint may prove of great use to dentists, who are frequently troubled by the clouding of mouth-mirrors, and it may also be of value to those who are compelled to shave themselves in chilly apartments.

SALT WATER FOR STREET USES.—The town of Tynemouth, England, has lately completed arrangements for supplying salt water from the mains of all the principal thoroughfares of the place. Salt water is to be used for flushing the sewers, watering the streets, and supplying public baths.

DYNAMO-TELEGRAPHY.

Until within a comparatively recent period all attempts at transmission of telegraphic messages with dynamo-electricity have proven futile.

There seemed to be no probability that the old voltaic battery system, involving multitudinous inconveniences, would ever be supplanted, and there are at the present time only two systems of dynamical telegraphs which are operative from a successful standpoint, both being of very recent origin and as yet comparatively unknown to the public.

For the successful operation of any telegraph line two important elements enter into consideration, viz.:

1st. A steady or uniform current.

2d. Delicate adjustment of receiving instruments; and any variation of the former necessarily precludes the possibility of the latter, so that they may be operative under all conditions of the line.

It is scarcely necessary to add that electricians have never fully appreciated the difficulties to be overcome in this class of telegraphy, and their attempts heretofore but verify this assertion.

These fluctuations of current are due to several causes, viz.:

1st. Any change of velocity in the generator.

2d. Any variation of external or internal resistance (the latter being often the result of the former, owing to high normal internal resistance); and either necessarily varying the electromotive force, and hence the current to line.

3d. To a total discharge of the magnetism in the field of force magnets on opening the line, and thus completely breaking down the currents until the line shall again be closed.

This might properly be included under the same head as the second, inasmuch as a total discharge of the field of force magnets is, theoretically speaking, simply the result of an infinite resistance offered to the current.

A dynamo machine produces a current of electricity by a series of actions and reactions in its internal mechanism; that is to say, the armature of the machine acts upon the field of force magnets, and these in turn react upon the armature at each revolution, and thus a set of actions and reactions ensue until a max mum effect is attained. This results when the neutral fluids (so to speak) balance each other.

Now, any increase in the external or line resistance acts to discharge the field of force magnets, and a break in the line, which necessarily occurs on opening a key to transmit a signal, increases the resistance to an infinite amount, and hence totally discharges the field of force magnets. Hence, inasmuch as it requires a definite time to charge the line by the above described series of actions and reactions, it is obvious that there would ensue at each break such fluctuations of current as would totally prevent any transmission of signals.

Furthermore, such an increase of external resistance reacts upon the machine and heats it internally, thus offering another objectionable element.

Thus we have a series of changes, which, acting under varying circumstances, produce fluctuations in the line current beyond the limits of accurate adjustment of delicate receiving instruments required on long lines of high resistance.

The problem, then, to be solved is:

1st. To prevent the total discharge of the field of force magnets on any variation of external resistance; or, at least, to provide some means for a constant relation between the resistances and the electromotive force of the machine.

2d. To prevent undue variations of current caused by an increase or decrease of the velocity of the generator.

Two systems have been devised which involve all of the essential principles required by the problem: one the invention of Mr. Stephen D. Field, Jr., and the other of Dr. Orazio Lugo, of New York city.

To obviate the first difficulty, Mr. Field energizes his field of force magnets by an independent generator, actuated by an independent power, the circuit from the commutators being through the field of force magnets of said generator, thence through the coils of the field of force magnets which develop the line currents. This circuit is entirely independent from the line circuit, and constitutes, as it were, an infinite supply of electricity to energize the field of force magnets, or at any rate an inexhaustible supply dependent on the power and capacity of the generator.

Hence, any change of resistance in the line can have no appreciable effect upon the field of force magnets.

To obviate any change in the current due to a change of velocity of the generator, he connects up a series of line generators whose field of force magnets are energized as above, and connects the commutators and said line generators to common supply points, being necessarily at the opposite poles of the machine. Each generator of line currents is actuated by an independent pulley, so that any change of velocity of any one generator can only affect the sum total of currents by its proportional ratio of gain or loss.

Theoretically, then, an infinite number of generators would be required to produce the best results, bearing in mind, of course, that such a series implies a range of velocities or changes of relative velocities varying from zero to infinity.

It is found in practice that a series of five generators produces satisfactory results. This, of course, is apparent if we consider that a change of velocity in any one from a normal velocity is not liable under ordinary circumstances to be more than ten per cent.

It is apparent that any change of velocity in the generator which energizes the field of force magnets would increase proportionately the electromotive force of the line generators. This is obviated by a governor which regulates the speed of the motive force and keeps it within practical limitations.

The same system of generators might be used to energize the field of force magnets as is required to generate line currents, thus making the system automatic in its operation; but this feature does not appear to have suggested itself to Mr. Field. In this manner any change of speed in any one of the energizing machines would only affect the line field of force magnets a proportional amount, as above suggested.

Thus it will be seen that if any one of the five generators increases or decreases twenty per cent from the normal rate it only has a proportionate effect of one twenty-fifth of the whole line current, which in practice is found to be inappreciable.

The broad idea of energizing the field of force magnets by an independent generator is not new *per se*, as is seen in the Wilde machine; but Mr. Field claims to be the first to energize a series of field of force magnets in this way, and just how much invention is involved in this idea it is not the province of this article to discuss.

Dr. Lugo has recently invented and patented a much simpler method of avoiding these difficulties, dependent upon well known electrical laws.

He uses a single current generator on the line with a shunt wire of low resistance, connecting the opposite poles thereof; so that the total resistance is that due to the lines, the shunt, and the machine.

The resistance of the shunt is less than that of the external lines and greater than that of the machine itself.

There results from this combination, under well known laws, a proportionate division of current between the line and the shunt; a much larger portion, of course, going through the shunt because of its low resistance.

It is obvious, then, that the field of force magnets can never be discharged, for there is always a path of low resistance for the current. Hence the electromotive force is dependent only upon two causes for its variations, viz., a change of velocity of the generator and a change of resistances between the shunt and the line. The former it is proposed to regulate by electrical governors, such as are well known, dependent upon the current sent to line, and the latter is in a measure automatically regulated by the shunt itself, inasmuch as changes of fluctuations which result from changes of resistances in the external line necessarily increase the flow in the shunt itself, and hence vary the resistance of the shunt by heating it. Hence there can be no change of resistance in the internal machine, because normally it is much less than that of the shunt. Of course in practice these adjustments must be made dependent upon varying circumstances of the external lines, but certain ratios may be attained which will produce the best results, and theoretically this will be when these line resistances equal that of the shunt.

When they pass below this limit the system is, of course, inoperative; but there exists a sufficient limit under ordinary circumstances to afford a perfect working system. This limit, it will be understood, is dependent upon the relative sectional area of the external line and that of the shunt, which affords sufficient resistance to prevent the machine from heating; thus in practice the generator never grows warm.

An attendant at the shunt may regulate variable resistances by testing the warmth thereof. Hence as long as a mean temperature exists a uniform current flows to line and no change need be made.

Both of the above described systems are in use, and the best results are attained; it being found that steady currents at all times flow on the line.

It is then entirely probable that within the next decade we shall find our large telegraphic corporations operating their elevators, supplying motive power, heat, and light throughout their buildings, and electricity for their lines from one common source of power.

Thus saving annually thousands of dollars, and being happily rid of numerous annoyances consequent upon such a system of forces as now exists by a concentration thereof at one common center.

C. J. KINTNER,
U. S. Patent Office.

Improvements in Cotton Pressing.

The new Morse Compresses in New Orleans are producing astonishing results by way of largely increased cargoes of cotton from this port.

The ship Mary E. Riggs, of 1,277 tons American register (1,226 British), received a cargo of 5,400 bales of cotton, weighing 2,568,640 pounds; making 2,011 pounds per ton American and 2,095 pounds per ton British measurement.

The first cargo of this ship from this port was 3,740 bales; the last, and largest (previous to the present one), was 4,364 bales, weighing 1,943,498 pounds. Her present cargo of 5,400 bales exceeds her largest previous cargo 1,036 bales, or 625,142 pounds, exceeding her largest previous cargo 1,404 bales of same average weight. With freight at one cent per pound and five per cent primage, the value of this increase, for this medium-sized vessel, is about $6,600. This cargo was compressed, without the advantage of a "tie puller," in the ordinary course of business by the Factors' Press, one of the seven large Morse Compresses. The only cargoes of single bales taken by sail vessels approximating this one are the followin

The Minnie H. Gerow (1,304 tons American), from the Champion Press, 2,481,790 = 1,903 pounds per ton measurement. The Western Empire (1,399 tons American register), from the Champion Press, 2,022 per ton. The Minnie H. Gerow, from the International Press (Taylor hydraulic, 64-inch cylinders), 2,644,906 = 2,028 pounds per ton. But in all of these cargoes of 1,903, 2,022, and 2,028 per ton measurement, tie pullers were used, for which is claimed an advantage of 20 per cent. If the present cargo of the Mary E. Riggs had had this advantage, her 2,011 pounds per ton American, and 2,095 British, would have been 2,413 and 2,514 per ton—or say 20 per cent larger than any cargo of single bales ever cleared in this country.

Since the above, the British ship Ben Lomond, of 887 tons register, cleared at New Orleans by her agents, Messrs. Forstall, Ross & Clayton, with 4,363 bales cotton under deck, none in cabin or crew spaces, weighing 2,054,848 pounds, making 2,316 pounds to the ton measurement. This is the largest cargo per ton ever taken by a sail vessel from an American port. The larger part of this cargo was "doubled." The cotton was tied by hand (by colored men), and consequently without the 20 per cent advantage claimed for steam "band pullers." It was all compressed at the Southern Press by the 90-inch cylinder Morse Compress. Not more than three years ago the average cargoes of ships from this port did not exceed 1,425 pounds per ton register; and for other modern-built presses the average is now about 1,725. The above cargo of 2,316, without tie pullers, therefore, exceeds recent average compressing by 35 per cent, or 524,773 pounds, in a single cargo of a small ship like the Ben Lomond, and at the rate of freight received makes a gain of £820—say, $3,936. The proprietors claim that under more favorable circumstances the 90-inch Morse Compress can considerably excel the above.

The Keely Motor Deception.

It is stated that immediately after the annual meeting of the Keely motor stockholders, held two weeks ago, a couple of gentlemen who are heavy on the motor stock called upon Mr. Keely and demanded that he should at once name a day and date for a public exhibition of his wonderful apparatus. They had a very plain talk with him, and announced that they voiced the sentiments of most of the parties interested. Unless the engine was put to work within a short time and sawed wood, sent a locomotive to Jericho on a pint of water, and did a hundred other things claimed for it, they would resist further payments to the discoverer.

Keely was not the least disturbed by their threats, and when they found this they began to persuade and coax him, as a boom in the stock was needed. The man of mysteries declined to accede to their requests, but said: "I see my way as clear as sunlight." Then he eased their minds by stating that he would make no further demands upon the company for funds for his own use, because he had enough to live on. This was very assuring, and made the stockholders happy. If they did not give him the money to complete his invention, he told them that he would keep his secrets to himself. This caused some bitter words, and Mr. Keely was the recipient of some unvarnished opinions. Already they had spent over $500,000 on the machine, and could see no appreciable results. Keely plainly informed his visitors that he would not give an exhibition for two months at least, because the engine needed some alterations.

Keely has had a new engine built at a cost of $10,000, and the lower one has been placed on the lower floor of the building on Twentieth street. Keely promised that when the exhibition is given both engines should be placed in operation, so as to show the improvement in the new one over the old. The callers were compelled to depart without being able to convince Keely that a time for a boom was near at hand.

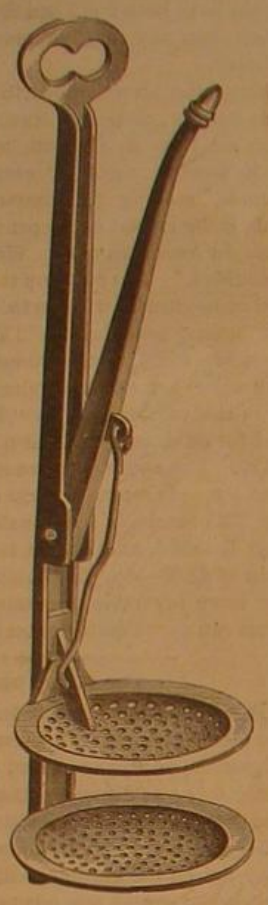
The stock of the Keely Motor Company is now held at about $7 per share. This time last year it was worth $18. The highest it ever reached was $300, when 3,000 shares were disposed of in New York at the figures named. The average price has been about $150 per share, and the transactions at those rates have been large. Of the present stockholders but few were on the original list, they having all been able to get out at the top price. Keely has been at work some seven years.—*Philadelphia Record.*

Paraffine as a Wood Preserver.

A German chemist, Dr. Schal, has established the useful fact that wood impregnated with paraffine is preserved from rot, especially when employed in alizarine manufactures, where it is exposed to the decaying action of damp, acid, and alkaline lyes. Wooden vessels which become totally rotten in two months last for two years when impregnated with paraffine. The preparation of the wood is effected by drying it in warm air for three weeks, then steeped in melted paraffine to which has been added some petroleum ether or sulphuret of carbon. In preparing this bath great care must, however, be exercised, owing to the inflammability of its ingredients. To prevent the paraffine from escaping from the pores, the wood should be coated with oil varnish or soluble glass, washed after drying with diluted hydrochloric acid. The silicic acid thus formed clogs up the pores from the outside, and protects the paraffine from the action of water. Paraffine, melted with equal parts of linseed or rapeseed oil, is also, according to Dr. Schal, useful for coating iron vessels, which in chemical manufactories are otherwise very liable to rust.

IMPROVED HAND PRESS.

The engraving shows a domestic hand press for fruit, cracklings, hominy, and other articles which require separation from the liquid which they may contain. The invention consists of a perforated bowl or receptacle having a rigid handle extending at right angles to the plane of the bowl, and a perforated presser head conforming to the bowl and connected by a slide with the handle of the bowl. The sliding presser head is connected by a link with a lever handle pivoted to the main handle. By bringing the presser head down on the material contained in the bowl by means of the lever, the liquid is expelled through the perforations. This invention was lately patented by Mr. J. T. Haile, of Whitesborough, Texas.



HAILE'S HAND PRESS.

GOLD IN NEW YORK STATE.—Two hundred and eighty-three notices of discovery of gold and silver were officially entered at Albany, last year. The alleged deposits are chiefly in Hamilton County. The law prescribes that mines of gold or silver found in New York shall be property of the State, but gives to the discoverers or their assigns the right to work them for twenty-one years free of any royalty on condition that they file with the Secretary of State notices describing their discoveries. After the twenty-one years the Legislature may dispose of the mines at its discretion; but the discoverers or their representatives shall be preferred in contracts for working them.

IMPROVED OIL-STOVE WICK TRIMMER.

In ordinary oil burning stoves it is necessary to remove the top of the stove, and any utensils which may be in use in order to trim off the crust which forms on the wicks and prevents the free operation of the stove. It is necessary to put out the fire before the wick can be trimmed. Beside the great inconvenience and delay in trimming the wick with shears in the common way, the wicks are wasted, and with the sharpest shears they will be poorly trimmed on account of their great width, and an uneven burning surface will be left which causes the stove to smoke and throw off a bad odor. Kerosene stoves are often condemned for this reason alone.

By means of the simple invention shown in the engraving these inconveniences are avoided, and the wick is quickly and evenly trimmed. This device is in every way superior to the old method.

A wick should never be cut; it is only necessary to remove the crust, and the stove or lamp burns freely with a flame of the proper form.

This invention is simple in its application and is thoroughly practicable. It consists of a wire rod carrying one or more lateral arms extending over the wick tubes. This wire passes through the front of the stove, and is provided with a ring or handle by which it may be grasped and moved back and forth over the ends of the wicks while they are turned down. By this means the crust is removed and a clean and free burning wick is left, without extinguishing the flame or removing any part of the stove or furniture.

Each wick tube is provided with a guide which is bent up at the ends forming a stop for the trimming attachment. Oil stove manufacturers may, with advantage, adopt this simple but useful and effective invention.

This invention has been patented by Messrs. Walker and Williams, and is owned by Walker, Williams & Co., Sing Sing, N. Y.

A Use for Cotton Seed Hulls.

The Chicago *Railway Review* reports that the use of cotton seed hulls as a substitute for cotton waste in packing the journal boxes of cars and locomotives has been adopted on several roads, and others are preparing to adopt it. It is claimed that the hulls are actually superior to ordinary cotton waste for packing, and would be preferable at the same cost. But the cheapest cotton waste is worth 7½ cents a pound, and the superior grades range as high as 14 cents. Cotton seed hulls can be delivered in any part of the United States at one cent a pound.

Cements for the Shop.

Iron Cement for Closing the Joints of Iron Pipes.—Take of coarsely powdered iron borings, 5 pounds; powdered sal-ammoniac, 2 ounces; sulphur, 1 ounce; and water sufficient to moisten it. This composition hardens rapidly; but if time can be allowed, it sets more firmly without the sulphur. It must be used as soon as mixed, and rammed tightly into the joint.

2. Take sal-ammoniac, 2 ounces; sublimated sulphur, 1 ounce; cast iron filings or turnings, 1 pound; mix in a mortar and keep the powder dry. When it is to be used, mix it with 20 times its weight of clean iron turnings or filings, and grind the whole in a mortar; then wet it with water until it becomes of convenient consistency, when it is to be applied to the joint. After a time it becomes as hard and strong as any part of the metal.

Cement for Uniting Leather and Metal.—Wash the metal with hot gelatine; steep the leather in an infusion of nut-galls (hot) and bring the two together.

Cement for Leather Belting.—One who has tried everything, says that after an experience of fifteen years he has found nothing to equal the following: Common glue and isinglass, equal parts, soaked for ten hours in just enough water to cover them. Bring gradually to a boiling heat, and add pure tannin until the whole becomes ropy, or appears like the white of an egg. Buff off the surfaces to be jointed, apply this cement warm, and clamp firmly.

Steam Boiler Cement.—Mix two parts of finely powdered litharge with one part of very fine sand, and one part of quicklime which has been allowed to slake spontaneously by exposure to the air. This mixture may be kept for any length of time without injuring. In using it, a portion is mixed into paste with linseed oil; or, still better, in boiled linseed oil. In this state it must be quickly applied, as it soon becomes hard.

Turner Cement.—Melt one pound of rosin in a pan over the fire, and when melted, add one-quarter of a pound of pitch. While these are boiling, add brickdust until by dropping a little on a cold stone, you think it hard enough. In winter it may be necessary to add a little tallow. By means of this cement a piece of wood may be fastened to the chuck, which will hold when cool; and when the work is finished, it may be removed by a smart stroke with the tool. Any traces of the cement may be removed from the work by means of benzine.

Wollaston's White Cement for Large Objects.—Beeswax, 1 ounce; rosin, 4 ounces; powdered plaster of Paris, 5 ounces. Melt together. To use, warm the edges of the specimen, and apply the cement warm.

Gutta Percha Cement.—This highly recommended cement is made by melting together, in an iron pan, two parts of common pitch and one of gutta-percha, stirring them well together until thoroughly incorporated, and then pouring the liquid into cold water. When cold it is black, solid, and elastic; but it softens with heat, and at 100° Fah. is a thin fluid. It may be used as a soft paste, or in a liquid state, and answers an excellent purpose in cementing metal, glass, porcelain, ivory, etc. It may be used instead of putty in glazing windows.

Fig. 1.

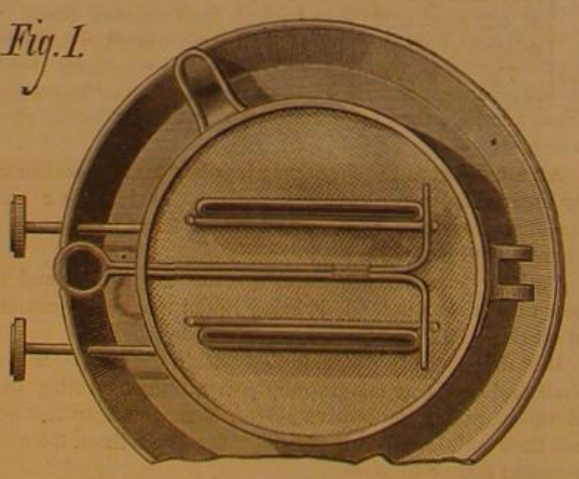
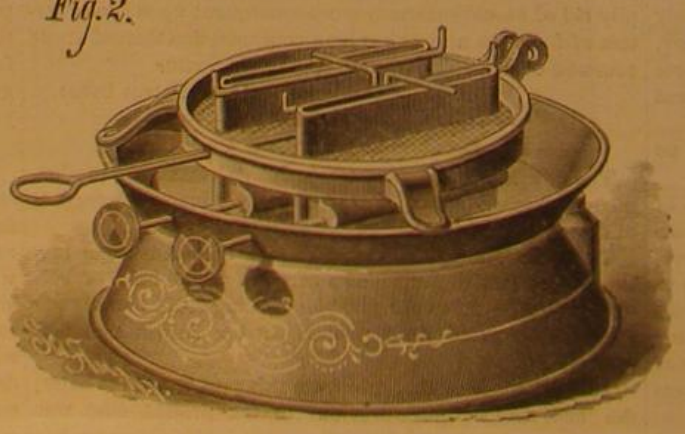


Fig. 2.

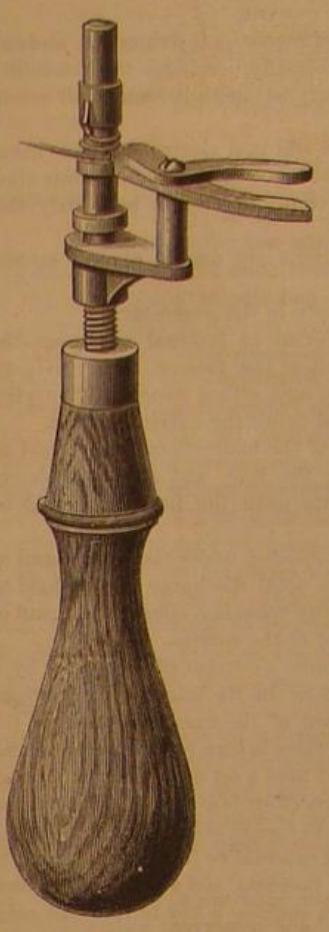


IMPROVED OIL-STOVE WICK TRIMMER.

THE miner's inch is the amount of water flowing in one second from an orifice 1 inch x 1 inch, under a head of 6 inches, measured from the upper side of the orifice.

SPRING-MAKING TOOL.

A hand tool to be used principally by jewelers for making wire spirals for shirt studs and buttons is shown in the annexed engraving. The mandrel upon which the spirals are formed is secured to an ordinary tool handle, and a carrier is fitted to the lower portion of the mandrel, which is threaded, the pitch corresponding with that of the spiral to be made. The end of the wire is placed in a slot in the end of the mandrel, and while the handle is turned with one hand, the carrier is held in the other hand, and the wire is pressed down upon the mandrel by a small lever pivoted to the carrier and grasped between the thumb and finger.



TOOL FOR MAKING SPIRAL SPRINGS.

The crook at the end of the coil is formed by bending the wire back upon the end of the lever.

This invention was recently patented by Mr. A. R. Wilbur, of Baltimore, Md.

NEW INVENTIONS.

An improvement in that class of devices that are designed for releasing a horse instantly from the vehicle to which he may be attached, has been patented by Mr. Whitefoord S. Martin, of Maybinton, S. C. An iron rod is attached to each end of the whiffletree and extends forward a short distance alongside the shafts or thills. The short leather traces are attached to the front ends of these rods by means of keys or eyebolts, which may be withdrawn—for the purpose of releasing the horse from the vehicle—by means of cords or straps that pass through a ring on the crupper or back-strap of the harness, and extend back over the dasher of the vehicle, so as to be easily accessible to the driver.

Mr. John W. Donnel, of Bedford, Iowa, has patented a self-adjusting driver for millstones, by which the stone is balanced on the top of the cock head, and thereby adjusted with a minimum of friction. The invention consists in the combination of a yoke pivoted to the upper end of a mill spindle so as to swing in a vertical plane, and four levers arranged in pairs, one pair being pivoted to each side of the yoke and suspending another yoke, which serves to make all the levers move together. The levers pivoted to the pivotal yoke extend above the point of the mill spindle and are provided with set screws, which bear against the bail at points lying in the same plane and in line with the point of the spindle.

A snow scraper, patented by Geo. F. Bond, of Troy, N. Y., is an improvement in apparatus for clearing ice fields for ice harvesting. Side boards or runners are pivoted or hinged at the front end and provided with apparatus whereby they may be made to assume the V-form, or closed into a parallel position for discharging their load at the will of the operator.

A sugar washing process and apparatus, patented by John V. V. Booraem, of Brooklyn, N. Y., acts to thoroughly wet and wash the crystals of sugar with water or sirup, and deliver the mass in a perfectly homogeneous state to the centrifugal machines. For this end a perforated pipe delivers water in a finely divided state upon the sugar just prior to the passage of the latter through crushing rollers, the pipe and rollers being arranged in relation with each other to secure the object sought. After crushing the sugar is further worked by revolving screws.

An improvement in tile and brick kilns, patented by Mr. Eber Davenport, of Waynesville, Ill., saves time, labor, and fuel. The kiln is circular, has furnaces and fire walls arranged around its peripheral wall, and a central opening in the top. The circulation of the heated air and gases is first upward near the outside wall, then downward, then upward again and out at the central opening, the deflection of the heated currents being effected by the fire walls, crown wall, and vertical passages with bottom flues formed in laying the bricks or tiles when filling the kiln.

A patent on a folding car step, granted to Mr. Josiah W. Radbraugh, of Columbus, Ohio, covers a combination of the folding steps of a car with mechanism whereby the steps on both sides of a car may be simultaneously adjusted by a single movement of a lever.

THE COMMON HORNBILL.

The common hornbill (*Tmetoceros abyssinicus*) is a strong, short-winged bird with a short tail and comparatively long legs. The beak is very large, curved slightly, flattened on the sides, and is provided with a short but quite high protuberance at the root. This protuberance begins on the center line of the beak, projects forward to about one-third of the length of the beak, and may be open or closed in part, and has the general appearance of a helmet. The legs are much more powerful than those of other hornbills and have very strong claws. The sixth feather of the wing is the longest, and the point of the wing projects only a short distance beyond the upper arm feathers. The color of the bird is absolutely black, excepting ten yellowish white feathers of the wings. The eye is dark-brown, the iris lead blue and red, and the beak is black excepting a spot on the upper beak, which is yellow in front and red in the rear. The length of the bird is about four feet. It is found in Central and Southern Africa.

THE COMMON HORNBILL.

The White Ant's Parasites.

At a late meeting of the Philadelphia Academy of Natural Sciences, Dr. R. S. Kenderdine exhibited specimens of the wonderful parasites found recently by Dr. Leidy in the intestines of the white ant, where they occur in such myriads as to constitute a mass greater in bulk than the food of the insect. When the intestine is ruptured millions of these living occupants escape, reminding one of the pouring out of a multitude of persons from a crowded meeting-house. So numerous are these parasites, and so varied their form, movement, and activity, that their distinctive characters cannot be seen until they become more or less widely diffused and separated.

The termites or white ants are so common, easily obtained and preserved alive, and their parasites are so exceedingly numerous and constant in their occurrence, that once the fact becomes sufficiently known the insects will be favorite subjects to illustrate at once the infinity of life and the wonders that are revealed by the microscope. The forms observed, together with a species of microscopic plant found in the same situation, are fully described and beautifully illustrated by Dr. Leidy in the forthcoming number of the Journal of the Academy.

HUMAN TREES OF INDIA.

BY DANIEL C. BEARD.

All those who feel a sufficient interest in the subject to study or notice the facts must at times be struck with amazement at the wonderful resemblance of certain insects and other animals to vegetable and inanimate objects. So exact is this resemblance in some instances as to deceive the most experienced. Wallace, the great naturalist, was very anxious to secure a specimen of a certain brilliant butterfly, but was unable for some time to capture one on account of the creature's sudden unaccountable and mysterious disappearance. He finally discovered that the outside of this insect's wings was an exact representation of a leaf. When the butterfly alighted upon a shrub and closed its wings it completely deceived even this experienced scientist. Some species of lobsters found at Bermuda so closely resemble submarine stones, even to the coating of sea weeds, that I have passed by an aquarium containing them supposing the tank to be uninhabited. The common katydid, whose constantly-repeated notes, late in summer, warn us of the approaching frosts, has a representative in South America, whose wings not only resemble a green leaf, but, to add to the deception, the tips of the wings are ragged and discolored, having the exact appearance of a leaf that has been disfigured from the attacks of caterpillars. I once had one in my studio, and it was with great difficulty that I could convince visitors that it was not an artificial insect with wings made of real leaves. In the snow-covered regions of the North the foxes, hares, bears, and birds, with very few exceptions, assume the prevailing white color of the surrounding objects. Man has not been blind to these hints. There are various tribes of savages who successfully imitate stumps and stones by remaining immovable in crouching positions so as to baffle their pursuers.

This mimicry is carried to a wonderful degree of perfection in India. That strange country, as Dr. Latham says, "of a teeming, ingenious, and industrious but rarely independent population. It is a country of an ancient literature and ancient architecture," and, he might have added, of a modern degradation. A country where such a society as the murderous thugs is possible; a country where robbers are educated from childhood for the profession in which they take great pride, openly boasting of their skill. One of our most skillful and adroit bank robbers would be considered by these India experts but a bungling amateur.

The scientific manner in which these robbers prepare for their raids shows a thorough knowledge of the dangers of their calling, and the best guards against the same, choosing darkness for their forays. When their dusky bodies are least observable they remove their clothes, anoint themselves with oil, and with a single weapon, a keen edged knife suspended from their neck, creep and steal like shadows noiselessly through the darkness. If detected, their greasy and slippery bodies assist them in eluding capture, while their razor-bladed knife dexterously severs the wrist of any detaining hand. But the most ingenious device to escape capture is that shown by the Bheel robbers in the accompanying illustration. It often happens that a band of these robbers are pursued by mounted Englishmen, and unable to reach the jungle, find themselves about to be overtaken upon one of those open plains which have been cleared by fire, the only shelter in sight being the blackened trunks or leafless branches of small trees that perished in the flames. For men so skilled in posturing this is shelter enough. Quickly divesting themselves of their scanty clothing, they scatter it with their plunder in small piles over the plain, covering them with their round shields so that they have the appearance of lumps of earth and attract no attention. This accomplished, they snatch up a few sticks, throw their body into a contorted position, and stand or crouch immovable until their unsuspicious enemies have galloped by.

When all is safe they quickly pick up their spoil and proceed upon their way.

The Rev. J. D. Woods gives an interesting account of these marvelous mimics. I quote the following:

"Before the English had become used to these maneuvers, a very ludicrous incident occurred. An officer, with a party of horse, was chasing a small body of Bheel robbers, and was fast overtaking them. Suddenly the robbers ran behind a rock or some such obstacle, which hid them for a moment, and when the soldiers came up the men had mysteriously disappeared. After an unavailing search, the officer ordered his men to dismount beside a clump of scorched and withered trees; and the day being very hot, he took off his helmet and hung it on a branch by which he was standing. The branch in question turned out to be the leg of a Bheel, who burst into a scream of laughter, and flung the astonished officer to the ground. The clump of scorched trees suddenly became metamorphosed into men, and the whole party dispersed in different directions before the Englishmen could recover from their surprise, carrying with them the officer's helmet by way of trophy."

HUMAN TREES OF INDIA.—BHEEL ROBBERS IN HIDING.

Marine Fauna of the New England Coast.

To the current number of the *American Journal of Science and Arts*, Prof. A. E. Verrill contributes an article on the remarkable marine fauna discovered during the present season off the southern coast of New England by the naturalists connected with the U. S. Fish Commission. The stations at which dredgings were made are all located in the regions designated on the charts as "Block Island Soundings," and nearly all proved to be exceedingly rich in animal life, the vast abundance of individuals of many of the species taken being almost as surprising as the great number and variety of the species themselves. Crustacea, mollusks, annelids, and echinoderms were most numerous. The very large number of specimens obtained on the three trips has, as yet, been only partially examined, but enough has already been done to prove this region to be altogether the richest and most remarkable dredging ground ever discovered on our coast. Of mollusks, about 175 species were taken, 120 of which were not before known to occur on the southern coast of New England; about 65 are additions to the American fauna, and of these about 30 are apparently undescribed species. The star-fishes and ophiurians were exceedingly abundant and beautiful at all the stations, and many species not previously known to our coast were taken, several of these appearing to be undescribed, while others were known only from Northern Europe or from the deep waters off Florida. Many of the species have only recently been obtained from the northern fishing banks off Nova Scotia. One new species of *Archaster* was particularly abundant, several thousands of specimens having been taken. But the two largest and most beautiful species of this genus were *Archaster Agassizii* (new),

and *A. Florx*. Of *Odontaster hispidus* over 100 were taken. One of the most conspicuous star fishes was the remarkable *Pteraster multipes*, Sars, one specimen of which was over six inches in diameter, and very thick and heavy. Its color when living is rich purple above, with the lower side orange streaked with brown, and with large dark purple suckers. A large and handsome orange-colored species of *Luidia* (apparently *L. elegans*), often ten to fifteen inches broad, was very common, but nearly all the specimens dismembered themselves before they reached the surface. Large specimens of two Floridian sea urchins were also taken.

What Machinery has done for Agriculture.

The various agricultural shows held last autumn in different parts of the country cannot fail to impress all who visited them with the extraordinary developments made in recent years in mechanical appliances for agriculture. It is well, therefore, to notice the benefits which this industry has derived from the genius and the labors of the mechanician. We may go back in thought to the time when the spade, the hoe, the sickle, and the flail comprised the farmer's store of machinery, and when the plow was the rudest contrivance hardly worthy to be called a tool. Then every man tilled the soil or engaged in pastoral pursuits because it was all one man could do to provide himself and his dependents with food. Then each man was forced to clothe himself and be his own mechanic for this simple reason. He labored long and with infinite pains, and the ancient sentence that man should earn his bread by the sweat of his brow came home to him with unmitigated force. In course of time improved and effective tools so lightened the labors of the agriculturist, and so increased his products, that the opportunity to make a division of labor arrived, because there was food to spare for the mechanic. This condition of things became more and more firmly established, until it changed the whole social and political aspect of human affairs. And now what do we see? The true "landlord" is not the owner of an English estate, proclaims a writer in *Capital and Labor*, but the farmer who commands an army of farmers, with brigades of plows, reapers, and other machinery upon the plains of Western America. He makes laws for countries thousands of miles away, and his products rule the world's markets. The genius of agriculture to-day is the mechanic; the soul of agriculture is the inventor. One farmer can now, with the help of machinery, feed a hundred men with greater ease than at one time he could feed himself alone. The farmer supports the railroads, for stocks rise and fall with the good and indifferent reports of what the harvest shall be. He supports lines of steamers with his wonderful freights of breadstuffs, provisions, meats, cattle, and sheep. He maintains the millions of artisans who clothe and shelter him, and who provide for every one of his wants outside of the field.

The mechanical power of the age is like a series of concentric and eccentric circles, of which the farmer stands out in the principal center. These all revolve with and about agriculture, and the same force sets all in motion. It is the farmer's duty now to make the most of his opportunities. He should be the foremost man of the age. His influence should be felt everywhere. It is felt everywhere, for the wealthiest merchants and capitalists and the most active politicians all ask themselves how far the farmers can be depended upon before they make a movement in their special pursuits. But the farmer should feel this himself. It is one thing to have power, and another thing to be cognizant of the possession. Let the farmers consider now their position, and, as they take a view of it, let them consider what they owe to the power and influence of machinery. One most conspicuous example of the results pointed out may be noted. A few years ago Minnesota spring wheat was graded very low in the grain markets and brought a low price. Unfortunately for the Western farmers this grade of spring wheat was the only one they could produce. A new process in milling was introduced. Elaborate machinery was invented to perfect the process. The best wheat by this process was the grade known as "Minnesota spring," theretofore despised and rejected—literally "rejected," in fact, in the markets. Afterward this grade became sought by millers, and the value advanced to a point equal to, and sometimes more than that of the previously much-sought winter wheats. If Minnesota farmers produce forty million bushels of wheat annually, this advanced value, due to the new process, puts several millions of dollars yearly into their pockets; and what a vast amount of comfort and happiness may be secured by the right use of so much money! This is but one instance of the vast concatenation of circumstances which points the moral here alluded to.

Supposed Preventive for Carpet Beetles.

A writer in the Germantown *Telegraph* suggests that, as the larvæ of the bacon beetle (*Dermestes lardarius*), an insect closely allied to the carpet beetle, will shun their food when tallow is placed near them, their repugnance to that substance being so great that the insects will devour each other rather than approach it, the same peculiarity may be quite possibly met with in the larvæ of the carpet beetle; and if so the coating of floors and filling the cracks with tallow (the cracks being their place of concealment) would possibly prove an effective destroyer of these troublesome pests. The experiment could be easily tried. If good mutton tallow be employed there could be no hurtful absorption of the grease, especially when the carpets have linen backs.

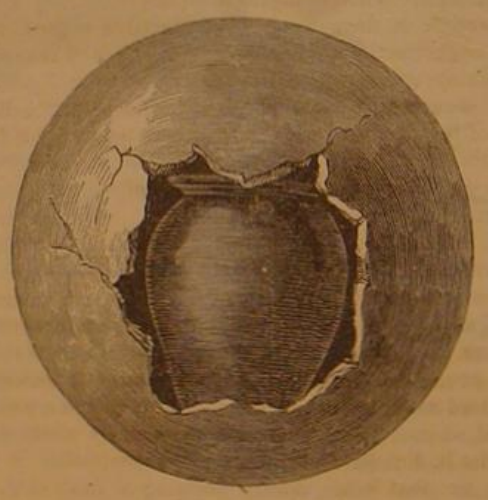
The Year.

The Egyptians, it is said, were the first who fixed the length of the year. The Roman year was introduced by Romulus, 738 B.C., and it was corrected by Numa, 713 B.C., and again by Julius Cæsar, 45 B.C., who fixed the solar year as being 365 days and 6 hours. This was denominated the Julian Style, and prevailed generally throughout the Christian world till the time of Pope Gregory XIII. The calendar of Julius Cæsar was defective in this particular, that the solar year consisted of 365 days 5 hours and 49 minutes, and not of 365 days 6 hours. This difference at the time of Gregory XIII. had amounted to 10 entire days. To obviate this error Gregory ordained in 1582 that *that* year should consist of 365 days only; and in 1751 it was ordered to be so used in England; and the next year 11 days were left out, the 3d of September, 1752, being reckoned as the 14th, so as to make it agree with the Gregory Calendar. The Russians still adhere to the Julian Calendar (called now *Old Style*), which is 12 days behind the reckoning of the Gregorian.

The year 1881 will be a mathematical curiosity. From right to left and left to right it reads the same. Eighteen divided by 2 gives 9 as a quotient; 81 divided by 9 gives 9; if divided by 9 the quotient contains a 9; if multiplied by 9 the product contains two 9s; 1 and 8 are 9; 8 and 1 are 9. If the 18 be placed under the 81 and added the sum is 99. If the figures be added thus, 1, 8, 8, 1, it will give 18. Reading from left to right it is 18, and 18 is two-ninths of 81. By adding, dividing, and multiplying 19 9s are produced, being one 9 for each year required to complete the century.

A CURIOUS GRAVE.

The practice of burning the dead was common among the ancients, and was in vogue during the first two centuries of the Christian era. In Italy, the ashes of the dead were generally buried in the ground or deposited in vaults, while among the Celtic people inhabiting Gaul and Britanny the urn was frequently inclosed in terra cotta globes and then



interred. One of these spherical graves is shown in the engraving; it was discovered near Lincoln, England, by the Rev. John Carters. The globe is roughly made of terra cotta. It has a diameter of several feet, and contains an urn, the shape of which indicates its Roman origin. As at that period Roman legions occupied England, the ashes are probably those of a soldier from the Gallic provinces. The urn is made from white clay.

Treatment of Whooping Cough in Gas Works.

According to the *Lancet*, a series of recommendations on the treatment of whooping cough in gas works has been made to the French *Académie de Médecine*. Some time ago a committee of three was appointed to investigate the subject, and of these M. Roger, the President of the Académie, is the sole survivor. He has lately presented a report which is of considerable interest. Before considering the communication, he described the arrangement of the chambers for purifying the gas, and the chemical products which patients would breathe therein. The purifying chamber is a large room with doors and windows freely open. Each contains twenty-four vessels, holding five cubic meters of depurating substance—lime and sulphate of iron, mixed with sawdust—through which the gas has to pass. When the workmen are emptying and refilling these vessels the children with whooping cough are placed around it, and inhale the vapors which escape. They are in an atmosphere containing ammonium sulphide, carbolic acid, and tarry products. As to the efficacy of the treatment, M. Commenge records 120 cases in which the treatment was persevered with. In 20 the treatment failed completely, in 48 improvement followed, and 101 were cured. M. Bertholle merely states that of 341 cases 122 were improved and 219 were cured. Failures or deaths are not mentioned. Besides the 490 cases improved there were, it appears, 671 cases not included, because the treatment was not persevered in, and these perhaps include a large number of failures. The remote situation of most gas works, and the exposure involved in the treatment in winter, must necessarily limit the application of the method. M. Roger thinks that it acts only upon one element of whooping cough—the catarrh—and that it is contra-indicated in febrile attacks of the disease, and would be dangerous in complicated cases. The method, however, is easy of use in some localities in summer, and seems worthy of further trial in suitable cases.

MISCELLANEOUS INVENTIONS.

Mr. Abraham Witmer, of Safe Harbor, Pa., has patented an improved car starter. Coiled springs are engaged by clutches operated by the wheels when the car is stopped, and the springs thus being wound up, the momentum of the car is stored up as a force to assist the subsequent starting. Means for placing this arrangement under the control of the driver or conductor of the car are provided.

Mr. Wallace H. Phelps, of Alliance, Ohio, has invented an improved drill for coal. It is a large auger provided with a peculiar screw feed and means for holding it in adjustment, and the bits or cutters are formed of S-shaped cutting knives formed with cutting edges at both ends The shape of these knives renders them effective and durable.

A curious combination of water races with gates at different heights, water wheels, tanks, and pumps, has been patented under the title of "water power," by Mr. Robert Thamm, of Oshkosh, Wis., by which means the water can be made to act upon a single motor, or a series of motors, the water acting successively upon the motors in the order of their elevation.

A patent for a spark arrester has been granted to Messrs. Geo. Gunther, of Bath, N. Y., and William Kowalski, of Brooklyn, N. Y. The lower part of the smokestack has a jacket, and the upper part of the stack is attached to the lower part by brackets. In the upper part of the stack is placed a deflecting cone with its apex downward over the opening in the lower part. The blast is turned outwardly and downward, and a portion of it emerges through the opening between the two parts of the stack, while the sparks are retained in a space between the upper and lower parts, the lower part projecting upward into the upper part.

Mr. Jonathan Cornell, of Sandy Hill, N. Y., has patented an improvement in paper pulp washers, which washes the pulp faster than strainers constructed in the ordinary manner, and enables the operator to see into the washers to watch the progress of the work, and to clean the strainers when necessary by water discharged through a hole against the inner surface of the strainers.

Mr. Oley C. Hanson, of Eureka, Cal., has patented an improved shingle machine, in which, by a peculiarly constructed carriage for conveying the block to the saw, a novel sliding crank feed mechanism and a device for changing the lead of the saw, he secures simplicity of construction, speed, and regularity in the operation of the machine.

A rectilineal motion of sulky plows is secured in an invention patented by Mr. Samuel H. Taylor, of Kansas City, Mo. Bars with lateral slots form the connection of the plow to the sulky shaft, which permits the draught pole of the sulky to oscillate laterally without affecting the direction of the plow, which can be raised or lowered at will by the operator.

Messrs. George Biehn and Rudolph Weidauer, of Racine, Wis., have patented an improved band cutter for thrashing machines so constructed as to cut the bands rapidly and surely and deliver the grain in good condition to the feeder. The feeder is protected from being accidentally cut by the knife of the band cutter.

An improved heel for boots and shoes, patented by Jean Leycuras, of Paris, France, provides improved means for mounting the heels upon the shoe, secures increased solidity and greater rapidity in manufacture, and completely masks nails, screws, and threads. The heel is provided with a circumferential groove, and the upper leather is secured at its edge in the groove by nails driven from the outside. An overlapping edge, or strip of leather, is arranged to turn up over and mask the nail heads.

Fires in Coal Mines.

A vein near Coal Castle, Schuylkill County, has been burning for forty-five years. A huge fire was kept in a grate at the mouth of this mine to prevent the water in the gutters from freezing. One night, in 1835, the timbers of the drift caught fire, and when discovered the flames were beyond control, and the mine was abandoned. Many efforts have been made since to work the mine, as the coal was of remarkably good quality; but although it has been flooded many times, the fire continues to rage, and the intense heat makes it impossible for miners to labor even in slopes which were opened some distance from the burning vein. No vegetation grows on the surface above this pit of fire, and it is dangerous to walk across it, as many places have caved in, and there seems to be but a thin shell of earth over it. Near Mauch Chunk there is Summit Hill Mine, which has been burning for about twenty-five years, and vast sums of money have been expended in fruitless efforts to extinguish the flames.

Quillaia Toothwash.

BY ALEXANDER E. BENNETT, PH.G.

An excellent toothwash containing glycerin is made as follows: R. Soap bark, ground, 4 ounces; glycerin, 3 ounces; diluted alcohol, sufficient for 2 pints; oil of gaultheria, oil of peppermint, ää 20 drops.

Macerate the soap bark in the mixture of glycerin and diluted alcohol for three or four days, and filter through a little magnesia previously triturated with the volatile oils.

Thus made, a much better preparation is obtained than by macerating the bark in the dilute alcohol, and adding the glycerin afterward.—*American Journal of Pharmacy.*

[New York Tribune.]

Interesting Tests Made by the Government Chemist.

Dr. Edward G. Love, the present Analytical Chemist for the Govern of the United States has recently made some interesting experiments as to the comparative value of baking powders. Dr. Love's tests were made to determine what brands are the most economical to use. And as their capacity lies in their leavening power, tests were directed solely to ascertain the available gas of each powder. Dr. Love's report gives the following:

"The prices at which baking powders are sold to consumers I find to be usually 50 cents per pound. I have therefore calculated their relative commercial values according to the volume of gas yielded on a basis of 50 cents cost per pound."

NAME OF THE BAKING POWDERS.	AVAILABLE GAS. CUBIC INCHES PER EACH OUNCE POWDER	COMPARATIVE WORTH PER POUND.
"Royal" (cream tartar powder)	127·4	50 cts.
"Patapsco" (alum powder)	125·2	49 "
"Rumford's" (phosphate) fresh	122·5	48 "
" " old	32·7	13 "
"Hanford's None Such"	121·6	47½ "
"Redhead's"	117·0	46 "
"Charm" (alum powder)	116·9	46 "
"Amazon" (alum powder)	111·9	44 "
"Cleveland's" (short weight ½ oz.)	110·8	43 "
"Czar"	106·8	42 "
"Price's Cream"	102·6	40 "
"Lewis's" condensed	98·2	38½ "
"Andrews' Pearl"	93·2	36½ "
"Hecker's Perfect"	92·5	36 "
Bulk Powder	80·5	30 "
Bulk Aerated Powder	75·0	29 "

NOTE.—"I regard all alum powders as very unwholesome. Phosphate and tartaric acid powders liberate their gas too freely in process of baking, or under varying climatic changes suffer deterioration."

[New York Tribune.]

Alum Baking Powders in Court.—Interesting Testimony of Scientific Men.

Within the past two years a bitter controversy has been waged between manufacturers, on account of the use of alum as a cheap substitute for cream of tartar, by many manufacturers of baking powders. The handsome profits yielded by using the substitute have induced dealers as well as manufacturers to push them into the hands of consumers, sometimes under definite brands, frequently by weighing out in bulk without any distinguishing name.

Are such powders wholesome? The Royal Baking Powder Co., who make a cream of tartar baking powder, declared that they are injurious to the public health, while others who make alum powders claim that they are not. The whole matter as to the effects of these alum powders has finally been brought into the courts, and the case was tried in the Superior Court of New York city before Chief Justice Sedgwick, reported substantially as follows in the New York *Sun*:

CONCLUSION OF A LITTLE TROUBLE BETWEEN A CHEMIST AND AN EDITOR.

The suit of Dr. Henry A. Mott against Jabez Burns, has brought to light the fact that this country produces at least forty-two different kinds of baking powders. Neither Burns nor Mott has been found guilty of making the baking powders, but Burns, who is the editor of a periodical called the *Spice Mill*, has been severely mulcted for libel in his efforts to make his paper spicy. Dr. Mott, it appears, is a chemist, and at one time was employed by the United States Government to analyze different specimens of baking powder which had been recommended for adoption to the Indian Bureau. Dr. Mott reported in favor of the cream of tartar baking powders for the Indians, and against the alum baking powders. The chemist analyzed forty-two kinds of baking powders.

The jury were out about half an hour. Then they came in with a verdict awarding Dr. Mott $8,000, to which the Court made an additional allowance of $150.

As the public have a large interest in the wholesomeness of whatever it is called upon to use as food, the following extracts are introduced from the testimony of some of the prominent men as to the injurious effects of alum powders:

DR. MOTT:

Q. Were you employed by the U. S. Government?

A. I was, sir; was employed as chemist, to analyze all the articles of food; to express an opinion as to the analysis of their healthfulness and purity.

Q. Please tell the jury the baking powders that you examined while in the employ of the government.

A. It would be difficult to remember them all; I could refer to my books; I examined twenty-eight powders; was given sixteen at first.

By the Court:

Give your best recollection.

Q. And one of the powders included was "Dooley's Baking Powder?"

A. Yes, sir.

Q. And the "Charm?."

A. Yes, sir; the "Charm" and "Patapsco."

Q. Please state in which powders you found alum.

A. I found alum in Dooley's "Patapsco," "Charm," "Queen," "Vienna," "Orient," "Amazon," "Lake Side," "Twin Sisters," "Superlative," "King," "White Lily," "Monarch," "One Spoon," "Regal," "Imperial," "Honest," "Economical," "Excelsior," "Chartres," "Grant's," "Giant."

Q. Recurring to the question that has been asked you upon this suit—the result of these examinations which you have made—is it your opinion that alum in these various compounds, in baking powders such as you have examined, is injurious?

A. It is my opinion, based upon actual experiments on living animals.

CHARLES F. CHANDLER, called on behalf of the plaintiff, being duly sworn, testified as follows:

Q. Dr. Chandler, you reside in the City of New York?

A. I do.

Q. Your business is that of a chemist?

A. It is.

Q. You are and have been Professor of Chemistry in several colleges?

A. I have.

Q. Please state how long that employment of yourself has been, and with what colleges you are now connected.

A. I am at present Professor of Chemistry in the Academic Department of Columbia College; the School of Mines, Columbia College; the New York College of Physicians and Surgeons, and the New York College of Pharmacy.

Q. You are President, also, of the Board of Health, are you not?

A. I am.

Q. In your various employments, have you had frequent occasion to examine the question of the wholesomeness of food, and the beneficial or injurious effects of its ingredients?

A. I have.

Q. I will ask you in regard to the use of alum with soda, in a baking powder, whether or not it is neutralized—is there any injurious constituent of alum left?

A. There is an injurious constitutent left after the mixture of alum and bicarbonate of soda.

Q. Without using any nicety of chemical terms, what is your opinion about the use of alum in a baking powder, in combination with bicarbonate soda and other ingredients, for raising bread—whether injurious or not?

A. I think it is dangerous to the digestive organs, and liable to produce serious disturbance of the liver of the individual making use of such powders

HENRY MORTON, President of "Stevens Institute," called in behalf of the plaintiff, being duly sworn, testified as follows:

Q. You are President of Stevens Institute?

A. I am.

Q. And have for many years been a chemist?

A. I have.

Q. Have you had occasion to examine the substances which are used in the composition of baking powders?

A. I have.

Q. Did you, some time ago, examine a sample of Dooley's Baking Powder?

A. I did.

Q. Is that it, sir? [handing can].

A. Yes, sir; that is it.

Q. Well, what kind of alum did it contain?

A. It contained potash alum.

Q. Did you make any extract of that alum, to show the kind?

A. I did; I extracted a large quantity of it as potash alum, and it is in that bottle which I have now here [showing bottle]; that is potash alum which came out of the alum baking powder that was in that can.

Plaintiff's Counsel offers said can of Dooley's Baking Powder in evidence.

Q. Now, sir, have you made any experiment in the bread made from baking powder, to see whether there was any soluble alumina in the bread itself?

A. I have; I took a portion of this powder and mixed it with flour in the directed proportions, and baked a small loaf with it; then I soaked this loaf—the interior part of it—in cold water, and made an extract, in which I readily detected, by the usual tests, alum—that is, alumina in a soluble condition.

Q. Does any baking powder in which any alumina salts enter, contain alumina, in your opinion, which can be absorbed in the process of digestion—are not such objectionable?

A. Very decidedly objectionable, in my opinion.

Q. Why do you say—from what system of reasoning do you make it out—that because alum is injurious, alumina is injurious?

A. Because the injurious effects of alumina, when it gets into the stomach and reacts on the organs, are the same; this hydrate of alumina meets in the stomach the gastric juices, and reacts with them the same as alum would; it forms, in fact, a kind of alum in the stomach with those acids, and whatever alum would do, it would do.

Dr. SAMUEL W. JOHNSON, Professor of Chemistry in the Scientific School, Yale College, being duly sworn, testified as follows:

Q. You have had much to do in the examination of substances that enter into food, and the adulteration of food?

A. More or less; yes, sir.

Q. After the use of alum with soda, in a baking powder, in your opinion, is there any injurious substance left?

A. In my opinion, there is an injurious substance left.

Q. What, sir, two years ago, was the prevailing opinion among scientific men, as to the effect of the use of alum in baking powders?

A. As far as my acquaintance with scientific men is concerned, my personal opinion is derived from my investigation and from reading; I should think the opinion was that alum, or any compound of alumina, would be decidedly injurious.

Q. Do I understand you to say that any baking powder in which there are aluminous salts, or any resultant from alum which could be absorbed in digestion, is objectionable and injurious?

A. Extremely so.

Prof. JOSEPH H. RAYMOND called, sworn and testified as follows:

Q. Would you be good enough to state your profession?

A. I am a physician, sir, and a professor of physiology.

Q. You also were, and have been for some time, Sanitary Superintendent in Brooklyn—is not that so?

A. I have, sir.

Q. Now, sir, I will ask you your opinion, from this experience, whether the use of alum with soda, in a baking powder, is injurious or not, in its physiological effects?

A. I consider it to be dangerous.

Q. You examined this question for the Board of Health in Brooklyn, some years ago, did you not?

A. Two years ago, sir, in December.

By the Court:

Q. What was the result of your investigation as to the use of alum in baking powder?

A. The result of my investigation at that time was this: that the changes which took place between the time that alum baking powder was put in the bread, and the time the bread was eaten, the chemical changes were so little understood by chemists, that as a physician and physiologist, I considered it a dangerous experiment.

Dr. Mott, the Government chemist, in his review on the subject in the SCIENTIFIC AMERICAN, makes special mention of having analyzed the Royal Baking Powder, and found it composed of pure and wholesome materials. He also advises the public to avoid purchasing baking powders as sold loose or in bulk, as he found by analyses of many samples that the worst adulterations are practiced in this form. The label and trade mark of a well known and responsible manufacturer, he adds, is the best protection the public can have.

DECISIONS RELATING TO PATENTS.

United States Circuit Court.—Northern District of New York.

UNITED STATES STAMPING COMPANY *vs.* JEWETT *et al.*

Blatchford, J.:

1. Patent to E. A. Heath, No. 119,705, granted October 10, 1871, not anticipated by invention of Weber, the proofs failing to show beyond a reasonable doubt that Weber was prior to Heath.

2. Where the decree in a former suit against one license of a patentee was for a simple dismissal of the bill a claim that the plaintiff is estopped from suing another licensee will not be entertained.

3. Where a patent has been allowed and ordered to issue, and an assignment has then been made authorizing the Commissioner to issue patent to assignee, and patent issue to inventor, the assignment not having been recorded until after the issue of the patent, *Held* that the legal right to the patent became vested in the assignee on the recording of the assignment.

Our Trade with China.

Recent official reports show an encouraging increase in American trade with China, whose vast and undeveloped markets offer enormous opportunities for our manufacturers and farmers.

A few years ago wheaten bread was all but unknown in China. The multitudes of returning Chinamen carry home with them not only a knowledge of wheat but a preference for it. One steamship from San Francisco carried to China, last year, 1,400 tons of flour; and the entire shipment for 1879 was 235,789 barrels. The vast wheat fields of the Pacific coast are likely soon to find an ample market for their products among the millions of the Celestial Empire.

During the same year California found in China a market for half her quicksilver product, or 36,696 flasks. Of other products the total shipment from the country was not large, but the variety indicates great possibilities of future development. The exports to China for the year, the last for which official reports have been published, included clocks, to the value of $50,397; cottons, colored, $270,600; cottons, uncolored, $1,302,000; drugs and chemicals, $13,700; glassware, $14,000; silver bullion, $1,831,000; machinery, $9,000; other iron manufactures, $9,000; firearms, $17,000; lamps, $22,000; kerosene, $690,000; ordinance stores, $9,000; provisions, such as bacon and other meats, butter and cheese, etc., $42,000; refined sugar, $7,000; tobacco, $52,000; clothing, $10,000.

TO RENDER IVORY FLEXIBLE.—Ivory is readily rendered quite flexible by immersion in a solution of pure phosphoric acid (specific gravity 1·13) until it loses, or partially loses, its opacity, when it is washed in clean cold water and dried. In this state it is as flexible as leather, but gradually hardens by exposure to dry air. Immersion in hot water, however, restores its softness and pliancy. The following method may also be employed: Put the ivory to soak in three ounces nitric acid mixed with fifteen ounces water. In three or four days the ivory will be soft.

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.

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.

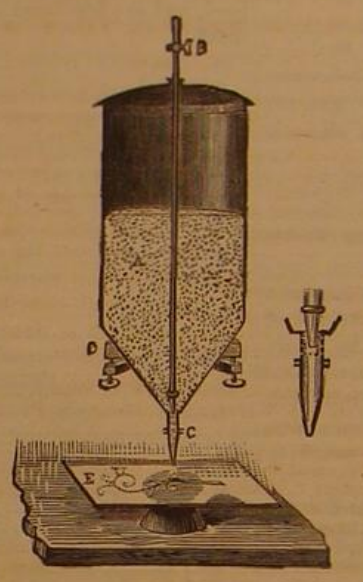
Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) W. C. L. asks: Will a combination of coal gas and air confined in a chamber explode if exposed to heat? A. We have not heard of any instance of such an explosion having taken place without contact with a flame.

(2) W. W. G. asks: What is the scientific reason for the fact that the moons of Jupiter may be seen by reflecting his image in a common looking glass or mirror held horizontally, that is, the moons may be seen reflected in the glass? A. What are imagined to be the moons visible under such circumstances are not so in reality, but only a reduplicating of the body of the planet itself. The following are the optical principles involved in the formation of these false satellites. When the light from a luminous body falls upon a mirror held as described, two primary reflections reach the eye of the spectator, one from the first surface of the glass, the other from the back or silvered surface, which is much brighter than that from the outer surface. But this is not all. When the rays from the silvered side were being transmitted to the eye, part of them, when encountering the upper surface of the glass, were stopped, reflected back to the mirrored surface, to be again sent forward to the eye from a point different from those at which the two previous, or primary, reflections were made. The thicker the plate of glass the greater will be the separation of those images. This phenomenon may very easily be seen and studied by holding a plain piece of glass up on a level with the face, watching in it the reflected image of the flame from the gas or a lamp, when, if the glass is properly held, from four to eight or ten of these supplementary reflected images will readily be seen. This is usually designated "multiple reflection."

(3) C. H. B. inquires: What acid or other liquid will destroy or decompose any kind of wood with the greatest rapidity? A. Wood is chemically composed of two parts, lignin and cellulose. The walls of the vegetable cells are formed of the former; the filling matter of such cells by the latter. Lignin may be separated from wood in a pure state by boiling sawdust successively in alcohol, water, weak potash solution, dilute muriatic acid, and, finally, water. Lignin is not soluble in water, alcohol, ether, or oils; it is, however, soluble in strong nitric acid, which, on the other hand, has no action on the other constituent of wood, the cellulose, which is readily soluble in sulphuric acid, and by which it is converted into a substance similar to dextrine. From this the inference will at once be drawn that a solvent of wood must be composed of both acids. Whether these had better be employed in succession or mixed together in the form of nitrosulphuric acid, one or two experiments will determine, such experiments to be made on sawdust of any special kind of wood that our correspondent may have in his mind when putting the query.

(4) R. G. and others ask how to construct a simple and inexpensive sand blast apparatus for engraving glass and hard metals. A. Well dried sand, contained in the cylindrical vessel, A, is allowed to flow in a continuous manner through the tube, C, whose length and inclination can be altered at will, so as to regulate the fall of the sand. The tube conveying the current of air or steam terminates just above this spout, in a nozzle containing a series of fine holes. The sand, urged on by the jet, is thrown violently against the



glass plate, E, or other body placed within its range, and thus exerts an abrading action. By varying the quantity of the sand, the volume and the velocity of the current, as well as the diameter of the jet, more or less rapid effects are produced. Holes may be drilled in glass and in substances much harder than glass by means of this apparatus. In engraving on glass very little pressure is needed, the current from the bellows of an enameler's lamp being quite sufficient. In this way the divisions on graduated tubes, the labels on bottles, etc., can easily be engraved in laboratories with but little trouble. The portions of the glass which are to remain clear are covered with paper, or with an elastic varnish, these substances being sufficient protection against the abrading action of the sand.

(5) J. F. asks how to remove the hard burnt oil off the cylinder head of a steam engine. A. Try a small quantity of a strong solution of caustic potash in alcohol.

(6) W. H. W. asks if the oil that is caught by the cups under the hangers or journals can be used again. A. It should not be used again without purification. According to Simm's process the waste oil is dissolved out from the impurities by bisulphide of carbon filtered, and the bisulphide distilled off in a retort jacketed with hot water or steam, condensed and collected so that it may be used again for a similar purpose.

(7) H. C. G. asks how to color violins a dark cherry similar to the Cremonas, and how to prepare the stain and shellac. A. Stain—Dragon's blood 2 ounces, spirits of wine 1 quart. Digest with occasional agitation until dissolved. Varnish—Coarsely powdered gum copal and glass, each 4 oz.; alcohol, 1 pint; camphor, ½ oz.; heat the mixture with frequent stirring in a water bath so that the bubbles may be counted as they rise, until solution is complete, and when cold decant the clear portion.

(8) T. P. writes: In glazing sash, when the glass is crooked or convexed, which is the proper side to place next to the wood, the convex or concave side? A. The concave side, for the simple reason that the convex side gives the window a better appearance when placed outward.

(9) P. M. H. writes: I have a cast iron kettle that is cracked: how can I repair the damage? A. Sulphur, 2 parts; blacklead (plumbago), 1 part; melt the sulphur in an old iron pot over the fire, then add the blacklead, stir well together, and pour out on an iron plate or smooth stone. Apply with a hot iron after the manner of tinsmith's soldering.

(10) F. D. M. asks. Will water expand or contract in freezing? Will a water pipe burst when it freezes or when it begins to thaw out? A. Water contracts on cooling, but in congealing it expands. The rupture of water pipes is caused by the change of the water from the liquid to the solid state—not by the thawing, though it is only then that the damage to the pipe becomes apparent. Consult Tyndal's "Heat as a Mode of Motion."

(11) A. F. T. asks how to make jet black writing ink. A. Blue galls, 4½ oz; bruised cloves, 1 drachm; cold water, 40 oz; pure sulphate of iron, 1½ oz.; pure sulphuric acid, 35 minims; sulphate of indigo in the form of a thin paste, and which should be neutral or nearly so, ¼ oz; pure water, about 1 quart. Boil the galls gently in 1½ pint of water for an hour, adding water for what is lost by evaporation. Strain and squeeze the galls (in a press). Cool, filter, and add the iron salt dissolved in water and filtered; add the acid, agitate briskly, then add the indigo, shake, and filter. Improves by age.

(12) C. H. S. asks: What are the ingredients of the lightning stove polish sold by men on the streets? It is rubbed on with a cloth, requires no brushing, and gives a bright luster. A. Pure graphite, or plumbago, reduced to an impalpable powder by grinding and bolting.

(13) G. H. C. asks: What preparation (weighing much less than paint) will effectually waterproof a canvas canoe? A. Try paraffine mixed with ½ its weight of boiled oil. Melt by heat or dissolve in benzole.

(14) A. J. S. asks: Is there any air in pure water? If so, in what proportion; or how much to the gallon? A. All natural waters hold air in solution. The quantity is usually small and very variable.

(15) J. D. S. asks: 1. Can you inform me if there is to be had a mineral (or other) powder which will answer the following requirements, namely: Color a bright full yellow; insolubility in hot or cold water or sugar solution; an impalpably fine state of division as is seen in the best German ultramarine; not poisonous unless taken in quantities over ten grains? A. Reduce the deepest yellow glass, pure crown, free from lead, the color of which is due to silver, to impalpable powder by milling. Then pass it through a silk sieve. 2. Is there any way of preparing a cement of rubber or other gum which I could use to firmly attach two pieces of leather without impairing its pliability? It must be entirely waterproof and strong. A. See p. 2510, No. 158, SCIENTIFIC AMERICAN SUPPLEMENT.

(16) J. L. S. asks (1) for a receipt for a varnish or paste, or solution, by which to cover or saturate woolen felting to make it waterproof (against warm water) and at the same time remain pliable. A. *a.* Dissolve 1 part of pure gum rubber (caoutchouc) cut in shreds in about 20 parts of bisulphide of carbon free from dissolved sulphur. Pass the felting, first thoroughly dried, through this, then expose to the air until the smell of the solvent has disappeared. Do not use the solvent too strong—dilute with bisulphide. *b.* Paraffine, 10 parts; boiled oil, 2 parts; benzole (pure), 46 parts. Apply as above. 2. Also a receipt for a cement for cementing felting together. A. See marine glue—p. 2510, No. 158, SCIENTIFIC AMERICAN SUPPLEMENT.

(17) W. T. asks (1) how to prepare the silver solution in electro-silver-plating. A. Pure nitrate, 2½ ounces; cyanide of potassium (pure), 4¼ ounces; water, 1 gallon. Dissolve the cyanide in a portion of the water and the silver nitrate in another, mix well together until clear. 2. Is one cell of gravity battery sufficient for silver-plating small articles, such as spoons, forks, etc? A. Hardly. The exposed surface of zinc should about equal the surface of the work in the bath.

(18) J. H. V. & Co. ask: Can you inform us of any solder with which we can mend small cast iron (2 oz.) castings with a heat that will melt hard solder? We find, by using common solder, the muriatic acid in a short time rusts under and lets the solder loose. A. Silver solder will answer your purpose, providing the fracture is clean and fresh. Paint the adjoining surfaces sparingly with borax ground to a fine cream on a slate or slab. Clamp or wire the joint firmly, and apply the silver solder in small pieces around the casting on the joint, sticking them with the borax cream. Heat in a charcoal fire or blow-pipe flame until the solder flows. If soft solder has been previously applied to the casting it cannot be soldered with silver solder. See soldering in SUPPLEMENT, No. 20.

(19) F. P. C. asks: 1. What is the best preparation to use on a stove pipe, to keep it from rusting? Something not very expensive, although durable, yet will not cause the pipe to burn out. A. Apply pure graphite (plumbago) ground to a very fine powder and mixed with a little water, then rub over with some of the same, dry. 2. Which is the best foot and power lathe, and where made—all things considered—for range of work, light running, moderate cost, durability, accuracy in the work without dead centers, something suitable for ordinary workshop or amateur varied work; screw cutting included? A. See our advertising columns, also "Hints to Correspondents." 3. Will pure virgin India-rubber, dissolved in about 8 or 10 times its own weight in benzole, do to mend boots? If serviceable, how should it be used? Should it be applied as varnish over the worn or damaged parts, or put under pressure with a suitable size to cover the defect or damaged part? And if pasted or cemented on under pressure, will it be serviceable? A. Yes; patch and put under moderate pressure until dry. 4. How are uppers on leather boots and shoes mended without using thread, etc.? Can a piece of leather, of suitable size, be pasted or cemented over the defective parts on the body of the boot or shoe, making a neat mend and also serviceable? A. See marine glue (second receipt), p. 2510, SCIENTIFIC AMERICAN SUPPLEMENT, No. 158; also rubber cement, same page.

(20) E. E. S. asks how to plate small articles of steel and brass with gold, silver, and nickel, without a battery. A. Gilding by dipping: Distilled water, 17 pints; pyrophosphate of potassa or soda, 28 ounces; solution of hydrocyanic acid (⅛ pure acid), ⅓ ounce; terchloride of gold, ¾ ounce. Put 16 pints of the water in a porcelain or porcelain-lined iron vessel, and gradually stir in the pyrophosphate, heat, filter, and let it cool down. Add the gold chloride dissolved in water, and then the hydrocyanic acid. Heat the bath nearly to the boiling point for use. (Hydrocyanic acid, it must be remembered, is very poisonous, and it must be handled accordingly.) When heated the liquid becomes colorless. If a red or violet is developed, add a few drops more hydrocyanic acid. Clean the articles thor-

oughly; dip them in a strong aqueous solution of mercurous nitrate, then, for a few seconds, in the hot gold bath, rinse in clear water, dry in warm sawdust, and burnish if desired. Silvering by dipping: To a saturated aqueous solution of bisulphite of soda in pure water add solution of nitrate of silver, with constant stirring, until the precipitate at first formed ceases to redissolve. Use the bath cold in a porcelain enameled iron vessel. Clean and dip as in the gold bath. We know of no satisfactory method of coating with nickel without a battery.

(21) R. M. asks for a receipt for making a gold and silver wash suitable for small brass articles. A. See answer to E. E. S., above.

(22) I. A. B. wants to know the cheapest and best deodorizer or deodorizing process for kerosene or petroleum. A. Hydrocarbon derivatives of petroleum —such as kerosene—possess a characteristic odor which cannot be totally removed without altering the identity of the substance. The unpleasant odor imparted to it by impurities which it commonly contains may be removed by the following treatment: Agitate it briskly with three per cent of oil of vitriol, wash out the acid with water; digest, with frequent agitation, for several hours with 5 per cent of clean, fresh chloride of lime, settle and wash out with water. Remove moisture by agitating with powdered chloride of calcium. Settle and decant.

(23) L. D. M. asks whether there is any law against turning out or filing off one side of United States gold and silver coins to make bangles of them, or against melting coins for the sake of the gold or silver. A. Section 5429 Revised Statutes, reads: "Every person who fraudulently, by any art, way, or means, defaces, mutilates, impairs, diminishes, falsifies, scales, or lightens the gold or silver coins which have been or which may hereafter be coined at the mints of the United States, or any foreign gold or silver coins which are by law made current or are in actual use and circulation as money within the United States, shall be imprisoned not more than two years and fined not more than two thousand dollars." We think this law prohibits the defacement of coins as in making bangles. We do not know of any provision that prohibits the melting of coins for the sake of the gold or silver.

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

Dr. G. H. P.—It is quartz rock.—J. T. C. and O. L.—A fair quality of fire clay. See column of Business and Personal for the addresses of dealers.—J. T. S.—A poor quality of peat.—O. A. P. T.—The ore consists chiefly of carbonate and sulphide of copper—it carries a small quantity of silver.—F. G. D.—A semi-decomposed feldspathic rock, with a little quartz and talc.—D. Mc. G.—Coal shale—of no commercial value.—P. M. C.—Limestone—of no value to lithographers.—J. G.—Hematite—an iron ore.—W. St. J.—The rock is a common mica and talcose schist - not the "tin bloom" of miners. It would hardly pay to dig deeper.—C. H. G.—The crystals are smoky quartz—of very little economic value.—H. S.—Chiefly carbonate of lime—not valuable. —G. J. G.—Quartz pebbles.—J. F. S.—Ferromanganese—iron and manganese oxides.—H. T. C.—It is a fair quality of carbon black. If properly packed might command a market here.

NEW BOOKS AND PUBLICATIONS.

CHICAGO FIELD, 155 and 157 Dearborn street, Chicago, Ill. Dr. N. Rowe editor. An illustrated weekly devoted to field sports. Price $4 per year.

This journal, under the editorship of Dr. Rowe, has taken a foremost position among papers devoted to sport and sporting. It is well edited, and each week contains articles of much valuable information for lovers of dogs and horses. It is the only illustrated paper published in this country devoted to sports of the field, and is well worth its subscription price to those who are fond of out-door sports.

WAR SHIPS AND NAVIES OF THE WORLD. By Chief Engineer J. W. King. Boston: A. Williams & Co. 1880. 8vo, cloth, pp. 623. Sixty-six pages of engravings.

Mr. King has had exceptional facilities for making a thorough study of the naval progress of Europe during recent years, and has brought to the task a degree of practical experience and insight quite as exceptional. He entered the United States Navy when the steam marine was in its infancy, and served in the first paddle wheel frigate, the first screw war ship, indeed in all the pioneer naval steamers with the single exception of the Fulton. He has been Government Inspector of ocean mail steamers, and Chief Engineer of the New York Navy Yard. He was Chief Engineer of the North Atlantic fleet in the early part of the civil war, and subsequently was superintendent of the construction of all the armor clads built west of the Alleghanies. More recently he has been chief of the Bureau of Engineering. Most of the information embodied in the present work was gathered during several tours of observation abroad under orders from the government of the United States, made for the purpose of studying recent progress in naval architecture and the mechanical appliances for use in naval warfare. The result is a comprehensive treatise containing a vast range of fresh information touching the construction, motive power, and armament of modern warships, naval artillery, marine engines, torpedoes, and torpedo boats, etc. The navies of all the naval powers are separately described, dwelling especially upon the changes in types of war ships, and in armor and armament made during the past decade. Much information is also given with regard to naval dock yards, methods of contracting for ships and machinery, naval administration, the personnel of navies, naval expenditures, and related matters. Extremely valuable also are the chapters on recent progress and improvements in artillery construction, the different systems of great guns, gun trials; armor plates and war ship materials and tests of them; the different systems of marine engines and boilers; steam and hydraulic steering gear; torpedo explosives, torpedo warfare, and the like. The author's wide experience as an engineer has admirably fitted him for this part of his task. Though treating of difficult subjects he has successfully endeavored to set down the information given in a manner so clear that the non-technical reader will be easily able to follow him. The volume is particularly timely at this juncture, when the great problems of restoring our commercial and naval marine, and of providing for the defense of our coasts, are attracting the attention of our legislators and citizens.

CHRISTMAS BOOKS. By Charles Dickens. New York: I. K. Funk & Co. 2 vols. 8vo, paper. Each 25 cents.

A Christmas Carol, The Chimes, The Cricket on the Hearth, The Battle of Life, and the Haunted Man, with sixteen full page illustrations, printed on clear type, are here given for fifty cents. The books comprise Nos. 48 and 49 of the standard series, the excellent quality and extreme cheapness of which we have several times taken occasion to speak.

JOSH BILLINGS' COOK BOOK. New York: G. W. Carleton & Co.

A cent's worth of proverbial philosophy badly spelled, some poor engravings, and a few burlesque recipes as destitute of wit as they are of resemblance to English speech.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

December 28, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, 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. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Addressing machine, F. A. Darling 236,001
Amalgamator, W. D. Smith 236,100
Angle shears, W. & C. Sellers 235,908
Assay furnace, W. E. Judson 236,037
Axle boxes, oil guard for car, J. G. Tiller 235,917
Axle, car, J. M. Sigourney 236,097
Axles, machine for machining, F. D. Bliss 235,929
Bale tie, T. A. Weber 236,128
Bale tie, J. White 235,973
Bandage, W. E. Hull 236,033
Barrel, metal lined wooden, J. L. Barlow 235,980
Bat, game, C. Kreutzer 236,045
Beehive, J. W. Read 235,896
Belt lifter, F. Stapelmann 235,970
Billiard table chuck, V. Estephe 235,861
Billiard time register, automatic, H. Von Leesen. 236,123
Boiler, etc., covering, I. N. Peirce 236,077
Boneblack, kiln for drying and revivifying, W. R. Elmenhorst 235,942
Book, copy, E. P. Newman 236,070
Boot and shoe heel, F. Richardson 236,086, 236,087
Boot and shoe stiffeners, machinery for moulding, S. Prior 235,962
Bottle filler, E. Kleiber 236,043
Bottle stopper, J. Morschhauser (r) 9,521
Bougies, stomach pumps, and other surgical instruments from celluloid, etc., manufacture of, G. Otto 235,958
Box trimming machine, T. Vanier 236,120
Bracket stand, A. B. Denison (r) 9,517
Brick, pottery, etc., kiln for burning, Schlimp & Honzik 235,907
Buckle, G. Pratt 235,895
Buckle, J. F. Molloy 236,061
Buildings, construction of, W. H. Older 236,072
Burnishing machine, W. O. Way 235,921
Butter cooler and water holder, comb'd, P. Dorlon 235,857
Button hole cutting machine, S. D. Tripp 235,918
Button or stud, Cooke & Spencer, Jr 235,853
Cans, sealing fruit, G. T. Hunsaker 235,879
Cant dog, T. F. Cassidy 235,992
Car brake, S. S. Leach 236,048
Car brake, G. Smith 235,912
Car brake, automatic, S. P. Tallman 235,916
Car coupling, McDougall & Shaw 236,054
Car, dumping, M. Van Wormer 236,121
Car heater, M. C. Root 235,899
Carpet cleaners, stretcher for, Bixby & Brooks ... 235,848
Carpet exhibitor, A. Peterson (r) 9,522
Carriage dash frame, H. Davies 235,905
Carriage seat, W. S. Durie 236,008
Carriage shifting seat, C. K. Mellinger (r) 9,520
Carriage spring gear, A. Warnock 235,920
Carriage top, J. Deline 236,002
Carriage top, F. A. Norcross 235,892
Carriage top, child's, J. N. Hazelip 236,027
Cartridge belt, A. Mills 236,059
Catamenial sack, J. Korff 235,884
Catarrh remedy, J. D. Olcott 236,071
Celluloid tubes, necking, W. B. Carpenter 235,933
Check row cords, coupling hook or button for, G. D. Haworth 236,025
Cheese cutter, L. J. Smith 236,102
Chuck, nipple, A. Saunders 235,902
Cigar box, J. M. Roberts 236,099
Cigarette machine, L. J. Bejottes 235,985
Clay press, Wilcox & Pearson 236,132
Clay to obtain porous and slagged bodies, preparing, G. Praetorius 235,961
Clock, J. H. Gerry 236,016
Clock winding attachment, J. H. Gerry 236,017
Clothes line fastening, E. A. Rice 235,964
Coffin pedestal, F. R. Taylor 236,109
Collars and cuffs, method of and apparatus for turning, I. P. Turner 236,118
Collars, sweat pad for horse, E. R. Jones (r) 9,519
Cooling, disinfecting, perfuming, etc., apparatus for, G. Praetorius 235,960
Copying press, J. S. Sammons 235,906
Cornice, window, J. Hermann 236,028
Corpse preserver, J. H. Forshay 235,863
Corset, T. C. Bates 235,928
Corset, L. S. Bortree 235,989
Corset, I. Newman 236,069
Cot, folding, R. E. Avery 235,977
Cranks, apparatus for overcoming dead points in, P. E. Jay 235,876
Cultivator, S. R. Bell 235,986
Curtain fixture, W. L. Washburn 236,126
Decoy duck, J. Appleton 235,845
Dental engine, portable, B. J. Quattlebaum 236,090
Dolls, colororing the eyebrows, etc., of celluloid, W. B. Carpenter 235,993
Door hanger, S. A. Drake 236,006
Draught equalizer for side reaping machines, A. 236,066
Drain pipe, burning, J. Murtagh 236,019
Dress protector, M. M. Graham 235,998
Egg boiler, L. M. Couchoud 235,978
Electric lighting device, G. D. Bancroft 235,930
Electric vapor bath, Hoffman & Palmer 235,997
Electrical apparatus, adjustable armature for, T. Cochran 235,913
Electricity, lighting cities by, H. C. Spalding 235,914
Electricity, lighting towns by, H. C. Spalding 236,004
Engine stopping device, G. H. Dougherty 235,871
Explosive compound, W. Heick 235,930
Eyeglass, H. Borsch 235,995
Eyeglass holder, F. A. Clark 235,900
Fare box, S. R. Ruckel 235,877
Fence holster, etc., T. B. Jones 235,934
Filter and cooler, water, Chapman & Miles 235,893
Filter, water, E. Over 236,044
Fire escape ladder, E. J. Krause 235,847
Fire extinguisher for railway cars, J. Berg 236,088
Fire kindling stick, C. Rieger 236,064
Fleam, Reinhold & Schreiber 235,881
Fore end stocks, fastening for, C. A. King 236,093
Fruit drier, J. M. Rusk 236,000
Fruit drier, domestic, H. M. Dake 235,904
Furnace, F. Schaffer 235,963
Game apparatus, A. Christie 236,047
Game apparatus, N. C. Larsen 235,951
Game board, P. Lawrence 235,987
Gangway and life raft, combined, J. E. Barstow 236,010
Gas burners by automatic means, apparatus for lighting and extinguishing, W. Effer 235,879
Gas lighting apparatus, electric, G. D. Bancroft 236,022
Gas, process of and apparatus for manufacturing, M. W. Kidder 236,039
Gate, N. Scarritt 236,094
Gate, S. Small 236,099
Glass button and mould for manufacturing the same, A. Hamann 236,029
Governor, steam engine, F. Heyer 235,965
Grain separator, A. A. Russell 236,104
Grinding mill, J. Stevens 235,855
Guard finger and sickle bar, P. Deevy 235,874
Harness, O. E. Hollister 236,078
Harness loops, machine for forming, Perkins & Allen 235,869
Harvester, corn, G. A. Harvey 235,924
Headlight, locomotive, I. A. Williams 235,927
Hinge, awning blind, F. B. Brown 236,124
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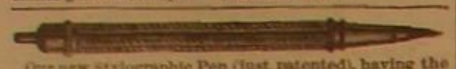

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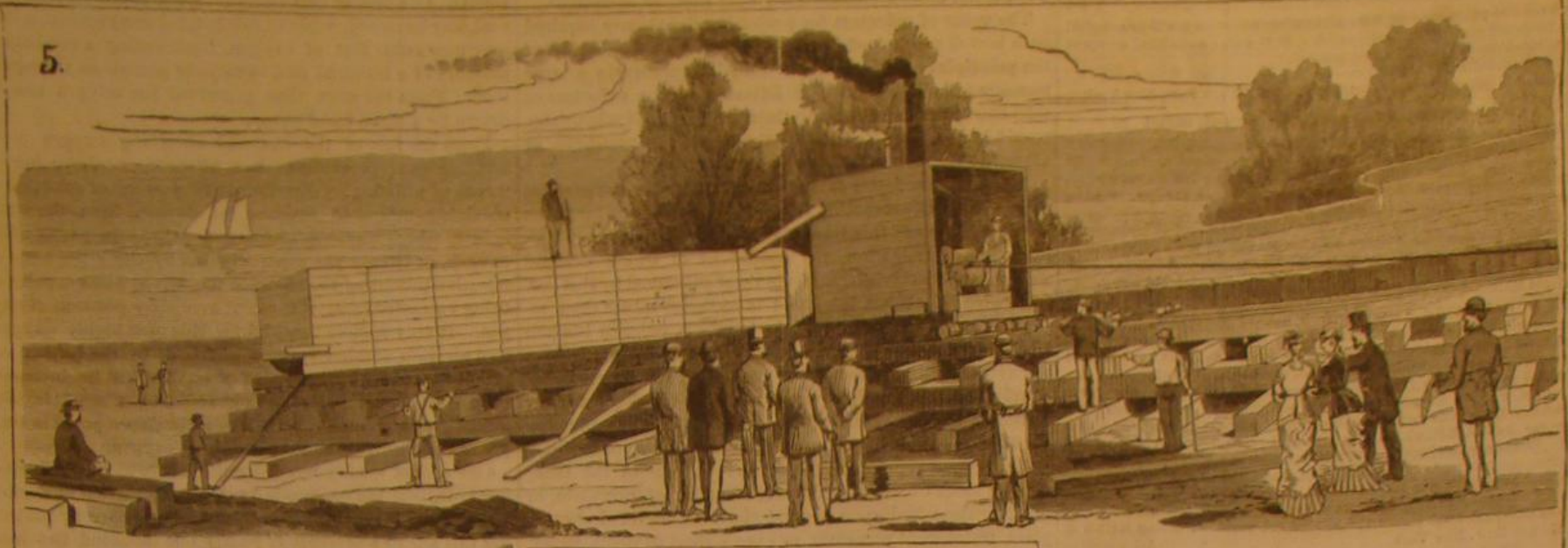

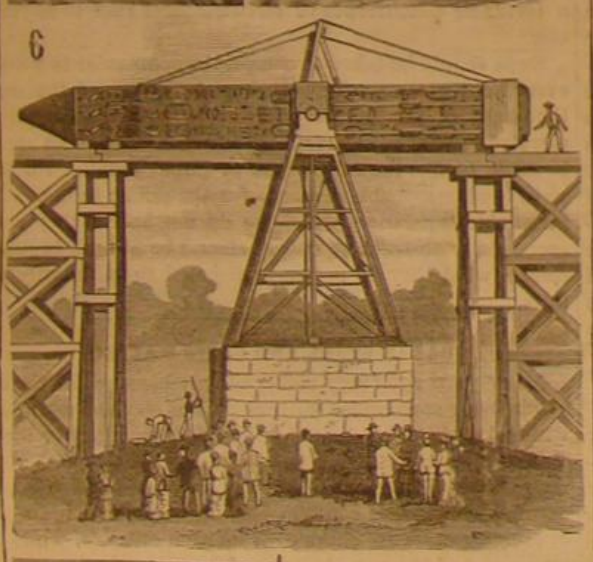

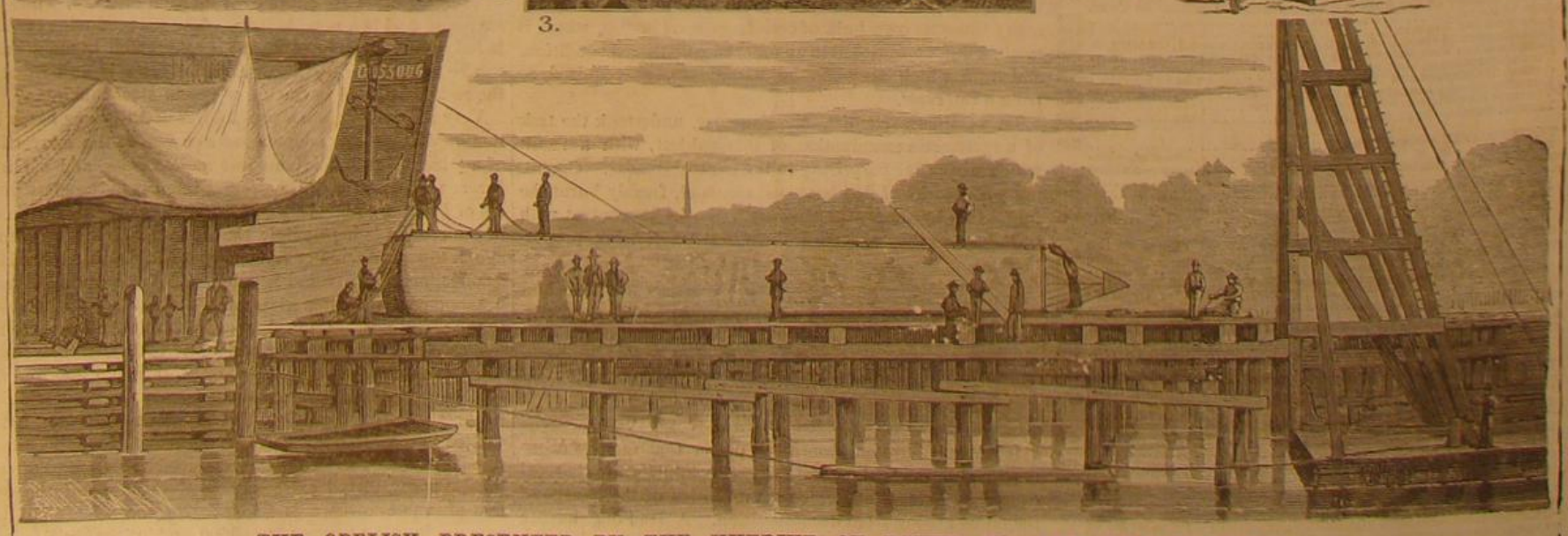

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Scientific American.

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NEW YORK, SATURDAY, FEBRUARY 5, 1881.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 266.

For the Week ending February 5, 1881.

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STREET ILLUMINATION.

Almost the first thing that strikes the scientific economist, when gazing upward in admiration at one or other of the numerous electric lights now being introduced in our streets, is the extremely small percentage of the light really utilized for achieving the purpose intended, viz., the effective lighting of the streets and thoroughfares. Somewhat more than one-half of the light emitted is totally lost, a fact scarcely requisite to be pointed out to any one acquainted with the rudiments of optical science, seeing that all light that passes upward into space rather than in the direction into which it is required must, for that requirement, be assumed to have no existence. The fifty per cent passing upward and outward is not more metaphorically than literally *in nubibus*.

The value of reflectors for projecting light in any required path is well recognized by all, but the proper application of the principles of reflection and diffusion appears in a large measure to be lost sight of. Divested of the reflectors or refractors to which they owe their efficiency, of what value would be the lamp in the lighthouse, at the pier-head, or affixed to that of the railway locomotive?

A parabolic reflector is that which utilizes to the greatest extent the light emanating from any lamp; but owing to the very perfection of this form it is quite unserviceable in aiding street illumination, the conditions of which demand something entirely different from those subserved by that perfect reflector. What is wanted is *radiation* rather than reflection in the optical sense of the term. A reflector is a polished surface, any one part of which reflects light from a radiant according to the law of the angle of incidence being equal to that of reflection; a radiator, on the contrary, possesses a surface from which is emitted in every direction the light that falls upon it. A silvered glass or polished metallic surface represents the former; a type of the latter being a sheet of white cardboard, a surface of porcelain, or of silver deposited upon *ground* glass. Unsilvered ground glass, translucent porcelain, or even a sheet of tissue paper, placed in front of a light, also act as radiators.

What is required to render perfect our system of street illumination by electric lamps is that all the light which is now lost by passing upward shall, by means of a bright radiating surface of a tolerably large area, be arrested and projected downward in the direction where it is really required. Dimension in the radiator is of importance, inasmuch as this forms a condition of softness and diffusiveness of the light. From several experiments which have been tried on a small scale, it is believed that a valuable means for utilizing in the most efficient manner the light from the electric lamp is to have erected over and at no great distance from it a nearly flat circular plate of coarsely ground glass coated with silver, according to the manner recently described in the SCIENTIFIC AMERICAN. The ground surface should be farthest from the light, and the deposit of silver protected first by a coating of varnish and afterward by a casing of thin metal. This insures the reflecting surface against becoming impaired by atmospheric or other deleterious influences. But it is also an essential part of this radiating "reflector" that it be surrounded by a deep edge, also of silvered glass, beveled outward in such a degree as to prevent any rays from passing out in a horizontal direction (that is, if the electric lamp be erected high overhead), but so as to arrest and diffuse them downward, which, by a proper selection of the angle at which the bevel is given to the edge, can be done so as to cause the greatest benefit to be received by those parts at a distance away from the lamp.

In such cases where it is desirable to hide the light itself from the eye this may be done in the best manner by the interposition of a plate of ground glass, which, of all other diffusers or radiators, is found to absorb less of the light than any other diaphanous body. Some kinds of porcelain shades are known to absorb sixty per cent of the light; to ground glass such an objection cannot apply.

UNRECOGNIZED QUALITIES IN CHARCOAL.

Among the numerous and varied properties possessed by charcoal there is one—one, too, of the most wonderful—which does not seem to be adequately recognized, probably from its being imperfectly known except to physicists. It is that of being able to condense and store away in its pores many times its own bulk of certain gaseous bodies, which it retains, thus compressed in an otherwise unaltered condition, and from which they can be withdrawn, as required, as from a reservoir.

That eminent scientist, M. Saussure, undertook the task of a systematic examination of this subject, with a result which will prove surprising to the general reader. Operating with blocks of fine boxwood charcoal, freshly burnt, he found that by simply placing such blocks in contact with certain gases they absorbed them in the following proportions:

Ammonia	90	volumes.
Hydrochloric acid gas	85	"
Sulphurous acid	65	"
Sulphureted hydrogen	55	"
Nitrous oxide (laughing gas)	40	"
Carbonic acid	35	"
Carbonic oxide	9·42	"
Oxygen	9·25	"
Nitrogen	6·50	"
Carbureted hydrogen	5	"
Hydrogen	1·75	"

It is this enormous absorptive power that renders of so much value a comparatively slight sprinkling of charcoal over dead animal matter as a preventive of the escape of the odors arising from decomposition. A dead dog having been placed in a box in the warm laboratory of an eminent chemist, and covered with charcoal to the depth of between two and three inches, could not be discovered to have emitted any smell during several months, after which time an examination showed that nothing of the animal remained but the bones and a small portion of the skin. To the large excess of oxygen over the nitrogen in the atmosphere, which, according to the above table, was absorbed by the charcoal, and which thus rendered harmless the noxious vapors given off by the carcass as they were being absorbed, is doubtless owing the fact above stated and the further fact of the charcoal never becoming saturated.

A reader of the SCIENTIFIC AMERICAN who has been trying certain experiments on the value of charcoal as a convenient means of storing oxygen, reports favorably as to the results. In a box or case containing one cubic foot of charcoal, may be stored, without mechanical compression, a little over nine cubic feet of oxygen, representing a mechanical pressure of a hundred and twenty-six pounds on the square inch. From the store thus preserved the oxygen can be drawn by a small hand pump.

From the fact of the charcoal absorbing oxygen in so much greater proportion than nitrogen, we have here a means of utilizing its discriminative powers of selection in obtaining unlimited supplies of oxygen from the atmosphere, which contains nitrogen five times in excess of its oxygen, or twenty per cent; whereas by the separating or selective powers of the charcoal the mixed gases capable of being extracted from it contain over sixty per cent of oxygen. It only suffices to withdraw this now highly oxygenized air into another vessel of charcoal, by the further exposure to which the proportion of oxygen will be increased to a still greater extent. This indicates a most feasible means by which atmospheric air can be decomposed in such a way as to provide a cheap supply of oxygen.

One cannot readily recognize the fact, which is nevertheless true, that the condensing power of charcoal as applied to ammonia is equal to what would be obtained by subjecting this gas to a pressure of nearly one thousand two hundred and sixty pounds on the square inch.

ELECTRIC SIGNALS FOR THE NEW YORK ELEVATED RAILWAYS.

A series of utterly inexcusable accidents have occurred on the elevated railways of this city, for which reasonable men will, we think, hold the companies responsible. It is easy to make a show of shifting this responsibility upon employes; but, so long as the companies persist in running these roads without providing electric signals, and all the other safety appliances used on our railroads, the recurrence of collisions, derailment at misplaced switches, etc., may certainly be expected.

The neglect to provide electric signals is all the more culpable when the comparatively small outlay required to supply them is considered.

The theory that accidents can be avoided on a double-track road when trains on the same track run all in one direction, has been over and again disproved by facts, and though the list of accidents has, as yet, resulted in little loss of life and small personal injury, this has been due rather to a fortunate concurrence of circumstances than to anything else.

Steps should be taken to compel the companies to provide every known means for securing the safety of the many thousands of people who daily trust their lives upon the elevated railways. The holders of these monopolies should be made to feel the full weight of public opinion till they yield to all reasonable demands for the public safety.

Suitable legislation, which we do not believe they could successfully obstruct or defeat, should be at once begun to compel what they do not seem disposed to voluntarily perform.

GAS IN STEEL AND GLASS MAKING.

A few years ago every maker of crucible steel in the city of Pittsburg surrounded his frail pots of clay and plumbago with coke, the direct heat from this fuel melting the metal. To-day finds every one of these furnaces discarded, and the regenerative Siemens gas furnace has supplanted the coke burning ones. As a consequence, instead of two heats, five or even six heats are obtained from each crucible, while the saving in fuel is a notable item. The gas producing furnace is fed with a grade of bituminous coal which in many cases can be had for the hauling. Such in brief is an outline of the results attained in the use of gas in steel making.

Very recently a glass manufacturer of Pittsburg has, with remarkable success, adopted gas as a fuel in the converting of a "batch" of ingredients into molten glass, and his little furnace is an object of the deepest interest to the glass makers of Pittsburg and elsewhere. The glass melting furnace of the present is in principle that of the furnace of a century ago, a towering mass of refractory brick, holding at its base a collection of costly and fragile "pots," containing usually 2,000 pounds of molten glass each, these pots being exposed to the direct heat of burning coal beneath. The extreme tenderness of these pots, their liability to deposit their costly contents into the ash pit, their first cost, about $50, and the care necessary in preserving them from sudden lowering of temperature are a few only of the objections that have always existed in the orthodox form of furnace. In the best of these a pound of melted glass produced for a pound of coal burned is considered extremely good results and the first cost of such a furnace is $6,000. On the other hand, the new gas burning furnace costs $500, and in it every day there is melted a 6,000 pound batch with 1,000 pounds of "nut"

coal in 12 hours after lighting the fires, against 24 to 36 hours in the old furnace.

The new or "open tank" glass furnace is built of fire-brick and is of the subjoined modest proportions. The "tank," holding 6,000 pounds of glass, is 7 by 5 by 2 feet. Across one end of this space, and separated from it by a fire wall, is the furnace or fire box. This is simply a fireplace, 30 inches square, furnished wth grate bars, and not differing in appearance from the ordinary furnace under a steam boiler. To this fire box is led air from a rotary blower. This finds its way to the grate bars and through flues in the surrounding wall. In the latter instance this air becomes intensely hot before escaping through suitable openings and mingling with the products of the burning coal. So mingled, air, smoke, and gases blend in a flame of intense heat, and following the draught pour over the fire wall and down upon the tank, converting the "batch" into molten glass in the time stated. It should be added that the old style furnace, with its great mass of brickwork, requires two weeks of continuous firing to make ready for melting, and that skilled labor, "teasing," is necessary to properly preserve the pots from undue heat or cold.

The new furnace is the invention of Mr. Thomas Atterbury, of Pittsburg, and an inspection of the operation of the gas furnace warrants the supposition that the days of the old style and time-honored furnace are numbered.

TREES IN CITIES.

An interesting paper has been recently read by Dr. Phené at Edinburgh on the benefits to be derived from planting trees in cities. Among the beneficial results to be attained are, he stated, the relief to the optic nerve through the eye resting on objects of a green color. Just that which is effected by the use of green or blue glasses in strengthening and sustaining the power of sight, is attained, or, at any rate, much aided, by the presence of green in nature; and in streets the only method to procure this result is by planting trees. It was pointed out by the author that wherever opportunity exists nature provides green and blue (the latter being the same color minus the presence of yellow), and that as the absence of color produces snow blindness, and in tropical calms, where the ocean presents only a white reflected light from a uniform glassy surface, reduced optical power soon follows a long continuance of the absence of blue color, which becomes immediately apparent on motion of the waves.

So in the streets, to the occupants of houses having a northern aspect, the glare of the reflected light is injurious; but the effect would be much modified by the coolness to the eye produced by the green of trees. In ancient surgery, persons having weak or declining sight were advised to look at the emerald. In the old style of building, the streets being narrow, were both cooler, from the sun not being able to penetrate them with direct rays, and less subject to noxious exhalations from the scouring and purifying effects of the searching air to which the narrow streets were subject, so that while there was no space for trees there was also less necessity. Wide streets, on the contrary, are hotter, and require the shade of trees to cool them; and, as in the case of London, which had so far done without trees in its streets, it was pointed out that not only are modern streets compulsorily wide, but that the enormous increase in metropolitan buildings render every sanitary question one of importance; and the chemical properties of trees as shown by experiment give them an important standing, irrespective of ornament or the pleasure they produce. Some of Dr. Phene's experiments on this subject have extended over a period of thirty years, and he it was who first tried the planting of trees in the streets of London. Since the reading of a former paper by him at Manchester, wherein the importance of the subject was pointed out, a number of streets in wealthy localities have been planted, and even Trafalgar Square, in the heart of the metropolis.

SINGULAR DISCOVERY IN CONNECTION WITH PHOSPHORESCENCE.

The property possessed by certain metallic sulphides and other phosphorescent bodies of absorbing light when exposed to its influence, and giving out the same when brought into a darkened room, has long been known to scientists, but it is only quite lately that efforts have been made to utilize such properties. Of these, the most striking consisted in spreading a sulphide of this nature upon a flat tablet and exposing it to strong light for a few seconds under an ordinary photographic negative. Upon removing the tablet thus impressed into a dark room, the pic ture on it will be found to be glowing in quite a mysterious and wonderful manner, and it will continue for some minutes to radiate the light which it absorbed.

It has occurred to an ingenious physicist, A. L. Henderson, to mix one of the most sensitive of these phosphorescent metallic sulphides with the bromide of silver, now so generally employed in the preparation of photographic dry plates, and, after emulsifying this mixture with gelatine, spreading it upon the surface of glass plates, and treating the same as ordinary ones except in so far as regards the exposure, which must be momentary. He appears to have reasoned in this way: With even the briefest exposure capable of being given, a certain modicum of change will be produced on the sensitive bromide of silver, although manifestly such as will be incapable of yielding a properly developed image. But the light also falls upon the atoms of the phosphorescent powder incorporated in the films: and as these in turn radiate such light, it follows that they will complete the imperfect exposure set up in the bromide by the direct action of the light.

This reasoning has been found correct, and the result at present stands that plates have been prepared having such exceeding sensitiveness as to be well impressed by what Mr. Henderson designates "the flash of a match."

Phosphorescent sulphides may easily be prepared by heating the carbonate of lime, of barytes, of strontia, or other carbonate found most suitable, in a covered crucible with half its weight of sulphur. After an hour's exposure to heat the preparation is complete and phosphori are obtained which, upon being briefly exposed to light and then withdrawn into a dark room, will be seen to glow brightly, the color of the light emitted depending upon the nature of the carbonate originally selected.

This application of a well recognized fact in phosphorescence is so novel, and calculated to be of so much use, that we have no doubt its progress toward development will be rapid.

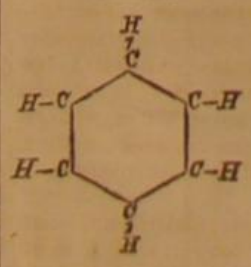
A DESCRIPTION OF CAUCASIAN PETROLEUM.

It has been known for years, if not for centuries, that combustible gases escaped from the earth at Baku, in the Caucasus, yet no one seems to have suspected that Baku was destined to become as famous for its oil springs as our own Pennsylvania. Recently, however, the production of Caucasian petroleum has been such as to interfere with the sale of American petroleum in Russia. Two of the foremost chemists of St. Petersburg, Messrs. Beilstein and Kurbatow, have subjected this oil to a critical examination, which is given in full in the *Berichte* of the German Chemical Society.

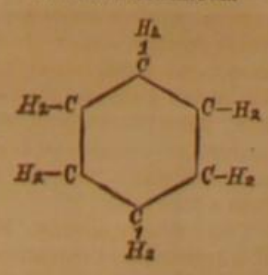
The peculiarity of this petroleum from Baku consists of its high specific gravity as compared with American petroleum of the same boiling point. For a long time this fact caused the consumers to be mistrustful of their own oil. Wilm and Biel, however, proved that the Russian oil gave ten per cent more light than the American, and Biel also found that the illuminating oil even of this high gravity was drawn up the wick to the flame more easily than the American oil. Since that time the public prejudice has disappeared, and the importation of American oil into Russia has as good as ceased entirely. The high gravity of Caucasian oils is taken advantage of by the manufacturers of lubricating oil, and at present a lubricator with a gravity of 0·940 is made without adding any solid substance, which has already found extensive use in Europe.

The oils examined by Beilstein and Kurbatow was the first distillate obtained by a careful distillation of crude oil. Although they submitted it to fractional distillation nine times with the aid of Glinsky's dephlegmator, they did not succeed in obtaining any products with constant boiling points. That which boiled below 176° Fah. had a specific gravity of 0·717, while American petroleum of like boiling point had a specific gravity of only 0·669. The portion distilling over between 200° and 212° had a density of 0·748, the American of 0·699. At first they were inclined to attribute this to the admixture of hydrocarbons of the aromatic series like benzol, C_6H_6; toluol, C_7H_8, etc. On shaking it with fuming sulphuric acid they were unable to detect a trace of any aromatic hydrocarbon. An ultimate analysis of that boiling about 185° corresponded nearly with the formula C_7H_{14}, while the American oil of 205° to 212° is nearly C_7H_{16}, showing that the Caucasian petroleum is *poorer* in hydrogen than the American. Yet it does not consist of homologues of ethylen (C_2H_4), because bromine did not act upon it until heated, when hydrobromic acid was copiously evolved, showing that substitution had not taken place. A farther study of these products convinced these investigators that they were dealing with the hydrogen addition products of aromatic hydrocarbons, such as hexahydrobenzol C_6H_{12}, hexahydrotoluol C_7H_{14}. The graphic formula of the former is given below:

BENZOL.



HEXAHYDROBENZOL.



A very unusual circumstance for a petroleum was the action of nitric acid (sp. gr. 1·38). When boiled until red fumes ceased the acid liquid contained acetic and succinic acids; the oily portion contained a liquid boiling at 410° to 420° Fah., and having the formula, $C_6H_{11}NO_2$. This may be either a nitrous ether, or a true nitro-compound, a very surprising fact in petroleums.

The different petroleum wells of the Caucasus yield oil of varying composition, according to their situations. Those examined came from the wells of Messrs. Von Benkendorff. Others will soon be examined by the same persons.

October 8, 1880. B. B.

Chemical Research by Means of Photography.

By the use of the electrical spark and a photographic apparatus the presence of very minute quantities of certain substances in certain liquids may be readily detected. The liquid to be examined is placed in a vessel, the sides of which are composed of quartz, which is one of the few purely transparent substances. If one part, by weight, of the coloring matter known as anthracene is mixed with fifty million times its weight of alcohol the presence of the color may be detected by a gelatine plate photograph taken as above, which will show the characteristic bands of the absorbed rays pertaining to anthracene.

ELECTRO-METALLURGY.

SILVER DEPOSITS.

For electro-silver plating the double salt of silver and potassium cyanide is almost universally employed. The baths are used either hot or cold. The latter method is generally adopted for articles which require great solidity. The hot process is used for small articles, and is preferable for steel, iron, zinc, lead, and tin, which have been previously electro-coppered. The hot baths are generally kept in enameled cast iron kettles, and the articles are either suspended or moved constantly about in them. A somewhat energetic current is needed, especially when the articles are moved about in order to operate rapidly. A gray or black deposit indicates too strong a current, and when the surface becomes covered with bubbles of gas the same thing is indicated. The anodes are plates of silver or heavy silver foil. The wooden tanks for the cold baths are similar to those used in plating with copper and nickel, but should be very thoroughly coated on the inside with gutta-percha.

THE BATH.

Water (soft)	1	gallon.
Cyanide of potassium (pure)	8	ounces.
Nitrate of silver	5¼	"

Dissolve the nitrate of silver in a sufficient quantity of pure water (soft), and add to it gradually, with constant stirring, hydrocyanic (prussic) acid until all the silver has been precipitated as cyanide, which may be known by the formation of no cloud in a portion of the clear liquid when a drop of the acid is added to it—avoid adding an excess of the acid. Throw the precipitate upon a fine cotton cloth filter, and as the liquid runs through wash the precipitate on the cloth several times with pure water. Dissolve the cyanide of potassium in the water, and stir in the cyanide of silver carefully removed from the cloth. If it does not dissolve in the liquid entirely, add more cyanide of potassium until it does, stirring continually. Let the impurities settle, and the bath is ready for use. Many electroplaters use a preliminary or silver "whitening" bath, which is the same composition, but contains less silver, more cyanide, and is worked with a somewhat stronger current.

The cleaned article in some cases is first dipped for a few moments in a solution of nitrate of mercury, one ounce in one gallon of water, and then in the whitening bath for a few minutes, and after brushing is transferred to the silver bath proper.

The vessels containing the cold bath are sufficiently high to allow about four inches of liquid above the immersed objects, whose distance from the bottom and sides should be nearly the same to give a regular deposit of metal at both ends of the object.

The upper ledge of the trough carries two brass rods all around, which do not touch one another, one above the other, so that other metallic rods placed transversely will rest upon the higher or lower series of rods only. The upper rods are connected with the zinc, the lower with the carbon or copper end of the battery, or with the corresponding poles of the dynamo-electric machine. The transverse rods resting upon the lower set support the silver anodes; those resting on the upper set, the work. The work suspended from an upper transverse is placed so as to face two anodes suspended from two lower transverse rods.

As the lower layers of the bath are apt to become denser (richer) than the upper, it is often necessary to reverse the articles during the operation to obtain a perfectly uniform thickness of deposit. For the same purpose small articles should be kept in motion as much as possible.

The deposit is finer and denser if obtained with a weak battery and long exposure than if a strong current is employed. A sufficient quantity of silver may be deposited in three or four hours, but it will be of much finer quality and more easily burnished if the work is left in the bath for twelve or fifteen hours with a few cells of battery.

When the articles, especially coppered iron, etc., have acquired a coherent film of silver, they are sometimes removed from the bath and thoroughly scratch-brushed, cleansed in alcohol, or preferably in a hot silvering bath, thence again passed through the mercurial solution and finished in the cold plating bath.

The first scratch-brushing, which is not always necessary, obviates the tendency of certain alloys to assume a crystalline appearance and corrects the imperfections of the cleansing in process.

Should the anodes become black during the passage of the current the solution contains too little cyanide. In this the deposit is adherent, but too slow; and the bath loses more silver than it can gain from the anodes.

If the anodes remain white during the passage of the current the bath contains an excess of cyanide, and the deposit does not properly adhere; correct by adding cyanide of silver until it dissolves with difficulty.

When in good working order the anodes present a gray appearance while the current is passing, becoming white when circuit is broken.

The specific gravity of the bath may vary from 5° to 15° Baumé's hydrometer and still furnish good results.

Electro-silvering baths do not generally work so well when freshly prepared. If properly used and cared for they improve by age. At first the deposit is often granulated, bluish or yellowish.

It is customary to mix portions of an old bath with a freshly prepared one. Some platers introduce small quantities of ammonia instead to age the liquid.

Bisulphide of carbon in small quantities imparts a bright luster to plated articles. An ounce of the bisulphide is put into a pint bottle filled with a strong solution of the cyanide of potassium and silver, briskly shaken, and a few drops of this liquid poured into the bath occasionally until the work appears sufficiently bright. An excess of bisulphide must, however, be avoided, as it will spoil the bath.

What has been said about the arrangement of battery in articles of nickel and brass plating will also apply here. (See p. 153, vol. xliii., and 4, current volume.)

Electric Light Experiment.

The recent experiment of lighting the Hoosac (Mass.) Tunnel with electricity was with an apparatus placed on a platform car which was pushed slowly along by a locomotive. The generator of 4,000 candle-power was operated by an engine of 20 horse power, and each of the burners was of 2,000 candle-power. In the parts of the tunnel free from smoke the light was thrown strong enough to do track work over 500 feet away, and driving spikes and shoveling 1,000 feet off. Between the central shaft and the east portal, where the smoke was so dense that an ordinary locomotive light would not be visible 10 feet away, the electric light could be seen for over 100 feet. In some parts of the tunnel one could read by the electric light 250 feet from the car. The State authorities are soon to witness an experiment, and it is probable that the improvement will be adopted. If the electric lights are adopted power can be supplied from a turbine water wheel now lying idle in a shop at the east end. It is thought that twelve lanterns will light the tunnel, except when the smoke is unusually dense.

IMPROVED LOCK FOR MUSEUM CASES.

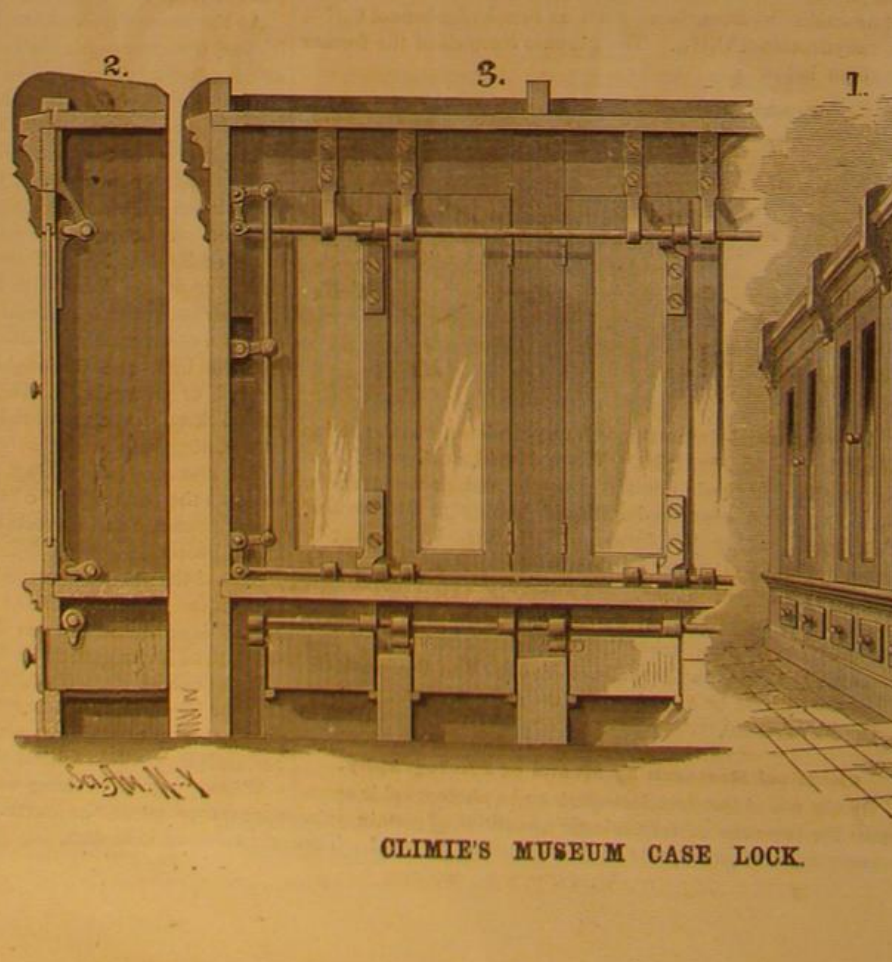
The difficulty of properly fastening the doors of museum, cabinet, and library cases in institutions where such cases are employed in large numbers, is only too well appreciated by those having such matters directly in charge. The usual method of bolting one of a pair of doors and locking the other, or of locking both doors simultaneously where cases are numerous, entails a great deal of labor, beside incumbering the person doing it with a weight of keys that is really burdensome.

We give herewith engravings of an improved system of locking mechanism for museum doors, by means of which an almost unlimited number of doors and drawers may be securely fastened by a single operation. This invention has been practically tested in the Museum of the University of Michigan, where its application to the newly-built cases effected a saving of $800, beside furnishing a complete fastening, which not only holds the doors securely, but draws them into place should they be left slightly ajar before locking. The inventor has shown us letters from several of the professors in the Michigan University indorsing the lock in the highest terms.

The bolt consists of a steel rod extending along the top and another at the bottom of the series of doors, and carrying beveled hooks capable of engaging sockets or eyes attached to the doors. The rods are supported at suitable intervals by guides attached to the casing of the doors. In like manner a rod extends over a series of drawers and carries hooks which engage sockets attached to the sides of the drawers. The upper and lower continuous bolts are each connected to a bell-crank lever, and the two levers are connected by a vertical rod, so that the bolts will move simultaneously in the same direction. The vertical rod is connected with a lever whose pintle extends through an opening in the front of the case, and is capable of being turned by a key adapted to it. The opening in the front of the case is closed by a small door, which is locked by means of a fine lock and key of approved make.

The bolt which locks the drawers is connected with the lower door bolt by a lever, so that when the key is turned, the bolts at the top and bottom of the doors and at the top of the drawers are all moved at once, permitting of opening any of the doors or drawers in the case. The bolt may be applied to cases containing any number of doors, and in fact to any number of cases if desired, so that one motion locks or unlocks the entire series. When the doors are closed and bolted the key is removed, and the small door which covers the pintle of the unlocking lever is locked by a single key, rendering all secure by the use of a single key weighing but the fraction of an ounce, and capable of being carried without the slightest inconvenience. These bolts are very cheaply made, and yet strong and durable, and capable of accomplishing all that is required of them.

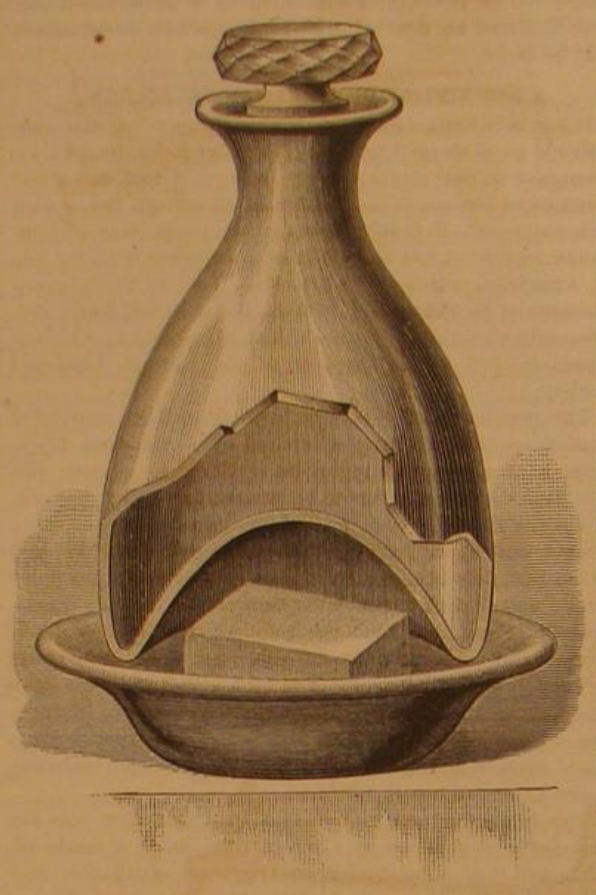
This useful invention was recently patented by Mr. Andrew Climie, of Ann Arbor, Mich.



CLIMIE'S MUSEUM CASE LOCK.

BUTTER COOLER AND WATER HOLDER.

The engraving shows a novel device for holding water and cooling butter. It consists of a water bottle, having a deeply-recessed bottom, and a butter plate of sufficient size



COMBINED BUTTER COOLER AND WATER HOLDER.

to receive the base of the bottle. The cavity in the bottle is sufficiently large to inclose the butter without touching it, and the bottle, when in use, is filled with water and ice in small pieces.

This invention was recently patented by Mr. P. Dorlon, of Brooklyn, N. Y.

Mr. Oliver Byrne.

We record with regret the death of Mr. Oliver Byrne, C.E., who died at Grecian street, Maidstone, England, on December 9, 1880, aged 70 years. For some time past he had been in failing health, and lived a retired and secluded life. About two months ago, when in London, he caught a violent cold, which terminated in inflammation of the lungs, involving the smaller bronchial tubes, from which he gradually sank. Mr. Byrne was the author of several engineering works, and notably editor of, and a large contributor to, "Spons' Dictionary of Engineering." He was the inventor of the dual system of arithmetic, for which he claimed many peculiar advantages.

MISCELLANEOUS INVENTIONS.

A reel for measuring bagging, patented by Mr. Charles J. Le Roy, of Palestine, Texas, may be used for handling, measuring, and cutting bagging, matting, carpet, etc. It consists of a spool or roller from which the stock is taken, a reel upon which it is wound from the roller, a cutting board or table, and a measuring wheel, by which the operations named are simply, accurately, and easily performed.

In a button hole attachment for sewing machines, patented by Mr. John K. Harris, of Springfield, Ohio, an automatically acting and adjustable feeding device gives the cloth an intermittent lateral movement combined with a forward movement by improved devices, whereby an extra pressure of the presser piece upon the cloth is obtained, the locks of the stitches are caused to terminate in a straight line either above or below the surface of the material or at the edge, according to the regulation of the tension, and all upword or downward motion of the goods around the needle is prevented.

A feather renovator, patented by Messrs. Jefferson Hatch and Leonard Fortune, of Felt's Mills, is intended for cleansing feathers before using them for beds, both when new and after they have been used. The feathers are placed in a rotating cylinder, in which the feathers are subjected to the action of a strong blast which issues from openings in the hollow shaft of the cylinder, through which air is blown by a fan blower, the air finding outlet through a perforated or reticulated door in the side of the cylinder, through which the feathers are put in and taken out.

Mr. William A. Jennings, of Dyersburg, Tenn., has patented a clevis that may be adjusted to draw-beams of different dimensions. Two bars are hinged to the ends of a link. A screw bolt is pivoted to the free extremity of one of the bars, and its threaded end passes through an eye in the free end of the other bar, where it may be secured by a nut. The pivoted bolt is passed through a hole in the beam to which it is desired to attach the clevis.

A skirt ironing board, patented by Mary H. Baldwin, of Hamlin, Texas, has hinged detachable leaves, with devices for holding the leaves open, the board being hinged to a frame, the lower part of which forms a box for receiving that part of the article which hangs down, to protect the same from dust and dirt and to keep it moist.

A jack screw, patented by Mr. William H. Williams, of Key West, Florida, appears a very effective device for raising heavy weights. A peculiarly constructed detachable pawl, combined with a bifurcated lever for actuating the screw, is the main feature of the invention. The construction of the pawl permits the screw to be worked in either direction according as the pawl is adjusted; its detachability affords means for preventing any tampering with the screw by unauthorized persons.

Mr. Karl Kreutzer, of New York city, has patented a game bat of that class having oval-shaped heads fitted with netting. He bends a piece of wood to the shape required, the strip having wire rods embedded into it at opposite sides throughout its length for strengthening the bat, and gore pieces fitted into the crotch in a peculiar manner to resist strain and prevent disconnection at that point.

Mr. Robert Watkinson, of Salford, England, has invented an improved coupling for hose and other pipes. The joints are formed by interlocking devices, assisted by an elastic packing, which not only maintains the locking of the parts after they are joined, but acts to tighten the joint through the action of interior pressure upon the packing.

An improved pile for the manufacture of composite metal plates, patented by Mr. Dolphus Torrey, of New York city, protects the metal forming the interior of the pile from the action of oxidizing flames and gases while in the heating furnace and immediately subsequent thereto. The pieces of metal forming the pile are so shaped that no bands, ties, bolts, or rivets are required to keep them in position. The pile is made of two plates and intermediate band and steel scrap, which fills the space inclosed by the plates and band.

Mr. Otis D. Thompson, of Elkhart, Ind., has patented an improvement in wind wheels, which consists in a novel construction, arrangement, and operation of the wheel and vane relatively to each other, whereby provision is made for throwing

the wheel out of wind when the current is too strong, and also for adjusting the sails to accommodate the wheel to the force of the wind.

MANY-COLOR PRINTING PRESS.

We present herewith a figure of a new press, which, with a single form and at a single impression, prints in several colors. This result is obtained by a special arrangement of the inking table, a full view of which is seen in the figure. This table, instead of being in a single piece, is composed of a certain number of narrow cast iron plates held in a frame. These plates are formed of four distinct parts, and are wide in the center and taper conically toward the extremity. This mode of construction allows them to move easily on each side at every revolution of the table, and has nearly the effect of an articulated joint. The end piece near the ink trough is stationary. The various colored inks are placed in the ink trough, which is divided into cells by metallic partitions. Directly over the trough is an iron frame carrying a set of screws and nuts. By tightening these screws, which are placed over the metallic partitions, the inks as they flow beneath are prevented from mixing. The inking rollers, instead of being fixed at a certain angle relative to the table, are arranged so as to run perfectly straight, the distribution being effected by the plates above described.

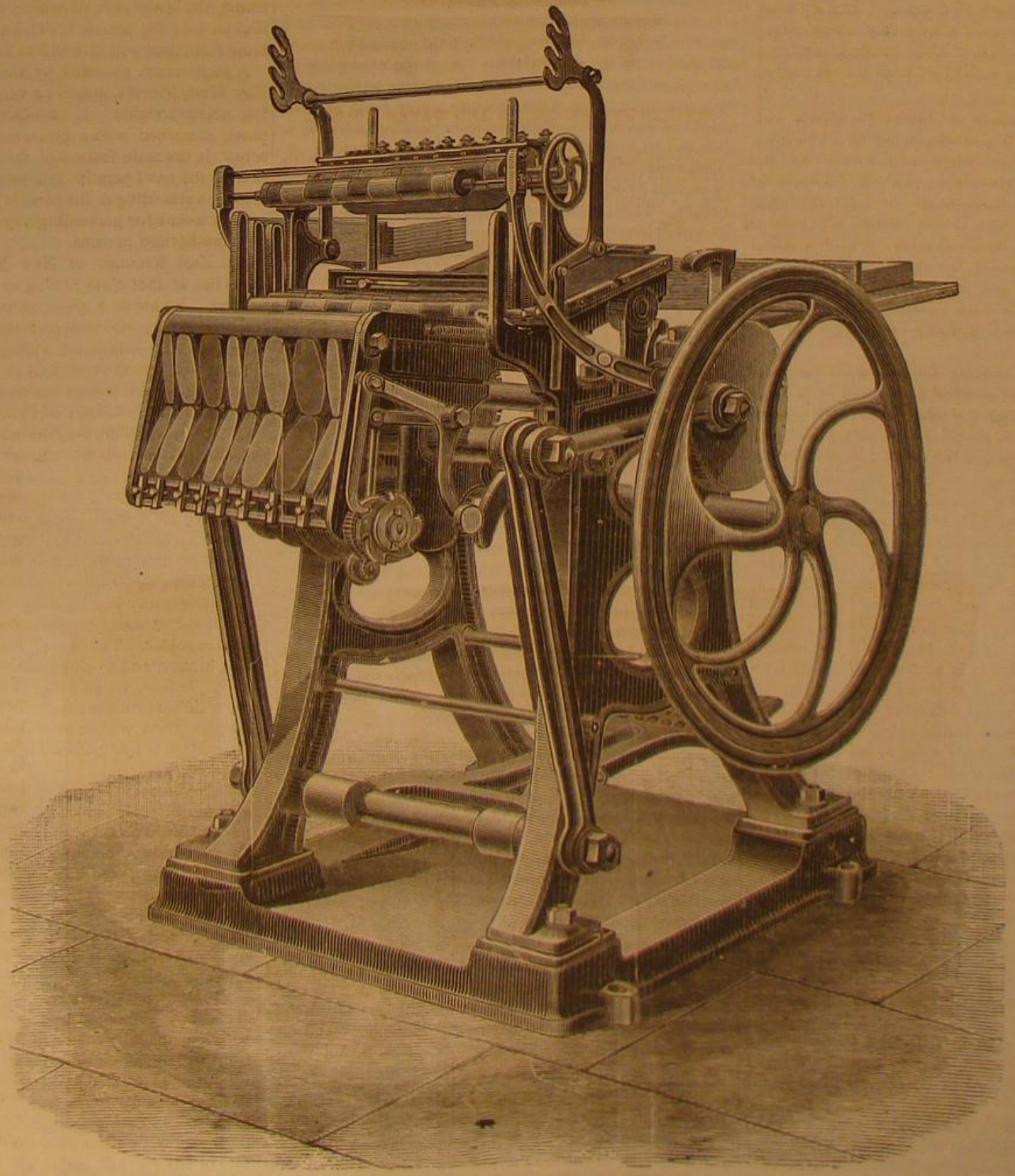
The different inks are spread on the multiple table in the usual way. As a consequence of the motion of the articulated joint, the inking table is caused to move slightly in one direction and the other at every revolution of the table, and the ink is thus as well distributed as if several rollers were used. The movable plates which constitute the inking table are of different widths, so that the uppermost or the lowest line in a prospectus can be printed in a color selected beforehand. Motion is communicated to the movable plates by a small lever which hangs under the table, and which rests on a small vertical iron plate affixed to a cross-stay of the machine.

The removal of an ordinary inking table and its substitution by the multicolorous one can be effected while the form is being prepared. There is, however, no reason why the articulated table should not be used for work in black; it is only necessary to have a sufficient number of plates to cover the whole breadth, and then the rollers may be allowed to run obliquely as usual. With this apparatus a demi-octavo prospectus may be readily printed in eight colors at a single impression, each color being brilliant and perfectly distinct from the others. As the rollers move in a perfectly straight line the inks do not mix, although the plates which carry them may be placed as close together as necessary.

This same system of multicolorous tables may be applied to various printing presses. The impression can be made in just as many colors as may be desired, and with such advantages it is certain that the use of such a method must become widespread for printing prospectuses, circulars, bills of fare, and other work of this nature. The apparatus will effect a complete revolution in colored work, since the difference in price between printing in black and printing in colors by the Bacon system is very slight, being merely the difference between the cost of black and colored inks. We should remark, in conclusion, that two colors cannot be printed on the same line—neither in initials nor in borders—since the colors are arranged in a straight line; but it will be readily understood that, by superposing the colors and taking several successive impressions, the most varied effects may be obtained.

This machine attracted considerable attention at the late fair of the American Institute.

T. Sarony-Lambert, Room 5, Bennett Building, New York City, is agent.

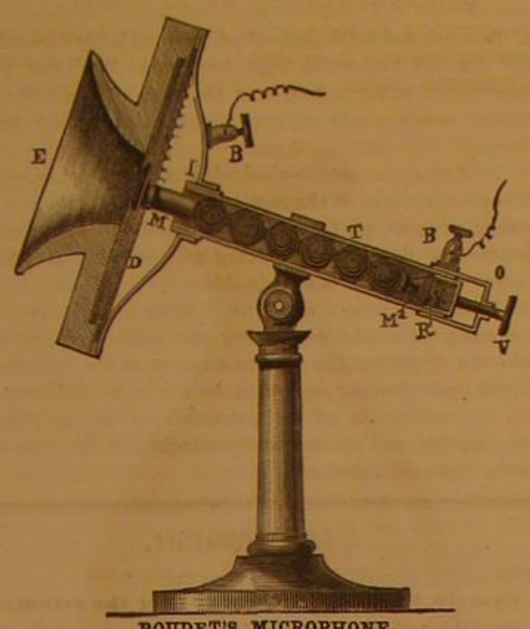


MULTICOLOR PRINTING PRESS.

NEW MICROPHONE.

BY M. BOUDET, OF PARIS.

This microphone, with multiple contacts, as shown in the accompanying figure, is composed of a mouthpiece, E,



BOUDET'S MICROPHONE.

affixed to the end of a glass tube, T, one centimeter in diameter, itself fixed on a jointed stand, thus enabling the whole apparatus to be moved at any inclination.

The mouthpiece contains an ebony plate one millimeter thick, on which is fixed a piece of copper, M^1, penetrating the glass tube a slight distance. In this tube there are six carbon balls slightly smaller in diameter, so that they can easily be moved.

The microphone is completed by a second piece of copper, M^2, supported on the end of a hollow breach, K, by means of a little spiral spring, not shown in the figure. The screw, V, fixed in the cup, Q, serves to regulate the pressure of the piece, M^2, against the balls. The variations in the resistance of the microphone are reproduced equally through all the contacts of the balls, because, when talking at the mouthpiece, the vibrations are transmitted almost instantaneously, as in the well known case of billiard balls.

The apparatus acts like an ordinary middle-sized Gaiffe microphone, with six elements (peroxide of manganese and chloride of zinc) set up with a resistance of 800 ohms, with a Bell telephone for receiver.

By employing inductive currents and a fine wire telephone receiver—a necessity with inductive currents—the distance may be largely increased, and extended, with artificial resistances, to 250,000 ohms.

We have been present at experiments made with this microphone, and we have found that it transmits the voice very clearly, without altering the tone and without any scratching sounds.—*Electrician.*

RECENT INVENTIONS.

A suspension clothes line pulley has been patented by Messrs. David H. Payne and Jerome H. Payne, of Troy, N. Y. The pulley is formed of a central disk, projecting arms, and rings, joined to the arms, the line running in the groove or throat formed by the arms and rings. The pulley turns horizontally on a vertical axis, and the lower ring has rollers placed on it, which prevent the entanglement of the clothes with the pulley when the line passes over it.

Mr. August Berghaus, of Brugge, Prussia, Germany, has patented a handle attachment for agricultural implements, which is simple and effective. A spring socket attached to the implement is arranged to receive the end of the handle, which is held therein by a conical ring or sleeve drawn over the ends of the spring socket. The handle is by this means quickly and firmly clamped in the socket.

Mr. James E. Tyler, of Orange Court House, Va., has patented a machine for edging sheet metal, which forms either a single or double lock upon the edges of the plates that may be hooked or pressed together to form a secure joint either for sheet metal articles or for roofing. A pair of griping jaws, one of which is provided with a lip, seize the edge of the metal and bring it under a presser bar to form a single fold or lock, and the machine is further supplied with a pivoted bending jaw that may be forced around the griping jaws to form a double fold.

Mr. William G. Lindsay, of Winneconne, Wis., has invented a stovepipe damper of that variety made in two circular parts separated by a narrow space and secured to the same turning rod. The pieces are made with lugs having square holes, and the turning rod is square to fit these holes. One plate is of greater diameter than the other, and has an opening in its center. By this construction the passage of the smoke or gases of combustion is obstructed, but never wholly prevented.

Mr. John Herrmann, of Columbus, O., has patented a window cornice which may be adjusted to windows of different widths. The adjustment is made under the center piece, and is therefore concealed. It is accomplished by a tongue and groove device with suitable means for fastening the adjustable pieces in adjustment.

Mr. Ila M. Moore, of Battle Creek, Mich.

has patented an improvement in knitting machines whereby a double web, with two threads, is formed in such manner that, if the threads be of different colors, the finished fabric will be striped lengthwise.

Mr. Patrick Deevy, of Melrose, Iowa, has patented an improved guard finger and sickle bar. The sickle bar is sectional, each section carrying a cutter as a part of it. These parts are made interchangeable, and by tongue and groove devices may be put together and fastened by screws to form one rigid bar. Each finger or guard is made in two parts, mortised and tenoned together at one end, and in the under part or section is a mortise in which is fixed a cutting blade that can readily be removed for sharpening and replaced securely without the aid of screw or bolt.

DECISIONS RELATING TO PATENTS.

United States Circuit Court—Northern District of Illinois.

RESWEATING OF TOBACCO.—ROBINSON *et al. vs.* SUTTER *et al.*

Blodgett, J.:

This is a suit for infringement of letters patent granted by the United States to complainant, Abraham Robinson, on the 10th day of June, 1879, for an improved apparatus for resweating tobacco.

The defense set up is, first, that defendants do not infringe complainants' patent; second, that complainants' patent is void for want of novelty.

It seems from the proof that in the manipulation of tobacco it is deemed very desirable to obtain a dark uniform color in the leaf, especially of that to be used for cigar wrappers; that in the natural sweating which the leaf undergoes in the ordinary process of curing it is left spotted, or some leaves will be darker than others, and the process of resweating is intended to bring the tobacco to a dark and uniform color.

Robinson claims to have discovered that tobacco can be successfully resweated by packing the leaves closely in a mass in a wooden box or tub made substantially tight, except so far as the pores of the wood will admit vapor or moisture to slowly percolate through the wood and diffuse itself with the mass of leaf from a body of warm water and expanded steam contained in an outer tank or chamber surrounding the tobacco holder, the process to continue from three to eight days according to the mass of tobacco to be operated upon. The apparatus which he devised for this purpose, and which is covered by his patent, consists: First, of a tank or chamber adapted to hold a body of water and sufficiently tight to hold expanded steam, or steam generated or let into the chamber at a very low pressure. The model presented here consists of a tank which is water-tight at the bottom and substantially water or steam tight above, with the tobacco holder let into it and suspended by a rim upon the edge, the holder being made tight, as described; but the patentee does not restrict himself to this precise form of construction. Second, a tobacco holder in which this mass of leaf tobacco is placed, which tobacco holder is placed or suspended inside of the tank or chamber. Third, a steam generator for producing steam, by which the water in the chamber is to be warmed and steam generated, whereby a warm humid atmosphere is kept constantly about the tobacco holder, and the warm moisture gradually diffused through the tobacco in the holder.

The device used by defendants operates upon precisely the same principle as that of complainants—that is, it has a tank or chamber within which the tobacco holder is placed. The bottom of the tank is supplied with water which is heated by an outside steam generator or heater; and the only difference between the two devices of the complainants and the defendants is that the defendants' tobacco holder is not made tight, so as to exclude moisture except through the pores of the wood, the defendants, in practice, using the ordinary tobacco cases in which leaf tobacco comes packed to hold the tobacco during their process of resweating. In other words, the defendants open the doors in their tank and slide the ordinary tobacco case full of tobacco into this steam box, and allow it to remain there until the tobacco has become resweated, which is in no respect different from the process of Robinson, except as hereafter noted; but it is claimed that this is a substantial difference, because it is insisted that complainants' claim requires their tobacco holder to be tight, while the defendants' tobacco holders are not tight. I think, however, the word "tight," as used in his claim, is to be construed, in the light of his specifications, as meaning sufficiently tight to subserve the purposes to be accomplished. The term as used here must be held, I think, to mean comparatively or approximately tight—close enough to exclude an excess of steam or moisture, and open or porous enough to allow the warm moisture to sweat or percolate into the tobacco holder, so as to warm and moisten its contents; and it would seem that slight crevices or openings arising from defective mechanical construction, if not large enough to admit steam in such quantity or volume as to wet the tobacco, would not violate this patentee's rule of construction.

1. The word "tight," used in the claim to qualify the wooden tobacco holding vessel, *Held* to mean sufficiently tight to subserve the purposes to be accomplished by the invention.

2. Crevices or openings in the wooden tobacco holder arising from defective mechanical construction, if not large enough to defeat the operation of the device, will not relieve the apparatus from the charge of infringement.

3. The patent shows an organized apparatus consisting of a steam and water containing chamber and a wooden tobacco holder specially constructed for that purpose suspended in said chamber. The defendants employ the steam and water containing chamber, but, instead of using a wooden tobacco holder specially made for that purpose, use for containing the tobacco in the chamber the ordinary wooden tobacco case in which leaf tobacco comes packed; *Held* to be an infringement.

United States Circuit Court.—District of New Jersey.

HARVESTER PATENT.—TYLER *et al. vs.* CRANE.

Nixon, J.:

1. In a suit for infringement of reissued letters patent No. 6,609, granted August 24, 1875, to Samuel W. Tyler, for an improvement in harvesters, two defenses were set up; first, want of novelty; second, the defendant's machine did not infringe.

2. *Held* that the patentee's device of placing the gearing and shafts that impart the motion to the cutters upon a rigid common support or frame formed in one piece, to correct the practical defects of twisting and warping in existing two-wheel machines, is sustainable.

3. That defendant's machine, having two wheels with connecting axle, and containing the solid piece or frame made of a single casting for the support of the intermediate draught and gearing sustained by the axle, differing only from the mechanism of the patentee's in having the solid piece directly and not mediately attached to the axle of the wheels, is an infringement.

Correspondence.

Captain Eads' Ship Railway over the Isthmus.

To the Editor of the Scientific American:

Referring to your issue of November 13, 1880, I suggest an improvement which I think might be made in the car of Capt. Eads for his projected ship railway, which you illustrate.

As illustrated the principal weight of the ship is on the keel, which rests rigidly on the car, while the bilge is supported by solid and unyielding blocks.

Now, to accomplish this without severe strain to the ship while in transit, the car or cradle must be perfectly rigid, while all elasticity must be in springs over the wheels.

It would seem that in order to construct a car four or five hundred feet long, which would be rigid enough not to bend and thus cause the ship to be unevenly supported while passing over any curve in grade or uneven place in the roadbed from whatever cause, would require a very great additional weight of metal, more than would be required were the keel rests and bilge blocks made to rest on air cylinders, all of which should be connected by hose or some other flexible connection by which compressed air could pass from one to another. Thus, regardless of the bending or twisting of the car, either longitudinally or otherwise, the ship would at all times have a perfectly even and elastic support, which would not in any case bring an unequal bearing or strain on the vessel in transit or wheels of the car, as when any bearings would be relieved by curve in grade or depression in track the compressed air from others would be forced through the connections, thus making every bearing do its exact portion of duty and allowing none to be overloaded or any unequal strain to the ship. This would avoid the necessity of any tilting tables, as the grade could be changed by a gentle curve.

The body of a cradle or car of this kind should be as light and flexible as strength and perfect safety would permit.

Another advantage of this system would be that in handling a large ship, instead of requiring another and longer car than for a smaller one, it would only be necessary to attach a section to make it the required length, and connect the air tubes as is done with air brakes on ordinary railroads. This in order to secure equal pressure in the cylinders of both sections.

My method of constructing such compressed air springs would be to build in the center of the cradle cylinders large and numerous enough to support the proper proportion of a ship's weight.

To support the balance of the burden, each bilge block should contain an air cylinder, and all cylinders should be connected as above stated. By arranging in this way with air-tight pistons to support the plates on which the ship would rest, a lighter car could be used with better result, and the bilge blocks might be moved into place as easily as if solid. Some such principle applied to the cradle would allow a more cheaply constructed roadbed than would be possible with a rigid car, and the ship would be relieved of any injurious strain in transit. WALTER B. GUILD.

New York, January, 1881.

[NOTE.—Capt. Eads appears to be fully alive to the value of the points above mentioned. One of the patents taken by Capt. Eads is for a hydraulic cradle to carry the ship, in which the vessel is supported on hydraulic jacks, all connected, as our correspondent suggests.—EDS. S. A.]

The Flywheel Explosion.

To the Editor of the Scientific American:

Please allow me to make a few comments upon Mr. Rose's article on "A Mysterious Explosion," on page 38 of your paper. He says: "If the flywheel broke first, it should have left the spindle all right running in its bearings." This is true, if all the fragments separated simultaneously; but—considering that every ounce of the rim of a 30-inch wheel at 2,000 revolutions per minute has a centrifugal force of about 100 pounds—suppose any considerable portion of one side to have gone first, would not the remaining unbalanced part have wrenched the spindle from its bearings in a twinkling?

Of the holes drilled in the rim of the wheel, Mr. Rose says "their number and size (as shown in Fig. 10) preclude the idea that they could have been made to balance the wheel, especially as it appears a well shaped casting," etc. There may be a difference of opinion on that point. What is the alternative? As near as I can judge by measurement of the figure, the weight removed by boring these holes would be not far from three-quarters of a pound. If, then, being a "good casting," the wheel was in balance without the holes, it would with them be out about 12 ounces on a radius of 14 inches. Is it at all probable, I may say, even possible, that it was used in that condition, at the velocity named? O. A. BENTON.

Amenia, N. Y., January 18, 1881.

Soldering Cast Iron.

To the Editor of the Scientific American:

A few weeks ago, being in a manufactory where hardware of all sorts is made for harness, I was told that pieces of cast iron could not be soldered together; and that if any inventor could devise a process by which cast iron *could* be soldered, he could not fail to disclose a process that would be of untold value, especially to manufacturers of harness hardware. As I have been accustomed, for many years past, to solder together pieces of cast iron, always with most satisfactory results, it occurred to me that perhaps the little experience which I have had may help some mechanics out of a little difficulty.

Many years ago the cistern pump of a neighbor was allowed to freeze up when partially filled with water, the result of which was the cylinder was bursted for about six inches in length. The part of the cylinder at the crack was placed on the grindstone, and ground away until the iron was clean and bright for an inch or more on both sides of the crack. Then the cylinder was put in a vise and screwed up tightly, and held in the vise while solder was applied along the crack. The first process was to "tin" the surface of the cast iron, so that the solder would take a strong hold of the iron. Muriatic acid was applied with a swab to the bright iron, after which a little of the best kind of solder was laid on and rubbed rapidly over the surface, with the soldering iron as hot as it could be without burning the tin off the copper soldering iron. After the cast iron had been well tinned solder was applied, and piled on over the crack until it was at least one-eighth of an inch thick all over the crack. That soldering never failed so long as the pump was in use.

Last year a cast iron wheel on our portable forge was broken, by an accident, into so many pieces that it was judged to be impracticable to mend it. As no one could determine where such forges were manufactured we could not procure a new wheel. To make a new pattern for another wheel like the broken one, pay for casting and fitting up, would cost several dollars; so I concluded to solder the parts together. Several machinists laughed me in the face for suggesting such a manner of repairing that wheel. But I took all the parts, and went where I could have the use of an emery wheel, and the surface of the iron on both sides of the cracks or breaks was neatly polished for at least half an inch to an inch from the break. Some of the arms were broken in two pieces. There were eight arms. Some of the arms tore away a piece of the rim. In some pieces it was not practicable to touch the surface with an emery wheel or file. The only way of removing the hard scale and rust from such places was with a sharp cold chisel. All the polished surfaces were first *tinned* in a thorough manner, after which the arms were put in their respective places, and the parts neatly and thoroughly soldered all over the breaks. The job cost about fifty cents' worth of time, and ten cents for the solder. The wheel runs as true as it did before it was broken, and to all appearance every part is as strong as ever. Indeed, we all judge that the parts would break in the solid iron sooner than where the arms and rim are soldered. There will be no difficulty in soldering cast iron if the surface is first polished and then well *tinned* with a hot soldering iron.

I always keep several small bottles containing muriatic acid of different degrees of strength. One bottle has in it pure acid. Another contains about three parts of acid and one part water. Another bottle contains about three parts acid and one part water, in which we have dropped numerous small pieces of sheet zinc. The acid will dissolve the zinc in a few hours. The acid in this last bottle is employed when soldering tin. The acid will corrode and clean the surface so that melted solder will unite with the clean and rough particles of iron, taking such a firm hold that one can scarcely perceive where the iron ends or where the solder begins. Wrought iron and steel also may be soldered with less difficulty than cast iron, if the surface is first polished and afterward tinned with good solder. If the surface is not tinned *thoroughly* the solder will not adhere with satisfactory tenacity to the iron. The reason why it is so easy for any one to solder tin consists in the fact that a sheet of tin is simply thin iron well covered with tin. After the surface of any piece of metal has been *tinned* any tinker can make melted solder adhere to the surface. S. E. T.

Orange, N. J.

THE OBELISK IN CENTRAL PARK.

The venerable monument, late of Alexandria, Egypt, and popularly miscalled Cleopatra's Needle, has been successfully transplanted to Central Park.

From time to time, from the first inception of the enterprise which has brought to our shores one of the most famous legacies of ancient civilization, down to the landing of the obelisk at the foot of West 96th street, last fall, the successive stages of the great undertaking have been described in this paper. With the completion of the work a brief review of the chief facts in the history of the obelisk and its voyage hither may properly be given before taking up the final chapter.

The material of the monolith, a reddish granite (syenite), shows that the stone must have come, as Egyptologists declare, from the ancient quarries of Syene, now Assouan, near the northern boundary of Nubia. From this point it was probably floated, as Pliny says all the obelisks were, on huge rafts or flat-bottomed boats to the sacred city of On, known to the later Greeks as the City of the Sun, or Heliopolis, a distance of about 450 miles. At Heliopolis, which was situated about eight miles from the site of the modern city of Cairo, our obelisk with its companion shaft now in London was set up before the entrance of the Temple of the Sun. Doubtless its position there was substantially like that of the remaining obelisk before the ruined Temple of Luxor, as shown in Fig. 1. The fallen mate of the Luxor obelisk was removed, it will be remembered, to the Place de la Concorde, in Paris, where it now stands.

The first erection of our obelisk at Heliopolis took place not less than 3,500 years ago, the precise date being fixed by some students of Egyptian history at B.C. 1640. Others give an earlier date as probable. It is certain, from the central columns of inscriptions on the stone, that the obelisk dates from the reign of Tothmes III., who ruled over Egypt when the Empire was at the height of its power and glory, and covered not only Northern Africa as far as Abyssinia, but Western Asia as far as Kurdistan and Armenia, south of the Caspian Sea, and all of Arabia.

For more than 1,600 years our obelisk stood at Heliopolis, and saw the glory depart from upper Egypt. It was then transferred to the newer seat of power and commerce, ancient Alexandria, 120 miles down the Nile, to adorn a majestic temple, probably begun by the great queen Cleopatra, but not completed until some years after her death. The fragmentary inscriptions on the copper crabs on which the obelisk rested at Alexandria make it certain that its erection there occurred during the eighth year of the reign of Augustus Cæsar, or B.C. 22.

While standing at Heliopolis, says Consul-General Farman, in one of his communications to the State Department, "it had passed the whole of the golden period of ancient Egyptian history. It had in all probability looked down upon the boy Moses as with the noble youths of the land he daily went to receive instruction from the priests of the Temple of the Sun, and also beheld on his part with admiration the then golden hieroglyphs that so long puzzled the wise men of modern times, but which he read as a student reads his Latin. It had beheld the chosen people of God in the days of their oppression and witnessed their exodus and the excitement that resulted therefrom, the hurrying to and fro of the priests of the temple, and the groups of people in the public places of the city discussing the great event. It had afterward watched the passing generations during the reigns of the Pharaohs for eight centuries, and had not only actually looked down upon those monarchs, but also upon all the long line of scholars who came to seek knowledge in this famous city of learning. It had then witnessed the conquests of the Persians, and mutely seen the City of On and its temples and many of its companion obelisks destroyed by the sacrilegious soldiers of Cambyses; and afterwards in a period of tranquillity it had seen Plato in his daily walks while sojourning in that city pursuing the study of philosophy and astronomy. Still later, amid the surrounding ruin and desolation, but ever looking further out upon the green fields of the valley of the Nile, it had seen the coming of Alexander the Great and his warm reception by the people as their deliverer from the yoke of the Persians, and afterward witnessed the three hundred years' reign of the Ptolemies, and finally, at the coming of the Cæsars, it had left the decay and ruin of its inland town and been transferred to the busy seaport of Alexandria. Here it has stood upon the seashore, a beacon for the mariners, for nineteen hundred years, and watched the rolling waves and the coming and going of the ships on the one side and the kaleidoscope of human events on the other.

Rebellions and insurrections, invasions and conquests, the struggles between Paganism and Christianity, between Christianity and Mohammedanism, between the different dynasties of the Arabs and the Turks, the successive rules of Sultans, Caliphs, and Mamelukes, and finally the conquest of Napoleon and the battles between the English and French on the waters and soil of Egypt, have all since its removal been witnessed by this sole surviving monument of the ancient City of Alexandria."

During the later ages of its sojourn in the modern city of Alexandria, the obelisk stood, as shown in Fig. 2, in a neglected quarter, its foundation, its unsuspected pedestal, and nine feet of its shaft buried in sand and rubbish, at last bereft even of its fallen companion, which had long lain half buried in sand.

The history of the removal of the obelisk from Alexandria to New York will doubtless be told at length by Lieutenant-Commander H. H. Gorringe, U. S. N., under whose direction its last migration has been brought to successful conclusion. The more salient facts of the history can be summed up in few words.

A little more than three years ago Mr. John Dixon, the engineer employed to convey the original and fallen companion of our obelisk to London, informed the *World* through Mr. Louis Sterne, an American engineer, that Ismail Pasha, then Khedive of Egypt, desired to present the remaining obelisk to the United States. The coöperation of Mr. Henry G. Stebbins, then a member of the Park Commission of New York, was enlisted by the editor of the *World*, and the possibility of securing the obelisk for our city was publicly announced. Within a few days a wealthy citizen of the city (understood to be Mr. Wm. H. Vanderbilt) agreed to defray the estimated expense of taking down the obelisk and bringing it to New York. The matter was thereupon laid before the State Department at Washington, and Mr. Farman, United States Consul-General in Egypt, was directed to take the necessary steps for the official transference of the obelisk from Egyptian to American ownership. French and English influence, then dominant in Alexandria, were strongly arrayed against the fulfillment of the Khedive's offer. About this time the Khedive was compelled to abdicate. Consul-General Farman at once obtained a written confirmation of the gift at the hands of Mohammed Tewfik Pasha, the son and successor of Ismail Pasha, the writing bearing date May 18, 1879.

Meantime Mr. Dixon's unfortunate experience in the transportation of the London obelisk led him to decline the more serious undertaking of lowering and transporting across the Atlantic the companion of the stone he had had such bad luck with. At this juncture Lieutenant-Commander Gorringe returned from a surveying cruise in the Mediterranean in command of the U. S. steamer Gettysburgh. He had made a study of the standing obelisk at Alexandria with reference to the conditions of its possible removal, and now submitted to the Secretary of State a proposition to undertake the task. His plans were approved; and having seen to the construction (at the Phœnix Iron Works, at Trenton, N. J.) of the machinery he had devised for taking down and shipping the monolith, he sailed for Alexandria by way of Liverpool, August 24. The completed machinery followed some weeks after. The ensuing winter and spring were spent by Commander Gorringe in the double task of overcoming the material difficulties and the more annoying political difficulties attending the lowering of the obelisk, its removal to the water, and its stowage in a vessel, the steamer Dessoug, which he had purchased for its conveyance to New York. The magnitude of the task will be appreciated when account is taken of the enormous size and weight of the stone. The obelisk proper is 69 ft. 2 in. long, 7 feet 7 inches by 8 feet 2 inches at the base, tapering to about 5 feet square at the foot of the pyramidion. The weight of the stone is 196½ tons. The pedestal is 9 feet square, 7 feet high, and weighs 43 tons. The weight of the other stones of the foundation is given at 87 tons. The summit of the obelisk was something over 81 feet above the lower step of the marble platform which formed the base of the monument.

A description of the engineering operations at Alexandria, as given by Lieutenant-Commander Gorringe before a recent meeting of the New York branch of the United States Naval Institute, was printed two weeks ago in the SCIENTIFIC AMERICAN of January 22.

The Dessoug sailed with her precious cargo June 12, 1880, and arrived at Gibraltar ten days later. The voyage from Gibraltar to New York occupied nearly a month, owing to a delay caused by a broken crank shaft. After her arrival, July 20, the Dessoug lay at anchor in North River for some weeks while the final disposition of the obelisk was under discussion. She was then taken to Clifton, Staten Island, hauled out of the water on the marine railway there, and opened at the bow for the discharge of the stone, which was run out on a massive platform supported by two rows of piles in such a way that the stone could be floated off on pontoons at high tide. A proper conjunction of weather and tide did not occur until September 22, when the stone was floated to the pier provided for it at the foot of West 96th street.

The method of disembarking the obelisk is shown in Fig. 3. Owing to the necessary narrowness of the opening in the bow of the Dessoug, the means by which the stone was to be moved had to combine the greatest strength with the least bulk. There was but 8 inches to spare, and the usual device for handling such heavy bodies would require at least four times that space. Accordingly, Commander Gorringe adopted a sort of railway formed of 6-inch channel iron and 5¼ inch cannon balls, one set of channel irons forming a trough for the cannon balls, the other set (inverted) riding above and carrying the stone. This device, Commander Gorringe is careful to state, was not original with himself, as has been reported. It was first employed, so far as he can discover, in the handling of the gigantic bowlder on which stands the statue of Peter the Great in St. Petersburg.

The same machinery was utilized in moving the obelisk across the tracks of the Hudson River Railroad at 96th street, as represented in Fig. 4. After that the plan of the ordinary marine railway was employed, as shown in Fig. 5, the movable track being carried forward as fast as the stone progressed. From the river the course of the stone was up 96th street to the Boulevard; thence to 86th street, through the transverse road to 5th avenue, and down to 81st street, from which point an incline of massive trestle work, 920 feet long and rising three-quarters of an inch to the foot, led to the site of the final resting place of the obelisk. The power required in hauling the stone up the stiff grade of 96th street was equal to a dead pull of 36 tons; on the incline the power required was 24 tons.

Meantime the foundation stones and the pedestal had been put in place and the towers or gallows frame erected for sustaining the obelisk during the last critical stage of the work. The towers were the same as were used in taking down the obelisk at Alexandria. The steel work of each tower was of six 12-inch heavy I-beams, spreading out at the base to a distance of 21 feet, and converging at the top to less than 5 feet. At their base the beams rested on four heavy I-beams, and were securely riveted to the platform by means of plates and knees. On top of the towers were caps 5 feet long and 30 inches wide, secured by plates and knees. The towers were braced from top to bottom by angles and channel irons, making them perfectly rigid. Placed on top of the caps and securely bolted to the towers were pillow-blocks weighing 3,700 pounds, and forming the bearings for the trunnions to turn in. The trunnions on which the obelisk turned while being swung into upright position were each 33 inches long and 18 inches in diameter, and were cast of the best quality of cannon metal. The trunnion plates, each 4 inches thick, 9 feet wide, and 6 feet high, were securely held in position, just above the center of gravity of the shaft, by strong connecting bolts. The two trunnions with their plates weighed 6 tons. The entire weight of metal employed in handling the stone was something like 60 tons.

As the monolith stood at Alexandria it was supported by copper crabs at the base, which left room for passing under it heel straps to be connected with the trunnion plates to prevent their slipping when the obelisk was lifted. In Central Park the stone rests squarely upon its base, the heel of the shaft, which was originally rounded, having been cut square off. This made it necessary to provide a substitute for the heel straps. For this purpose two massive friction plates of gun metal were cast at the Brooklyn Navy Yard to snugly fit the base of the stone, the hold being secured by pressure, by the penetration of the metal into the hieroglyphic incisions, and by overlapping the corners which had been cut away for the crabs. These base plates were strongly bolted together and connected with the trunnion plates with steel rods tightened by means of turn-buckles.

The copper crabs alluded to were originally four in number, but two of them had been stolen at some time, probably for their metal. The place of one had been supplied by a block of stone, wedged in with iron; the other corner was vacant. The bodies of the remaining crabs, which were genuinely crab-like in form, were about 8 inches thick, 12 inches long, and 16 inches broad, and weighed about 150 pounds each. They were much broken in lifting and turning the obelisk, and were replaced by other crabs of bronze made at the Brooklyn Navy Yard. Unlike the original, these do not bear the weight of the obelisk, which rests directly on the stone of the pedestal, but simply fill up and ornament the cut-way corners.

With the trunnions in exact line with their bearings as in Fig. 7, the ponderous stone was lifted by means of six powerful hydraulic jacks; the cradle was removed, and then the obelisk was slowly lowered by the jacks until its weight rested on the trunnions. Here, poised on its center of gravity between the towers, it awaited the final turn at noon Saturday January 22.

Not the least remarkable feature in the history of this unprecedented transportation of a great historical monument over a hundred degrees of longitude and across a great ocean, is the uniform success, celerity, and good fortune which attended every stage of the undertaking, a good fortune mainly due, all must admit, to the scientific and diplomatic skill of Lieut. Commander Gorringe. The practical wisdom of his prearranged plan of conducting the enterprise was justified by the fact that it was carried out without a single material alteration of mechanical or engineering detail, save that made necessary by the unexpected popular opposition stirred up by foreign influence in Alexandria against the carriage of the obelisk the nearest way to the ship through the streets of the city.

For our views of the several stages of the progress of the obelisk we are indebted chiefly to Messrs. Harroun and Bierstadt's admirable series of artotype views of the obelisk.

Erratum.

In article on "Expansion of Steam," by Prof. Thurston, January 8, 1881, for $\frac{P \times 37}{22}$ (Emery's formula) read $\frac{P + 37}{22}$

WE are informed that many of our leading manufacturers who have heretofore been troubled with the formation of scale in boilers are now using the Eureka vegetable boiler scale eradicator with very satisfactory results. G. E. Brinckerhoff, 107 Liberty street, New York, is agent for this article.

A Large Gold Brick.

Recently there was cast in San Francisco a brick of gold measuring 12¾ inches in length, 7 inches in breadth, and 4½ inches in thickness. It was 950 fine, weighed 3,785·17 ounces troy, and was valued at $70,000. It represented one month's product of the Spring Valley Hydraulic Mine, and was said to be the largest gold brick ever cast in California.

IMPROVED BENCH CLAMP.

The bench clamp shown in the annexed engraving is designed for the use of carpenters, sash, door, and cabinet makers, and is to be attached to the ordinary bench by means of a downwardly projecting foot which enters one of the several sockets formed in the bench top. The upper surface of the foot is inclined and serrated, as shown in Fig. 2. The general arrangement of the clamp is shown in the perspective view, Fig. 1. The nut formed on the base plate receives a screw having at one end a follower which presses the work, and at the other end a ratchet wheel whose teeth are engaged by a projection formed on the ratchet lever, which swings on the head of the screw and has sufficient longitudinal motion to permit of bringing it into engagement with the teeth of the wheel or of inserting it into the deeper notches formed in diametrically opposite sides.

The clamp may be placed in any desired position on the bench, and may be brought to bear upon the side or end of work whose opposite side or end is supported by the ordinary bench pin.

This device can be applied to great advantage in both wood working and iron work, and it will be found useful in marble and stone cutting. It replaces the cumbersome clamps in common use, and may be applied to a number of purposes which we need not enumerate. This invention was recently patented by Mr. James Murphy, of San Antonio, Tex.

Fig. 1.

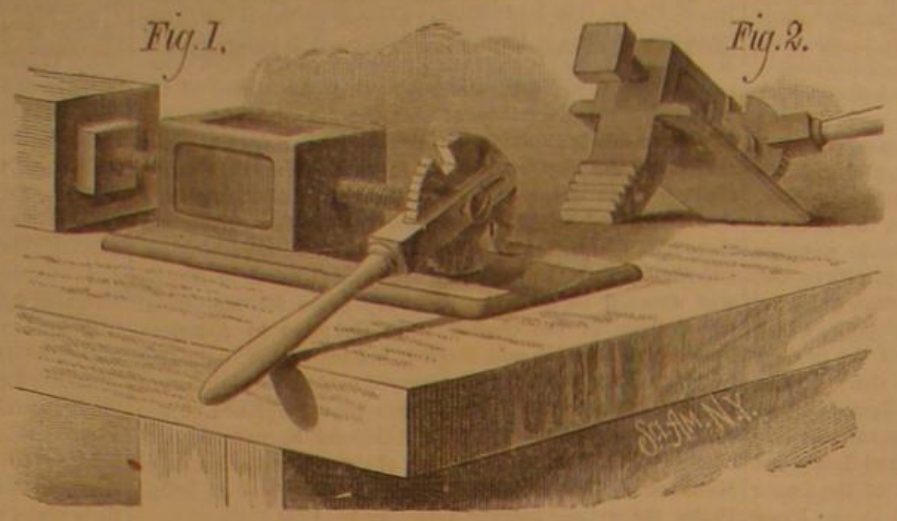


Fig. 2.

MURPHY'S BENCH CLAMP.

IMPROVED EXTENSION TABLE.

We give herewith an engraving of an improved extension table, in which the extending sections are contained in the table and are automatically placed when the table is pulled out or extended.

Fig 1 is a perspective view of the table showing one half closed while the other half is being extended. Fig. 2 is a perspective view of the under side, showing the mechanism which sustains and operates the extension sections. Lazytongs connect the legs at the ends of the table with the legs in the middle, and the extension sections, which drop and are covered by the other sections as the table is closed, are raised into their places by the lazytongs at the instant the table top is drawn out sufficiently to admit of it. The lower terminals of the lazytongs slide in slotted plates, D, attached to the legs, and when near the upper portion of the slot they strike brackets which support the movable end sections of each half of the table top. The permanent sections of the table top, that is, the sections which always lie in the same horizontal plane, alternate with the vertically movable sections, and are attached to and supported by alternate sections or links of the tongs.

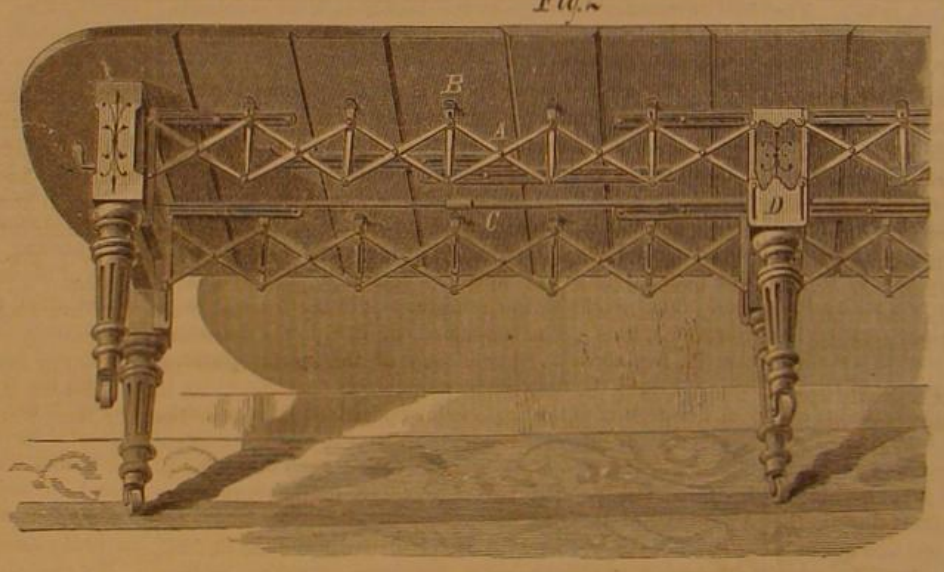
The extending sections are mounted on uprights, B, which extend downward and are slotted to receive the pivot of the upper joint of the lazytongs sections; these uprights are also connected by a sliding connection with the lower joint of the section. The parts are arranged so that the movable sections always maintain a central position in relation to the permanent ones; and when the permanent sections are sufficiently separated, the rising of the lower joint then carries the intermediate movable sections upward into place and sustains them in that position.

The table is locked in an extended or closed position by pressing a button. A lady or child may readily open and close the table, so small is the force required, as the pivoted trusses, C, are balanced and the table works almost as easily as a door turns on its hinges. The table top, whether drawn out or closed, is always supported by trusses, which give it great strength and rigidity, and there is no doubt of the superiority of the table in point of durability. It is a most desirable improvement.

The advantages of a table of this construction will be apparent to any one having had even a slight experience with extension tables of the common form. The extra leaves are always in place and properly stored, and all that is required to lengthen the table is to release the retaining rod and draw it out, and to shorten it when lengthened is simply the reverse of this operation. This useful invention was recently patented in this and several foreign countries by Mr. J. D. Brassington, 256 West 28th street, New York city.

The patentee will be pleased to correspond with parties wishing to purchase the patent, or to obtain license to work the invention in the United States, Great Britain, or Canada.

Fig 2



BRASSINGTON'S EXTENSION TABLE.

NEW INVENTIONS.

An improvement in tool handles, patented by Mr. John Gearon, of Beloit, Iowa, provides a new method of attaching handles to axes, adzes, hammers, etc. Instead of the usual eye for receiving the handle the tool has dovetail recesses on opposite sides, into which metal bars are inserted, which are concave on their interior surfaces below the tool for the reception of the handle, and are also provided with a recess for the reception of shoulders on the handles. The exterior of the lower part of the bars is screw threaded for ring nuts, which clamp the bars upon the handle, forming a secure attachment.

Mr. Aaron M. Sidwell, of Girard, Kansas, has patented a transplanter so constructed that plants can be readily removed from the ground without disturbing the soil around their roots, and holes made in the ground of exactly the shape and size of the soil raised with the plants. A very convenient implement.

Mr. Emil Schubardt, of New York city, has patented a jacking wheel for vehicles, which can be applied in case a loaded truck or other vehicle breaks a wheel or axle. By means of clamps and braces this wheel, which is small, can be readily applied, and by a screw the vehicle can be jacked up for immediate removal. The device is portable.

Mr. Edward N. Oualline, of Hockley, Texas, has patented an improved wheel hub, which permits the taking out of a broken spoke and the insertion of a new one without the removal of the wheel tire. The hub is sectional, and provided with spoke sockets having open sides, which are closed by a plate held by bolts which pass between the spokes.

An improved copybook, patented by Mr. Elmer P. Newton, of Dimondale, Mich., is claimed to be more convenient in use and less expensive than those heretofore used. The copies are printed in rows on a few pages of the book, the rows being easily separated by perforated lines. Each copy may be torn off, and by means of a copy holder attached to any of the pages where required. A saving in the cost of printing is thus effected.

Mr. George Blair, of Prescott, Ontario, Canada, has patented an improvement in stovepipe collars. It is formed by curving laterally a ribbon of metal into a circular form, at the same time forming therein radial corrugations or flutes which are deepest near the interior border of the collar. This collar will fit stovepipes of different sizes, and of course will allow expansion or contraction. The whole is made integral by joining the ends of the ribbon by a tongue and slot joint.

Mr. John D. Sanders, of Lone Oak, Texas, has patented an open link for connecting trace chains to whiffletrees and other purposes, so constructed that it can readily be attached or detached without the use of tools, is fastened automatically when closed, and is not liable to become accidentally detached.

Mr. Laurids J. M. Mortenson has patented a wagon hound brace holder or post, by which the hounds and circle are firmly held together, and by use of which the brace, instead of being weakened, as it is by some forms of brace holders, is strengthened.

A bottle filler, patented by Mr. Emile Kleiber, of New Orleans, La., supplies a machine for filling bottles with viscid oils and other viscid liquids, by which the oil or other liquid is forced out by air pressure, and the cocks are opened by the rise of the bottles to be filled. The arrangement is very ingenious, and will greatly facilitate the bottling of this class of liquids.

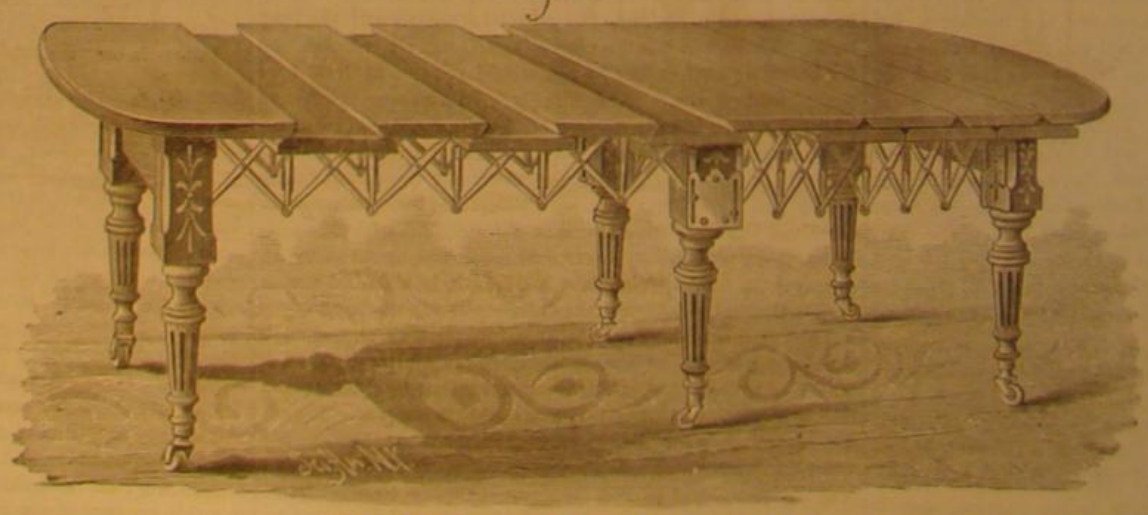
Mr. Alexander C. Bell, of New Alexandria, Pa., has patented an improved cider mill and wine press. The fruit is first placed in a hopper and ground. It is then passed between compression rollers to extract the juice, and the pomace is then dropped on an endless belt, which carries it out of the mill. The compression rollers are covered with rubber. These rollers compact together so closely as to prevent the passage of the juice between them, while their elastic quality permits the pomace to pass. The juice flows from their upper surfaces as from a trough, and is received into a conductor, through which it flows out of the mill.

Mr. Charles W. Millspaugh, of Rowaton, Conn., has patented an improved music holder. It is a horizontal bar provided with two sliding blocks, carrying clamping springs which press upon the leaves on each side of a music book.

An indicator, designed more especially for attachment to boxes or drawers which contain boots and shoes, but which may be employed for other purposes, has been patented by Mr. C. Friedrich A. Bultmann, of Sumter, S. C. It not only indicates the kind of merchandise contained in the drawer or box, but also the number of articles.

A band cutter for thrashing machines, patented by Messrs. John Alexander and William Alexander, of Hazelrigg, Ind., is so constructed as to cut the bands as the bundles are fed to the band table, and to present the grain to the feeder in better condition than when the bands are cut by hand, economizing labor, and preventing all danger of the feeder's hands being cut by the band cutter. The construction of the device is simple, and its action effective.

Fig. 1



BRASSINGTON'S EXTENSION TABLE.

THE SEA CAT.

"Sea cat" is the popular name bestowed on certain cartilaginous fishes of the order *Holocephala* because of a peculiarity of their eyes, which have a greenish pupil, surrounded by a white iris, and which have the property of shining, especially at night, like the eyes of the cat. These fishes seem to form a group intermediate between sturgeons and sharks.

Nothing is stranger and more ugly in appearance than one of these fishes, especially the species represented in the engraving, and which is well deserving of its scientific name, *Chimæra monstrosa*. It is from three to four feet long, and its body, from the base of its enormous head, gradually diminishes in size and ends in a long slender tail like that of some reptile. Its skin is smooth, elastic, and flabby, of a silvery white, and covered with scales that are so minute that they are scarcely perceptible to the touch. It is thrown into folds and sinuous wrinkles all along the body and on the top of the head, so that it appears to be too large for the body that it envelops. Under the mouth, and on the lateral faces of the snout, it is perforated with numerous holes, from which issues a glutinous mucus. The pectoral fins are supported on a sort of thick fleshy arm. Before and behind the ventrals hang two appendages resembling small paws. Between the eyes there is a large fleshy club-shaped process, with serrated edge, and ending in a spine, which somewhat resembles a crown, and has given rise to one of the popular names of the fish—"king of the herrings." What makes the sea cat still more hideous is its quick and odd movements, bending and twisting, as it does, in all possible directions. Besides this, the different parts of its snout are constantly in motion, so that it has the appearance of making grimaces, which have been compared to those made by monkeys. There are two kinds of this fish—the northern sea cat (represented in the engraving) which is found in the North Sea and Northern Atlantic, and the southern sea cat (*Callorhyncus australis*), inhabiting the southern seas. The first of these pursues shoals of herrings and other migratory fish, and also feeds on jelly fishes and crustaceans. Its flesh is tough, but the Norwegians use the eggs (which, as in the sharks, are inclosed in a leathery capsule) as food, and employ the oil of the liver in diseases of the eyes and for wounds.

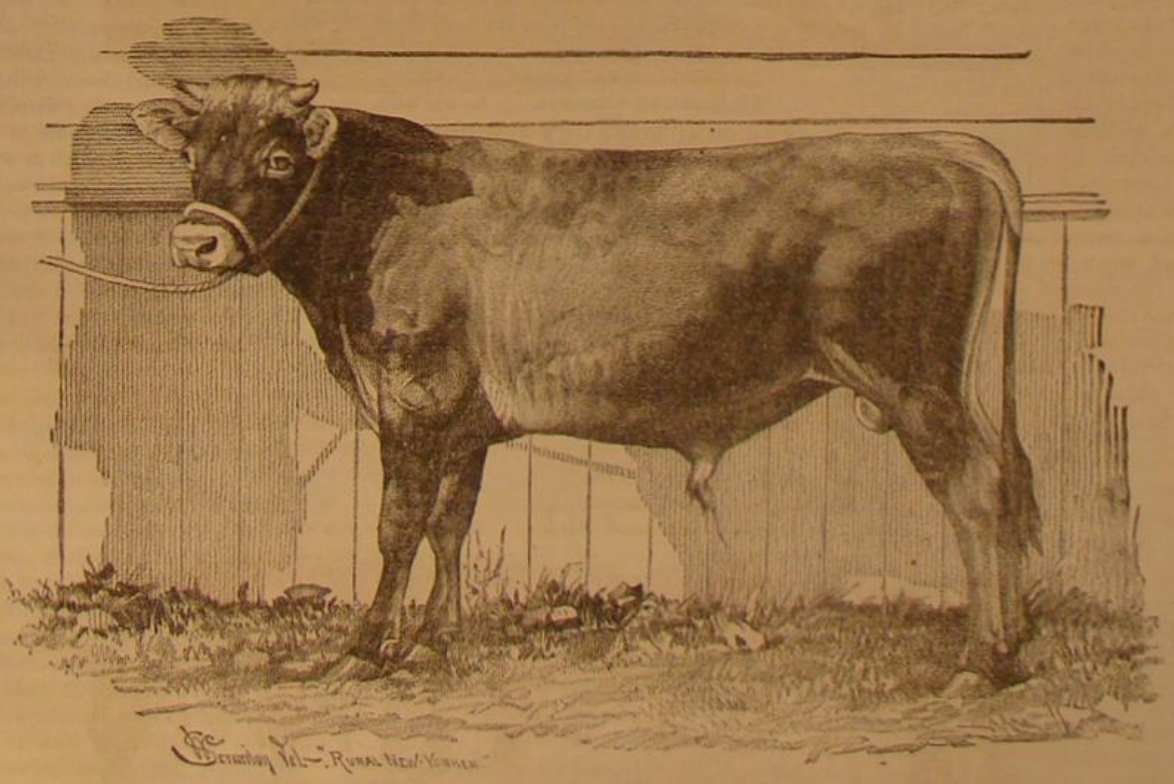
In the southern sea cat the snout ends in a gristly appendage, bent backward at the end so as to resemble a hoe; the anterior dorsal is very far forward over the pectorals; the second over the ventrals and reaching to the caudal, and the tail does not end in a filament. The singular shape of its snout, which is not unlike that of the tapir, has gained for it the familiar name of "elephant fish." It is about the same size as the northern animal, and is silvery, tinged with yellowish brown.

THE SEA CAT.

JERSEY BULL DIAVOLO.

This bull was the first prize in the yearling class at the New York State Fair in 1880. It is the property of Hon. Erastus Corning, of Albany.

The engraving, from a photograph taken for the *Rural New Yorker*, at the time of the Fair, and reproduced with great faithfulness, is a very correct portrait of this spirited and beautiful animal. That he is "good enough" goes without saying, for he won the highest honor in a large class. The photograph, as usual, slightly exaggerates the legs, perhaps, but the life-like play of light on the hide, the shadows, the spirited pose of the animal, are excellent, and so well preserved that the picture is a source of pleasure simply as a work of art. Diavolo was sired by Stockwell 3d, the noble bull which won the first prize at the same show in "aged" class, and was imported by Mr. Corning. His dam, Tranquillity, is by the same sire, her dam being Daisy Morton, also imported.



JERSEY BULL DIAVOLO.

Black Sheep of Australia.

Mr. Charles Darwin communicates to *Nature* the following extract of a letter from a Mr. Sanderson, of Chilhurst, which seems to explain the reason for raising and scattering black sheep among flocks of white ones on ranches in Australia. Mr. Sanderson writes: "In the early days, before fences were erected and when shepherds had charge of very large flocks (occasionally 4,000 or 5,000), it was important to have a few sheep easily noticed among the rest; and hence the value of a certain number of black, or partly black sheep, so that colored lambs were then carefully preserved. It was easy to count ten or a dozen such sheep in a flock, and when one was missing it was pretty safe to conclude that a good many had strayed with it, so that the shepherd really kept count of his flock by counting his speckled sheep. As fences were erected the flocks were made smaller, and the necessity for having these spotted sheep passed away. Their wool also being of small value, the practice soon grew of killing them off as lambs, or so young that they had small chance of breeding, and it surprised me how, at the end of my sheep farming experience of about eight years, the percentage of colored lambs produced was so much smaller than at the beginning. As the quantity of colored wool from Australia seems to have much diminished, the above experience would appear to be general."

Filtration and Decolorization.

BY C. G. PFANDER, LONDON.

It consists of dried or baked granulated clay mixed with blood to the proportion of about three of clay to four of blood; sometimes a proportion of vegetable charcoal is added. This mixture is moulded into lumps of convenient form, dried, broken into small pieces, mixed with an equal bulk of granulated clay, and then carbonized in a retort. This material, when screened, constitutes the new filtering material especially adapted for treating sugar, etc. The dust screenings will remove color from solutions of sugar and form a new product.

NATURAL HISTORY NOTES.

The Colors of Flowers.—Hitherto it has been supposed that the colors of flowers were due to so many different materials, each color being a chemical combination having no relation with the others. But now, however, Prof. Schuetzler, in a communication to the Vaudois Society of Natural Sciences, shows that, when the color of a flower is extracted by placing the latter in alcohol, the addition of an acid or alkali will give all the colors that plants exhibit. Flowers of pæony, for example, give when put into alcohol a violet-red liquid. If to this solution binoxalate of potassa ("salt of sorrel") be added the color becomes pure red. Soda causes it to change, according to quantity used, to violet, blue, or green. In the latter case the green liquid appears red by transmitted light, just as a solution of chlorophyl (the green coloring matter of leaves) does. The sepals of pæony, which are green bordered with red, become entirely red when put into a solution of binoxalate of potassa. These changes of color, which may be obtained at will, may well be produced in plants by the same causes, since in all plants there are always acid or alkaline matters. Moreover, it is quite certain that the change from green to red observed in leaves in autumn is due to the action of the tannin which they contain on the chlorophyl. Consequently, without wishing to affirm it absolutely, Prof. Schuetzler believes that *a priori* there is in all plants but one coloring matter—chlorophyl—which, becoming modified by certain agents, gives all the tints that flowers and leaves exhibit. As for white flowers, it is well known that their want of color is due to the fact that their cells are filled with a colorless fluid, and that their opacity proceeds from the air contained in the interspaces.

When such flowers are placed under the receiver of an air-pump they are seen to lose their opacity and become transparent in measure as the air is exhausted.

Relation of Fish to the Lime in Water.—In a recent paper by Herr Weith, entitled "Chemical Investigation of Swiss Waters with Reference to their Fauna," he gives a large number of quantitative analyses of the water of Swiss lakes, rivers, and streams, with regard to the proportion of lime and earthy substances generally contained in them. In this research a very interesting relation appeared between the quantity of fish and the amount of lime contained in the water. The result arrived at was that, in general, of the various bodies of water under otherwise similar conditions, those which contain the most *dissolved carbonate of lime* also contain the most fish. The explanation of this fact is also given by the author. The simple carbonate of lime is found largely distributed on the bottom and banks of lakes, etc., but it is insoluble, and therefore cannot be taken up by the water. If, however, the water contains carbonic acid in abundance (which of course is produced by the respiration of animals) this transforms the carbonate into the bicarbonate, which is readily soluble in water. The correctness of this view was proved by the author by experiment. By a sure chemical analysis, then, one may with considerable probability form a prognosis as to the quantity of fish in a body of water, to say what its chemical composition was, and to find his estimate remarkably verified. An important practical consequence would be deducible from these facts, if further experiments should confirm the supposition that not only do

fishes increase the proportion of lime in water, but that, conversely, an abundance of lime in water might have a stimulating effect on fishes. The latter, for their part, produce this carbonic acid which, with lime present in the water, does not escape into the atmosphere, but remains dissolved in water, and so stimulates plant life. Water plants, however, serve aquatic animals as food, and render possible their existence; and thus vegetable and animal life, whose mutual dependence is well known, is maintained by the mediating action of lime in continuous and intimate connection. Experiments on a large scale would decide whether it is possible to transform a body of water on ground which is without lime, and therefore poor in organic life, by suitable addition of carbonate of lime into such as would afford proper condition of life for animals and plants.

Effect of Strong Drink on the Liver.

The *Family Physician* tells us that when alcohol is introduced into the stomach in the ordinary way, it nearly all passes through the liver. Undiluted spirits are much more injurious than when mixed with water, and produce greater irritation. Alcohol consumed as wine or beer is far less destructive to the liver than when taken in the form of ardent spirits. A hot climate intensifies all the vicious effects of alcohol. The symptoms of cirrhosis of the liver are in the early stages often obscure, but later they are sufficiently well marked. At first the liver gets slightly enlarged, and the patient suffers from pain in the right side, indigestion, wind, and costive bowels. He is occasionally feverish, his skin is hot and dry, and he has a peculiar, unhealthy, sallow look, which he probably fails to notice, but which is sufficiently obvious to his friends. The necessity for making a change in his habits is forced upon his attention, and for a week or two he is under the doctor's orders, and not feeling able to drink any more, he consents to follow a restricted diet, and to take a course of purgatives.

Soon the most prominent symptoms are relieved, he fancies himself well again, and quickly returns to his old habits. Gradually, however, he notices that he is getting thinner and weaker, and occasionally he has a good deal of pain in the side. He is nervous and out of sorts. He has no longer the pluck he used to have; first his friends notice it, and then he gradually becomes aware of it himself. He finds that he is not "fit for business," and he is afraid to see people. The patient has occasional attacks of diarrhea, his appetite fails, and the emaciation and debility increase. He tries all kinds of treatment, but never sticks to one for *long* at a time. He consults every one of any note in London, but derives little if any benefit from their advice. He would give up the drink if he could, but he can't. His self-reliance is gone, the alcohol has stolen away his will, and he is utterly incapable of giving up the dangerous fascination. He will take an oath to-day that he will never touch another drop of spirit, and will probably break it to-morrow. Sometimes he wishes that some one would lock him up in an asylum, or that by some chance or other he could have six months' imprisonment, but he never feels able to put himself under restraint. After a time the liver gets smaller, and this, instead of being a good sign, is a bad one, for it is contracting. He would willingly enough consent to knock off drink now, but it is too late; the mischief is done, the liver is in a state of cirrhosis, and no medicine can restore it to its natural condition. Is there any remedy for this horrible complaint? Yes, one, teetotalism—absolute abstinence from alcoholic liquors of all kinds. This remedy must be applied early. If he waits till his liver has undergone serious organic change, it is too late. No half measures will suffice; he must give up drink of all kinds. If he does this he will recover; but if he goes on in his old plan an early and painful death is the inevitable consequence.

Exercise and Temperature.

These have been made the subject of a series of observations (about 150 in number, extending over four years) by M. Bonnal. He finds that all muscular exercise raises the rectal temperature. The rise is not, however, in direct relation either to the duration of the exercise or the apparent fatigue. For a given exercise, performed under like conditions, the rise of temperature may vary in different individuals, and even in the same individual. The altitude, the state of the atmosphere, the energy of the movement, the nature and amount of clothing, have a very manifest influence, especially on the rapidity of the rise. Absence or abundance of perspiration has no appreciable influence. The rectal temperature is rarely elevated beyond 38·6° C.; but in one case, that of a runner who, on the 14th of November, ran about 18 kilometers in an hour and a half without stopping, M. Bonnal found it 39·5°. (This man showed no accelerated respiration, but merely an increase of pulse to 145 beats.) In rest after exercise the rectal temperature falls, and the more rapidly the shorter the exercise has been. It is noted that all rapid exercise diminishes the peripheric temperature (in the mouth, armpit, or groin), which, on the other hand, rises again directly rest is taken, and after some time the peripheric and rectal temperatures come to their normal difference, 0·2° or 0·3°. If the rectal temperature be over 37°, a moderate exercise (such as walking 20 minutes on level ground) only raises it 0·2° to 0·4°.; but if under 37°, the rise may be more. In rapid ascent it is always after the first half hour that the rectal temperature is most raised; it may then remain stationary, or rise, or even descend a few tenths of a degree. Gymnastic exercise in the horizontal position, and limited to the upper limbs, does not alter the initial temperature. If limited to the lower limbs, it may, in 30 minutes, raise the rectal temperature 0·3° to 0·7°. In general, a rigorous application of the laws of mechanics to the human organism is not justified.

Accumulation of Foreign Bodies in the Stomach.

The following case is reported by Charles L. Dayton, M.D., in the Buffalo *Medical and Surgical Journal*. It demonstrates that in gastric diseases there is great difficulty in forming a correct diagnosis, and also in reaching a reliable prognosis, the problem only yielding a satisfactory solution through a *post-mortem* examination:

Mr. S., aged 45, residing at Black Rock, for a period of six months had complained of gastric pain with nausea, and other symptoms of indigestion. He presented the appearance of one suffering from scirrhus of the stomach or aggravated dyspepsia. Failing to secure relief after consulting several physicians, he consented to accompany me, with a view to consult Prof. Austin Flint, Sr., at that time residing in Buffalo. Prof. Flint examined the patient thoroughly, and expressed the opinion that he would ultimately recover. Two days afterward the patient suddenly died. At the autopsy, in the presence of Drs. L. P. Dayton, Tobie, and Beaman, the stomach was removed. It contained a tumblerful of prune pits; the pyloric orifice was so far occluded by the induration of the surrounding tissues that it admitted only the passage of a small catheter. About three inches from the pyloric orifice the stomach was perforated, probably through the influence of the prunes. His wife stated that he had not eaten prunes in five or six months, and could offer no explanation for his swallowing the pits.

The case is interesting on account of the presence of so large a quantity of foreign substances in the stomach, of the similarity of symptoms to those usually occurring in ulceration and scirrhus, and of the obscurity often attending gastric and intestinal disease, which is cleared up only through the *post-mortem* examination.

Neuralgia as a "Warning."

The great prevalence of "neuralgia"—or what commonly goes by that name—should be regarded as a warning indicative of a low condition of health, which must necessarily render those who are affected with this painful malady especially susceptible to the invasion of diseases of an aggressive type. This is the season at which it is particularly desirable to be strong and well furnished with the sort of strength that affords a natural protection against disease. There will presently be need of all the internal heat which the organism can command, and a good store of fat for use as fuel is not to be despised. It is no less essential that the vital forces should be vigorous, and the nerve power, especially, in full development. Neuralgia indicates a low or depressed state of vitality, and nothing so rapidly exhausts the system as pain that prevents sleep and agonizes both body and mind. It is, therefore, of the first moment that attacks of this affection, incidental to and indicative of a poor and weak state, should be promptly placed under treatment, and as rapidly as may be controlled. It is worth while to note this fact, because, while the spirit of manliness incites the "strong-minded" to patient endurance of suffering, it is not wise to suffer the distress caused by this malady, as many are now suffering it, without seeking relief, forgetful of the condition it bespeaks, and the constitutional danger of which it is a warning sign.—*Lancet.*

Suggestions Concerning Long Life.

If any one could furnish the world with a medicine which would insure a long life, there is no end to the demand he would have for his drug. The *Herald of Health* thinks he would need many factories to make it, and many banks to hold the money he would receive. Fortunately there is no such medicine, and so the world will have to get along in some other way.

Some time ago the French Government sent a circular letter to all the districts of that country to collect information as to those conditions of life which seemed to favor longevity. The replies were very interesting, but on the whole rather monotonous; and the general result was that longevity is promoted by great sobriety, regular labor, especially in the open air, short of excessive fatigue, easy hours, a well-off condition, a philosophical mind in meeting troubles, not too much intellect, and a domestic life. The value of marriage was universally admitted, and long-lived parents were also found an important factor. A healthy climate and good water were mentioned. All this agrees with common sense, unless the idea that the intellect is a hinderance to longevity be considered unreasonable, and we know that some of the most intellectual men have lived to great age.

Soda for Burns.

All kinds of burns, including scalds and sunburns, are almost immediately relieved by the application of a solution of soda to the burnt surface. It must be remembered that *dry* soda will not do unless it is surrounded with a cloth moist enough to dissolve it. This method of sprinkling it on and covering it with a wet cloth is often the very best. But it is sufficient to wash the wound repeatedly with a strong solution. It would be well to keep a bottle of it always on hand, made so strong that more or less settles on the bottom. This is what is called a saturated solution, and really such a solution as this is formed when the dry soda is sprinkled on and covered with a moistened cloth. It is thought by some that the pain of a burn is caused by the hardening of the albumen of the flesh which presses on the nerves, and that the soda dissolves the albumen and relieves the pressure. Others think that the burn generates an acrid acid, which the soda neutralizes.

Sewage, and Rules for Public Buildings.

The following rules, to be observed in the construction of all buildings erected under her Majesty's Office of Works, have been prepared and issued by the Secretary to the Office of Works:

1. All water closets and urinals shall be constructed so that one wall at least of such closets and urinals shall be an outer wall of the building.

2. All soil pipes shall be carried outside the building, and ventilated by means of pipes leading the foul gases above the highest point of the building. Such pipes to be carried to points removed from chimney stacks.

3. Separate cisterns shall be constructed for the water closets and for the general purposes of the building. No tap or "draw-off" shall be affixed to any pipe communicating with a cistern supplying a water closet or urinal.

4. All waste pipes and overflow pipes of cisterns shall terminate in the open air, and be cut off from all direct communication with drains.

5. Great attention shall be paid *to insuring* thorough ventilation in all rooms. Rooms so high that their ceilings shall be more than two feet above the top of the windows, corridors, staircases, and other open spaces, shall be specially ventilated so as to prevent the accumulation of stagnant air.

6. All main drains should, where practicable, be formed outside the building. In the event of its being necessary to carry a main drain underneath a building, it must be trapped immediately outside the main wall, and a ventilating-pipe must be carried from that point to the highest part of the roof, as under Rule 2.—*Journal of the Society of Arts.*

Pilocarpin in Diphtheria.

Last week fifty-two children died in Brooklyn of diphtheria. Sad reports of similar mortality come from other quarters. It is our duty to call the especial attention of American physicians to the extraordinary success which is now reported in Germany, in this disease, from the *muriate of pilocarpin*. It is given in ordinary doses, internally, and a large number of cases have been reported by different physicians wherein the results were astonishingly good. As soon as the pilocarpin exercises its specific effect on the salivary glands, the false membrane detaches, the inflammatory phenomena disappear, and improvement begins.

We particularly request our readers to try this treatment and report their results, whether good or bad.—*Medical and Surgical Reporter.*

Raspberry Culture Made Easy.

It is a source of constant regret with farmers that small fruits require so much care and attention, and that, too, in the season when they are hardest at work at something else. Field work must be done at all events, and so the "berry patch" struggles on single-handed with weeds and grass till it submits to the inevitable sward. Some years ago, coming into possession of a patch of black-cap raspberries that had received the usual shiftless culture, I treated them in the following way: After carefully plowing and hoeing them, I covered the ground with a heavy layer of strawy manure, and the work was done, not only for that year, but for the two years following, only renewing the mulch each spring. Only a few straggling Canada thistles will ever grow through such a mulch; the soil is always rich and moist, and the berries can ask no better treatment. Since that time I have tried the same plan without removing the sod, and find that the result is quite as satisfactory. Late as it is in the season now, any raspberry plot can be reclaimed by a liberal application from the horse manure pile. Farmers, try it, and you will not need to complain that berries cost more than they are worth.—*J. C. in N. Y. Tribune.*

Sewer Ventilation.

At a recent meeting of the Leith Town Council, Provost Henderson, *a propos* a memorial from certain inhabitants on nuisance said to be caused by the sewer ventilation in the streets, took occasion to address the Council on the principles and practice of sewer ventilation. He described the various means which had been resorted to in different towns to secure ventilation of the sewers, by in-draughts, by out-draughts, by furnaces, by screws, but thought experience had proved that the simpler the means adopted the more effectual the result. In fact, the more numerous and more direct the openings made in the sewers the better the ventilation and the less the nuisance (if any) from sewer air. He, as Mrs. Lirriper with the chimney-cowls and smoke, preferred the ventilation, and the means thereof, *plain*, and this was the general conclusion of competent observers on the subject. If the street ventilators of Leith stink, the evil must be sought not in the ventilators, but in the sewers themselves.

PASTE FOR PAPER.—To ten parts by weight of gum arabic add three parts of sugar in order to prevent the gum from cracking; then add water until the desired consistency is obtained. If a very strong paste is required add a quantity of flour equal in weight to the gum, without boiling the mixture. The paste improves in strength when it begins to ferment.—*Chron. Industr.*

Cotton Manufacture.—Census of 1880.

Preliminary report upon the *specific* cotton manufacture of the United States, exhibiting the number of looms, spindles, the number of bales of cotton consumed, and the number of operatives employed, as reported by Edward Atkinson, of Boston, Mass., Special Agent of the Tenth Census on Cotton Manufacture.

STATES.	Number of Looms.	Number of Spindles.	Number Bales of Cotton Used.	Persons employed, including Agents, Overseers, Clerks, Mechanics, Watchmen, and Operatives.
The United States...	230,223	10,921,147	1,586,481	181,628
Alabama	1,060	55,072	14,887	1,600
Arkansas	28	2,015	720	64
Connecticut	18,036	931,538	107,877	15,497
Delaware	823	48,858	7,512	695
Florida	—	816	350	33
Georgia	4,713	200,974	67,874	6,678
Illinois	24	4,860	2,261	281
Indiana	776	33,396	11,558	720
Kentucky	73	9,032	4,215	359
Louisiana	150	6,096	1,354	108
Maine	15,978	696,685	112,361	11,318
Maryland	2,325	125,014	46,947	4,159
Massachusetts	94,788	4,465,290	578,500	62,794
Michigan	131	12,120	600	208
Mississippi	704	26,172	6,411	748
Missouri	341	19,312	6,269	515
New Hampshire	25,487	1,008,521	172,746	16,657
New Jersey	3,344	222,305	20,569	4,658
New York	12,822	578,512	70,014	10,710
North Carolina	1,960	102,767	27,508	3,438
Ohio	42	14,328	10,597	563
Pennsylvania	10,541	446,379	86,355	11,871
Rhode Island	30,274	1,649,295	161,694	22 228
South Carolina	1,776	92,788	33,099	2,195
Tennessee	1,068	46,368	11,699	1,312
Texas	71	2,648	246	71
Utah	14	432	—	29
Vermont	1,180	55,088	7,404	735
Virginia	1,324	44,336	11,461	1,112
Wisconsin	400	10,240	3,173	282

The Health of Cities.

Statistics compiled by the National Board of Health show that for the year ending October 31, 1880, the more important cities of the world rank as follows in comparative healthfulness. The death rate shows the number of deaths to each 1,000 persons during the year:

City.	Population.	Death Rate.
Chicago	503,298	17·9
Philadelphia	850,000	18·3
St. Louis	333,577	18·8
Boston	375,000	20
Baltimore	393,796	20·9
London	3,254,260	21
Leeds	318,291	21·8
Glasgow	589,598	21·9
New York	1,203,223	23·4
Paris	1,988,806	24
Brooklyn	556,889	25·8
New Orleans	216 359	27·7
Lyons	342,815	27·7
Berlin	1,096,644	29·3
Dublin	314,666	32·9

Luminous Paint.

According to the London *Building News*, luminous paint is getting into quite extensive use in England. Mention is made of offices coated with the paint which give great satisfaction to the occupants. The effect is that of a subdued light, every object in the room being clearly visible, so that in a room so treated one could enter without a light, and find any desired article. The luminous paint is excited by the ordinary daylight, and its effect is said to continue for about thirteen hours, so that it is well adapted for painting bedroom ceilings, passages that are dark at night, and other places where lamps are objectionable or considered necessary. For staircases and passages a mere band of the paint will serve as a guide, and costs but a trifle. For outdoor purposes the oil paint is used, but for ceilings and walls the luminous paint, mixed with water and special size, can be used the same as ordinary whitewash, and presents a similar appearance in the daylight. By the recent discovery that it can be applied as ordinary whitewash considerably expands the field of its usefulness. Sheets of glass coated with the paint are in use in some of the vessels of the navy, at the Waltham Powder Factory, at Young's paraffine works, and in the spirit vaults of several London docks; and now that, by increased production and the use of water as the medium, its cost is reduced by one half, it will probably be extensively used for painting walls and ceilings. The ordinary form of oil paint has already been applied in many ways, to statues and busts, to toys, to clock faces, to name plates and numbers on house doors, and to notice boards, such as "mind the step," "to let," etc. The paint emits light without combustion, and therefore does not vitiate the atmosphere. Several experimental carriages are now running on different railways, the paint being used instead of lamps, which are necessary all day on account of the line passing through occasional tunnels.

Light Road Locomotive Wanted.

A correspondent suggests that this is one of the great needs of the times, and wants us to keep the subject before our readers. He says: "Your suggestions in years past have brought out many valuable inventions. Having been a patron of the SCIENTIFIC AMERICAN for thirty years I know its value. It has been a schoolhouse, workshop, and laboratory to thousands of men who are now in mature life."

Cities Having a Population of 10,000 and Over.—Census of 1880.

State.	Pop.	State.	Pop.
Akron, O	16,512	Malden, Mass	12,017
Albany, N. Y	90,903	Manchester, N. H	32,630
Alexandria, Va	13,658	Marlborough, Mass	10,126
Allegheny, Pa	78,681	Memphis, Tenn	33,593
Allentown, Pa	18,063	Meriden, Conn	18,340
Altoona, Pa	19,716	Middletown, Conn	11,731
Amsterdam, N. Y	11,711	Milwaukee, Wis	115,578
Atchison, Kan	15,100	Minneapolis, Minn	46,887
Atlanta, Ga	34,398	Mobile, Ala	31,205
Attleborough, Mass	11,111	Montgomery, Ala	16,714
Auburn, N.Y	21,924	Muskegon, Mich	11 262
Augusta, Ga	23,023	Nashua, N. H	13,397
Aurora, Ill	11,825	Nashville, Tenn	43,461
Austin, Texas	10,960	Newark, N. J	136,400
Baltimore, Md	332,190	New Albany, Ind	16,422
Bangor, Me	16,857	New Bedford, Mass	26,875
Bay City, Mich	20,693	New Britain, Conn	13,978
Belleville, Ill	10,982	New Brunswick, N. J	17,167
Biddeford, Me	12,652	Newburg, N. Y	18,050
Binghamton, N. Y	17,315	Newburyport, Mass	13,537
Bloomington, Ill	17,184	New Haven, Conn	62,882
Boston, Mass	362,535	New London, Conn	10,529
Bridgeport, Conn	29,148	New Lots, N. Y	12,681
Brockton, Mass	13,608	New Orleans, La	216,140
Brooklyn, N. Y	11,544	Newport, Ky	20,433
Brooklyn, N. Y	566,689	Newport, R. I	15,693
Buffalo, N. Y	155,137	Newton, Mass	16,995
Burlington, Iowa	19,450	New York, N. Y	1,206,590
Burlington, Vt	11,364	Norfolk, Va	21,966
Cambridge, Mass	52,740	Norristown, Pa	13,064
Camden, N. J	41,658	North Adams, Mass	10,192
Canton, O	12,258	Northampton, Mass	12,172
Castleton, N. Y	12,679	Norwalk, Conn	13,556
Cedar Rapids, Iowa	10,104	Norwich, Conn	21,141
Charleston, S. C	49,979	Oakland, Cal	34,556
Chattanooga, Tenn	12,892	Ogdensburg, N. Y	10,340
Chelsea, Mass	21,785	Omaha, Neb	30,518
Chester, Pa	14,996	Orange, N. J	13,206
Chicago, Ill	503,301	Oshkosh, Wis	15,749
Chicopee, Mass	11,325	Oswego, N. Y	21,117
Chillicothe, O	10,978	Oyster Bay, N. Y	11,913
Cincinnati, O	255,708	Paterson, N. J	50,887
Cleveland, O	160,142	Pawtucket, R. I	19,030
Cohoes, N. Y	19,417	Peoria, Ill	29,315
Columbia, S. C	10,040	Petersburg, Va	21,656
Columbus, O	51,665	Philadelphia, Pa	846,984
Concord, N. H	13,838	Pittsburg, Pa	156,381
Cortlandt, N. Y	12,664	Pittsfield, Mass	13,367
Council Bluffs, Iowa	18,059	Portland, Me	33,810
Covington, Ky	29,720	Portsmouth, O	11,314
Dallas, Texas	10,358	Portsmouth, Va	11,388
Danbury, Conn	11,669	Pottsville, Pa	13,253
Davenport, Iowa	21,834	Poughkeepsie, N. Y	20,207
Dayton, O	38,677	Providence, R. I	104,850
Denver, Col	35,630	Quincy, Ill	27,275
Derby, Conn	11,649	Quincy, Mass	10,570
Des Moines, Iowa	22,408	Racine, Wis	16,031
Detroit, Mich	116,342	Reading, Pa	43,280
Dover, N. H	11,687	Richmond, Ind	12,743
Dubuque, Iowa	22,254	Richmond, Va	63,803
Easton, Pa	11,924	Rochester, N. Y	89,363
East Saginaw, Mich	19,016	Rockford, Ill	13,136
Eau Claire, Wis	10,118	Rock Island, Ill	11,660
Elmira, N. Y	20,541	Rome, N. Y	12,045
Elizabeth, N. J	28,229	Rutland, Vt	12,149
Erie, Pa	27,730	Sacramento, Cal	21,420
Evansville, Ind	29,280	Saginaw, Mich	10,525
Fall River, Mass	49,006	Salem, Mass	27,598
Fishkill, N. Y	10,732	Salt Lake City, Utah	20,768
Fitchburg, Mass	12,405	San Antonio, Texas	20,561
Flushing, N. Y	15,919	Sandusky, O	15,838
Fond-du Lac, Wis	13,091	San Francisco, Cal	233,956
Fort Wayne, Ind	26,880	San Jose, Cal	12,567
Galesburg, Ill	11,446	Saratoga Springs, N. Y	10,822
Galveston, Texas	22,253	Saugerties, N. Y	10,375
Georgetown, D. C	12,578	Savannah, Ga	30,681
Gloucester, Mass	19,329	Schenectady, N. Y	13,675
Grand Rapids, Mich	32,015	Scranton, Pa	45,850
Hamilton, O	12,122	Shenandoah, Pa	10,148
Hannibal, Mo	11,071	Shreveport, La	11,017
Hartford, Conn	42,553	Somerville, Mass	24,985
Harrisburg, Pa	30,762	South Bend, Ind	13,279
Haverhill, Mass	18,475	Springfield, Ill	19,746
Hempstead, N. Y	18,160	Springfield, Mass	33,340
Hoboken, N. J	30,999	Springfield, O	20,729
Holyoke, Mass	21,851	Stamford, Conn	11,298
Houston, Texas	18,646	Steubenville, O	12,093
Hyde Park, Ill	15,716	Stockton, Cal	10,987
Indianapolis, Ind	75,074	St. Joseph, Mo	32,484
Jackson, Mich	16,105	St. Louis, Mo	350,522
Jacksonville, Ill	10,927	St Paul, Minn	41,498
Jamaica, N. Y	10,089	Syracuse, N. Y	51,791
Jeffersonville, Ind	10,422	Taunton, Mass	21,213
Jersey City, N. J	120,728	Terre Haute, Ind	26,040
Johnstown, N. Y	16,626	Toledo, O	50,143
Joliet, Ill	16,145	Topeka, Kan	15,451
Kalamazoo, Mich	11,937	Trenton, N. J	29,910
Kansas City, Mo	55,813	Troy, N. Y	56,747
Keokuk, Iowa	12,117	Utica, N. Y	33,913
Kingston, N. Y	18,342	Vicksburg, Miss	11,814
La Crosse, Wis	14,505	Virginia City, Nev	18,705
Lafayette, Ind	14,860	Wallkill, N. Y	11,483
Lake Township, Ill	18,396	Waltham, Mass	11,711
Lancaster, Pa	25,769	Warwick, R. I	12,163
Lawrence, Mass	39 178	Washington, D. C	147,307
Leadville, Col	14,820	Waterbury, Conn	20,269
Leavenworth, Kan	16,550	Watertown, N. Y	10,697
Lenox, N. Y	10,249	Watervliet, N. Y	22,220
Lewiston, Me	19,083	Weymouth, Mass	10,571
Lexington, Ky	16,656	Wheeling, W. Va	31,266
Lincoln, Neb	13,004	Wilkesbarre, Pa	23,339
Lincoln, R. I	13,765	Williamsport, Pa	18,031
Little Rock, Ark	13,185	Wilmington, Del	42,499
Lockport, N. Y	13,522	Wilmington, N. C	17,361
Logansport, Ind	11,198	Winona, Minn	10,208
Long Island City, N. Y	17,117	Woburn, Mass	10,938
Los Angeles, Cal	11,311	Woonsocket, R. I	16,053
Louisville, Ky	123,643	Worcester, Mass	58,295
Lowell, Mass	59,485	Yonkers, N. Y	18,892
Lynchburg, Va	15,959	York, Pa	13,940
Lynn, Mass	38,284	Youngstown, O	15,431
Macon, Ga	12,748	Zanesville, O	18,120
Madison, Wis	10,325		

Curious Industries.

The work of the staff of officers appointed by the superintendent of the census to collect statistics relating to the industries and manufactures of New York city is, says the *Evening Post*, now approaching completion, and will show, in the opinion of Mr. Charles E. Hill, the gentleman in charge of it, a very satisfactory growth since 1870.

In the course of the investigation by Mr. Hill's deputies some singular industries were brought to light. It was found, for instance, that some use was made of old shoes, but exactly what use was hard to find out. Large numbers of old shoes were sold by rag pickers to certain men who disposed of them at a good price. It is well known that bits of old leather make the commercial article known as Prussian blue, but only a few firms manufacture it, and the new call for old shoes was evidently for some other purpose. In New York city and Brooklyn about three million pairs of old shoes are thrown away every year. Formerly old shoes were plentiful in the gutters of certain neighborhoods; now it appears that they are sought after as choice prizes in the rag picker's line. By dint of persevering inquiry it was discovered that the old shoes were used for three purposes. First, all shoes not completely worn out are patched, greased, and after being otherwise regenerated, sold to men who deal in such wares. Some persons wear one shoe much more than the other; these dealers find mates for shoes whose original mates are past hope. Secondly, the shoes not worth patching up are cut into pieces; the good bits are used for patching other shoes, and the worthless bits, the soles and cracked "uppers," are converted into Jamaica rum by a process known only to the manufacturers. It is said that they are boiled in pure spirits and allowed to stand for a few weeks, the product far surpassing the Jamaica rum made with essences, burnt sugar, and spirits. A gentleman who doubted the truth of this story stopped recently at a low grog shop in the neighborhood of the factory spoken of and inquired if they had any rum from old shoes. "No," said the barkeeper, "we don't keep it much now; the druggists, who want a pure article, all sell it, and the price has gone up. But we have had it, and we can get you some if you want it." How many old shoes go to a gallon of rum could not be ascertained.

It has been noticed by some deputies that while manufacturers are quite willing to put a valuation upon their manufactured product they hesitate about stating the value of the raw material and even return the schedules with the space for the value of raw material left blank. In one instance a manufacturer of tomato catsup returned a report giving the value of his manufactured product at $18,000 and the value of his raw material as nothing. His explanation was as follows: Every year in the coming season he sends to all the wholesale houses which make a business of canning tomatoes clean tubs, with the understanding that the women who trim and peel shall throw the skins and parings into these tubs; every day the tubs are removed, the stuff in them ground up, fermented, flavored, and sold as tomato catsup to the extent of $18,000.

Another singular and decidedly pernicious business is the manufacture on a large scale of cheap candies from white earth or terra alba mixed with a little sugar and glucose. The deputy who investigated the confectionery business reports that seventy-five per centum of some candies is composed of these substances, and such candy, notably "gum drops," contain still less sugar. The effect of white earth upon the stomachs of the unfortunate children who buy these candies is yet to be determined by future autopsies. What is called a fine brand of castile soap has been found to be composed chiefly of this white earth and grease, but the evil effects of such an imposture are trifling compared to the results of turning children's stomachs into miniature pottery works.

Among the new industries which have sprung into existence during the last few years is the system of finishing in this city foreign goods imported in an unfinished condition. Foreign articles composed of several parts are now largely finished in this city, the parts calling for hand labor being imported while those calling for machine work are made here. In this way heavy duties are saved, although the articles are sold as imported goods.

The Photophone.

The opinion is gaining ground, especially among French *savants*, that the musical sounds produced by Professor Bell in disks of various substances, such as mica, India-rubber, metal, and wood, by holding them in the path of a rapidly interrupted beam of light, are really due to heat and not to light. Radiophonic notes, such is the new term, have been obtained by M. Mercadier from ordinary gas lamps without employing lenses to concentrate the interrupted beam, by simply bringing the receiving disk near the source. Even a plate of copper heated to a bright red heat produced very distinct musical tones, which gradually died away as the plate cooled to a dull red followed by obscurity. The fact that when the receiving disks were coated with silver on the side next the light the effects were feeble, and that when coated with absorbent lampblack they were strong, would seem to tell against Professor Bell's conclusion that the sounds were due to light.

It is a curious fact that when the radiometer was first brought out by Dr. Crookes he intimated his belief that its rotation was due to the impact of light waves; but heat is now known to be the cause of the motion.

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.

Notes & Queries

HINTS TO CORRESPONDENTS.

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

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

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

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

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

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

(1) J. R. asks how to mix aniline colors so that they will hold on glass buttons without rubbing off by touching. A. Mix them with a thin colorless varnish (alcoholic), such as bleached shellac or spirit copal.

(2) C. E. N. asks how to soften rattan so as to make neat basket work. A. Coil and steep in boiling water for a time.

(3) C. H. A. asks: Are kerosene heaters unhealthy? A. As commonly used, without means of carrying off the products of combustion, yes.

(4) J. B. asks how to make soap hard and firm. A. Heat the paste nearly to boiling, add plenty of soap, skim off the curds soap which separates, press and let stand to cool. Then cut up and stack in a dry place to harden.

(5) W. B. H. asks if the same cutter is used to cut all the wheels in a set of change wheels for a lathe. I have a lathe, and wish to cut some more wheels, have an index plate and gear cutter, but don't know whether a cutter made from one of the wheels as a pattern would answer for others having more or less teeth. A. Yes, if you shape your cutter to the teeth of a wheel not differing much from the diameter of that you wish to cut. 2. Please give me the title of some good work on amateur mechanics, or some work where I can get some information relative to gear cutting, etc. A. "Shelly's Workshop Appliances."

(6) H. S. asks the cause of the noise in the pipe connecting the range and boiler. The noise is something like that of a steam pump. The pipe connecting my range and boiler has burst twice in as many months, and the plumbers say they cannot account for it, and, therefore, cannot remedy it. The boiler is about 40 gallons size, and is supplied from a tank. The burst has occurred just where the noise is, and the noise does not commence until the water becomes heated. A. The pipe when it leaves the water back must rise gradually and have no place for steam to gather in. Anything which retards the free circulation of the water will cause noise, whether there is a partial stoppage in the pipe or whether the pipes are not properly set. It is excessive heat, with alternate heating and cooling at that part of the pipe, assisted by the ordinary pressure, which causes it to burst.

(7) A. W. asks: 1. Is there a common way of melting German silver? A. Use a black lead crucible, cover with charcoal, and give a good white heat in a small crucible or melting furnace. 2. How can I harden small gouges? A. Heat to bright redness under charcoal and quench in clean water, draw to a purple color. 3. Can you tell me of a way by which I can clean files, such as used by manufacturers of metal show cases; they get filled with soft solder? A. Use a piece of sheet brass or soft hoop iron to detach the metal between the teeth by striking across the file in the direction of the teeth.

(8) C. G. R. asks: 1. At what speed is the boat described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 166, supposed to run with a load. A. Probably eight to eight and a half miles. 2. What wood is best for ribs and keel, and is it bent or sawed into shape? A. White oak; best bent. 3. What wood is best for the hull and how thick? A. Cedar or cypress, five-eighths inch or three-fourths inch thick. 4. Would a four horse power engine answer for this boat? A. Probably it would if the stroke is not too great.

(9) M. J. H. asks for a cheap receipt or process for removing the color from calico prints and colored cotton cloth and bleaching it white. A. Boil in a strong solution of caustic soda, rinse thoroughly in clean water; steep for half an hour in a strong clear solution of chloride of lime (calcium hypochlorite) in water; ring out and pass through water containing about 3 per cent of sulphuric acid, rinse in running water until all traces of the bleaching materials are removed; dry.

(10) W. C. K. asks: What will remove tattoo marks from the skin? A. It is said that milk pricked into the skin in the same way that the ink was originally applied will change the blue color to red and ultimately cause it to disappear.

(11) J. B. D. asks how to make a solution that will take thick grease from steel wire so that it can be immediately dried, without causing it to rust? A. Use a boiling hot solution of potash in water. Bisulphide of carbon and naphtha also readily dissolve grease or oil without rusting.

(12) R. E. N. writes: We have two valuable sleigh robes, which are not used very often; how can I keep them free from moths when not in use? A. Alcohol, 1 pint; camphor, half an ounce; dissolve. Spray with this liquid before storing.

(13) W. T. B. asks (1) how oil of neroli is made. A. The freshly gathered flowers (sweet orange) distilled with an equal quantity of soft water in a retort provided with a condenser. The oil separates from the distilled water, which is returned to the still with fresh leaves. Rectify by redistillation. About 600 pounds of the flowers produce 1 ounce of the oil. 2. How are orange flowers gathered and preserved? A. The flowers cannot be preserved without loss.

(14) C. asks: Can you give me test for grease in glue? A. Macerate the glue with a little pure bisulphide of carbon, draw off the latter, filter quickly, and let it evaporate, in a clean porcelain vessel. The oil or grease (if any) in the glue tested will remain as a residue.

(15) J. S. B. asks why it is that the salts in a storm glass rise to the top of the hermetically sealed glass tube in damp weather, and sink to the bottom in dry weather. A. These glasses are usually not hermetically sealed—the change is chiefly due to the effects of the varying temperature.

(16) F. M. W. asks: What is the method of preparing and using soluble glass in the place of resin, in the manufacture of hard and soft soaps? A. Pure quartz sand, 1 lb.; reduce by grinding to a fine powder, and intimately mix with 1¾ lb. carbonate of soda deprived of water by calcination. Place the mixture in a retort, capable of holding four times the quantity, and expose to a white heat until the mixture is in a state of calm fusion. Pour out on an iron plate to cool. When powdered it dissolves to a syrupy liquid in boiling water. Consult Feuchtwanger's "Soluble Glass" and Dussauce's "A Treatise on the Manufacture of Soap."

(17) L. G. G. asks: 1. What gas is the lightest? A. Hydrogen. An equal volume of atmospheric air under like conditions of temperature and pressure weigh about fourteen and a half times as much. 2. How much lifting power has it per 1,000 cubic feet? A. If pure, about 109 pounds. 3. How is it made? A. On a large scale usually by decomposing dilute oil of vitriol with scrap iron, or by decomposing superheated steam by passing it over red hot iron. See Giffard's process (illustrated), p. 104, Vol. 38, SCIENTIFIC AMERICAN. 4. If kept in an air-tight vessel will it always remain the same under all conditions of weather? A. If pure, yes.

(18) J. S. asks whether there is any process besides painting, of transferring a photograph on glass for the purpose of showing it in a magic lantern. A. The process of obtaining photographic lantern transparencies is briefly as follows: Clean the glass, coat it with a thin ammoniacal solution of albumen, dry, flow with photographer's sensitized collodion, dip for a few moments in a bath of nitrate of silver, 5 drachms; distilled water, 10 fluid ounces (in a dark room). Adjust the photograph to be copied before the camera and focus. Then put the sensitized glass plate in the dark box, transfer to the camera, expose a minute or two (according to light), then cover, immediately remove to the dark closet and wash the plate in a strong solution of sulphate of iron to develop the picture. Tone in a little warm water containing a few drops of gold chloride, wash and fix by immersion in a strong aqueous solution of hyposulphite of soda or cyanide of potassium, rinse thoroughly dry, and flow with photographer's varnish. Place this in the outer aperture of a dark tube, the other end of which joins the front of the camera, so that the light passing through it enters the lenses of the camera and the image may be focused on the glass plate at the back. Then prepare another sensitized glass plate as before, expose in the camera, develop, tone, and fix as before. This plate will bear a positive image, and may be used directly in the lantern. Consult any good photographer.

(19) J. M. R. asks: By what means can I restore to its original whiteness a plaster vase that has become yellow? It appears to be a mixture of plaster of Paris and oil or wax of some kind, the outside being coated with spermaceti or paraffine. A. While chlorine or peroxide of hydrogen might be tried, we believe that there is no known method of restoring the original purity of a plaster article prepared as indicated. The easiest and most effective manner will be to paint it with a white paint possessing good body, such as Dutch white lead.

(20) E. B. F. asks: Can you give a description of the blue photographic process of copying tracings, etc., used by architects and others? The process is that by which white lines on a dark blue or purple ground are obtained. A. To compress a full description in the small space at disposal in this column would be impossible, but we give hints from which you can work. Brush the paper over with a solution of ferric-oxalate, ten grains to the ounce. This paper will remain good for years, but must be kept carefully in the dark. Expose to light under the drawing that is to be copied, and then brush it over with or immerse it in a solution of ferridcyanide of potassium (red prussiate of potash), by which the picture will be immediately developed, white lines upon a blue ground. The strength of the developing solution is immaterial. The blue color becomes intensified by subsequent washing with a solution of bisulphate of potash. The best sensitizing preparations are those in which ammonia as well as oxalic acid forms a part. Such ammonio-ferric oxalate may be prepared by mixing together oxalate of ammonia, 437 grains; oxalic acid, 386 grains; water, 6 ounces; heating the mixture to the boiling point and then stirring in as much hydrated peroxide of iron as it will dissolve. Peroxalate of iron alone is simply prepared by adding peroxide of iron to a hot solution of oxalic acid in water to saturation.

(21) S. A. C. asks how the iron moulds for cast steel ingots are made. Do they separate at the corners or in the middle of the mould to allow the ingot to be got out? A. The moulds are in a single piece. The cavity into which the metal is poured is made slightly tapering to admit of lifting the mould from the ingot.

(22) G. K. writes: I have a lot of keys that have got badly rusted through lying by for some time. Will you please inform me how to clean the rust off? A. Scour with a little fine emery and oil, if iron; if brass boil in strong washing soda solution, rinse in water, then dip momentarily in strong nitric acid, rinse quickly, rub with a cloth or sawdust and slightly oil.

(23) J. P. B. asks for a recipe for making a cheap black paint for coating canvas. The paint must not crack, and have a good gloss. A. Try the following: Gum amber, 16 oz.: melt in boiling oil (linseed), half a pint; add genuine asphaltum and resin, each 3 oz. Mix thoroughly over the fire, remove to the open air, and gradually add 1 pint of oil of turpentine, slightly warm.

(24) E. T. W. asks: What is used and how prepared and applied for a dressing for carriage tops when they become worn? I have seen one that had been dressed over and it looked as well as new. A. See answer to J. P. B., this page.

(25) J. N. S. asks: How many pounds of iron turning, of vitriol, and of water will it require to make eight thousand cubic feet of hydrogen gas? Can I make it in one vessel or tank, and what size, or will it operate better by using two or more smaller vessels, and of what size? A. About 1,176 lb. iron turnings, 374 gallons strong oil of vitriol, and 45 barrels of water. Better use a number of large, tight hogsheads. Make connection by means of varnished canvas hose, with a short piece of iron pipe driven in a hole in the head of the vessel; 7 lb. iron require at least 12½ lb. acid mixed with about 6 gallons of water. See Giffard's apparatus and process for making hydrogen for inflating balloons, p. 104, Vol. 38, SCIENTIFIC AMERICAN.

(26) J. F. writes: I have in my possession a graduated tube with a bulb on the end loaded with shot; it is marked "Baume for coal oil," temperature 60° Fah. I wish to know how to use it so as to tell the best oil and which is the least explosive. It is marked from 10 up to 75. I have never seen these instruments described by you. A. In Baume's hydrometer for light liquids zero (0°) indicates a specific gravity of 1·075; 10° corresponds to sp. gr. 1·000; 25° to sp. gr. 0·906; 50° to sp. gr. 0·782, and so on. Suspend the instrument in astral oil, which will serve as a good standard; those in which the instrument sinks deeper are of poorer quality. Almost any dealer in optical and philosophical apparatus can provide you with printed tables and explanations of the instrument.

(27) D. V. C. asks if there is any ingredients which would mix with our sizing, composed principally of glue and soap dissolved in water, to prevent

window shades from curling on the sides when exposed to the heat of the sun. A. Try the addition of a trace of glycerine to the size.

(28) C. E. R. asks: 1. Is the pressure the same on the bottom of steam boiler as on the top? A. The pressure is as much greater at the bottom, than the pressure of steam, as is due to the head of water. 2. What is the largest size steam engine cylinder ever made? A. We suppose the largest cylinder is that of the drainage engine at Harlem lake, 144 inches diameter.

(29) J. M. M. asks: 1. With what color are paraffine matches colored? A. Usually the colors are pigmental and not dyes, such as red and yellow lakes, ochers, Prussian blue, and green, etc. 2. If it is aniline how is it applied and mixed? A. The aniline dyes may be introduced by first dissolving them in alcohol. The merest trace of the dyestuff is sufficient. 3. Is there any liquid color for dyeing matches in the market? A. We know of no color sold especially for this purpose.

(30) F. T. R. asks: How is brass made and melted? My experiments have resulted in a blue flame and ashes. A. Yellow brass—zinc, 35; copper, 70; for turning (common) copper, 20 lb; zinc, 10 lb.; lead, 1 to 5 oz. Red brass for turning copper, 24 lb.; zinc, 5 lb.; lead, 8 oz. Red brass, free, for turning copper, 160 lb.; zinc, 50 lb.; lead, 10 lb.; antimony, 44 oz. Another—copper, 32 lb.; zinc, 10 lb.; lead, 1 lb. Best red brass for castings copper, 24 lb.; zinc, 5 lb.; bismuth, 1 oz; put in bismuth last. In melting use a black lead crucible, put in the copper and heat in a crucible until melted (requires a very bright red, or white heat). When the copper is barely hot enough to remain liquid, add the zinc, with a little borax and charcoal powder. The zinc must be dry. Where lead, antimony, or bismuth is one of the constituents, stir in these just before taking from the fire to pour. Stir with a stick of green wood, skim and pour. In remelting brass use a quick fire and add a little zinc to make up for that invariably lost in the operation.

(31) W. M. C. asks how to put a black bronze on gun barrels. When the guns or carbines are first issued to us they have a lustrous black bronze, which lasts about six months and wears off, leaving the barrel smooth and bright. I think that it is applied with a brush or by a dip, as muriatic acid takes it off clean, leaving the barrel bright. What I need is a recipe such as a soldier can use. I think that a liquid preparation would be the thing, if possible. A. The blue color is due to a thin film of oxide formed in tempering. We know of no way of reproducing the film without reheating the whole barrel. A thin coating of spirit copal varnish, diluted (with alcohol), somewhat and properly colored with aniline blue, may be used to imitate the color and appearance, but it is not very durable.

(32) T. W. asks if a glass ball placed on top of a flag staff on a house is any protection against lightning. A. No, the glass ball would not be any protection from lightning. The proper protection would be a three-quarter inch iron rod, made if possible in one continuous piece, or in sections with soldered and riveted joints, extending from the staff or highest point on the house to the ground, and connected underground with the iron water main pipe or iron gas pipe; the connection between rod and pipe being by soldered joints. This would afford a large area of conducting material under ground in direct connection with the rod. No rod is a protection unless it is thoroughly joined to a large conducting surface in the earth.

(33) J. P. asks for formula for electro-plating iron on other metals. A. Neutral ammonio sulphate of iron (double sulphate of commerce) three-fourths lb.; water, 1 gallon; dissolve and filter. Use a clean iron anode, clean the work thoroughly. (See Nickel Plating, p. 153, Vol. 43, SCIENTIFIC AMERICAN.) Use a moderately strong battery. The success of the operation depends very much upon the preparation (thorough cleansing) of the work. 2. Is the formula given in No. 1, new volume, for electro-plating brass, patented? A. No.

(34) J. H. M. writes: Some makers of boilers, to be used in connection with pipes for heating dwellings and greenhouses by the hot water system, have, in this country and in England, used pipes for grate bars, intending that the water in the boiler should circulate through these pipes, and expecting to obtain greater efficiency from the exposure of more surface to the action of the fire. In what respect is an apparently good theory practically defective, for it seems to have been adopted by but few, and to have been abandoned by some who have experimented with it? A. Such "water grates," as they are called, are not used for economy of fuel, but because they are more durable than the ordinary grate. Coal burning locomotives are frequently fitted with them

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

R. P. W.—It is a fine silicious sand, useful for polishing purposes and for glass making; might also find a market with pottery manufacturers and artificial stone makers.

COMMUNICATIONS RECEIVED.

A Plan for the Reformation of the Orthography of the English Language. By H. A. S.

On Solar Phenomenon. By J. C.

NEW BOOKS AND PUBLICATIONS.

EXTRACTS FROM CHORDAL'S LETTERS. New York: *American Machinist* Publishing Company.

These selections from the contributions of "Chordal" to the *American Machinist* make an interesting, entertaining, and usefully suggestive addition to the literature of the machine shop. The author discusses shop work and shop management with much practical shrewdness, and in a manner that mechanics, artisans, and wide-awake working men generally cannot help but enjoy.

YELLOW FEVER: ITS SHIP ORIGIN AND PREVENTION. By Robert B. S. Hargis, M.D. Philadelphia: D. G. Brinton.

Dr. Hargis is an enthusiastic disciple of Professor Gamgee as to the nautical origin of yellow fever, though he professes to have developed the same theory long before. This book comprises a number of articles on the subject published in several medical journals during the past year.

STUDIES IN SONG. By Algernon Charles Swinburne. New York: R. Worthington.

Swinburne's command of singing English is marvelous. His verses are unequaled in sweep and melody. If he could only freight them with thought and feeling of equal quality he would be a poet, and a great poet.

THE SCIENTIFIC BASIS OF SPIRITUALISM. By Epes Sargent. Boston: Colby & Rich. 12mo, pp. 372. $1.50.

Of the two classes of men—those who believe in spiritualism and those who reject the spiritual hypothesis—one must be grievously in error: perhaps both are. We are inclined to think that the one (however correct on the main point) errs as much in denying real phenomena because they are not readily explainable under a too limited theory of what is natural, as the other does in over haste to accept phenomena which are misunderstood or fraudulent, because they tell in favor of that most marvelous of men's inventions—the supernatural. Mr. Sargent's book is not likely to change radically the belief of either class. The natural material out of which men have created and peopled the supernatural, the "invisible universe," the "spirit world," or whatever it may be called, will have to be much more broadly and minutely understood, both as regards its origin and its character, before the question of fact and fancy involved in spiritualism can be brought to any real scientific basis.

SPONS' ENCYCLOPEDIA OF THE INDUSTRIAL ARTS, MANUFACTURES, AND COMMERCIAL PRODUCTS. Edited by G. G. Andre. 30 parts. Each 75 cents. New York: E. & F. N. Spon.

Parts 15, 16, and 17 of this encyclopedia complete the subject of explosives, and embrace feathers, fibrous substances, floor cloth, food preservation, fruit, fur, coal gas, gems, glass, and graphite.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

January 4, 1881,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, 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. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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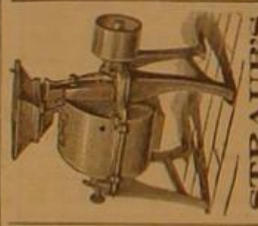

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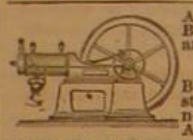

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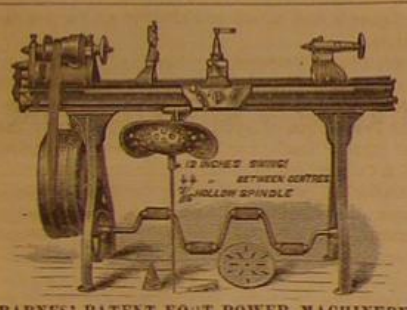

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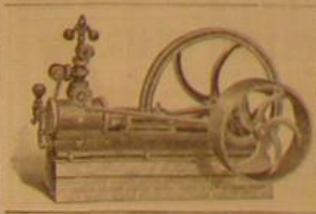

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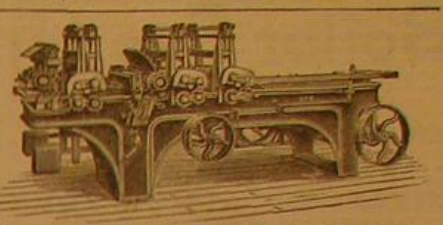

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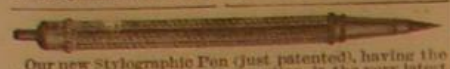

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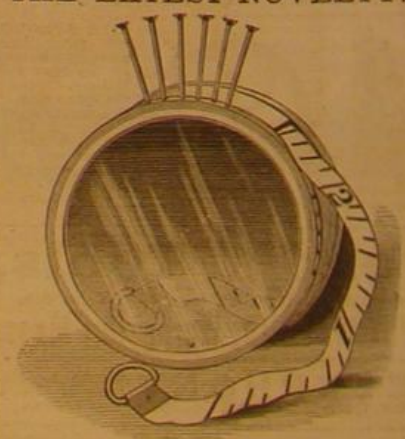

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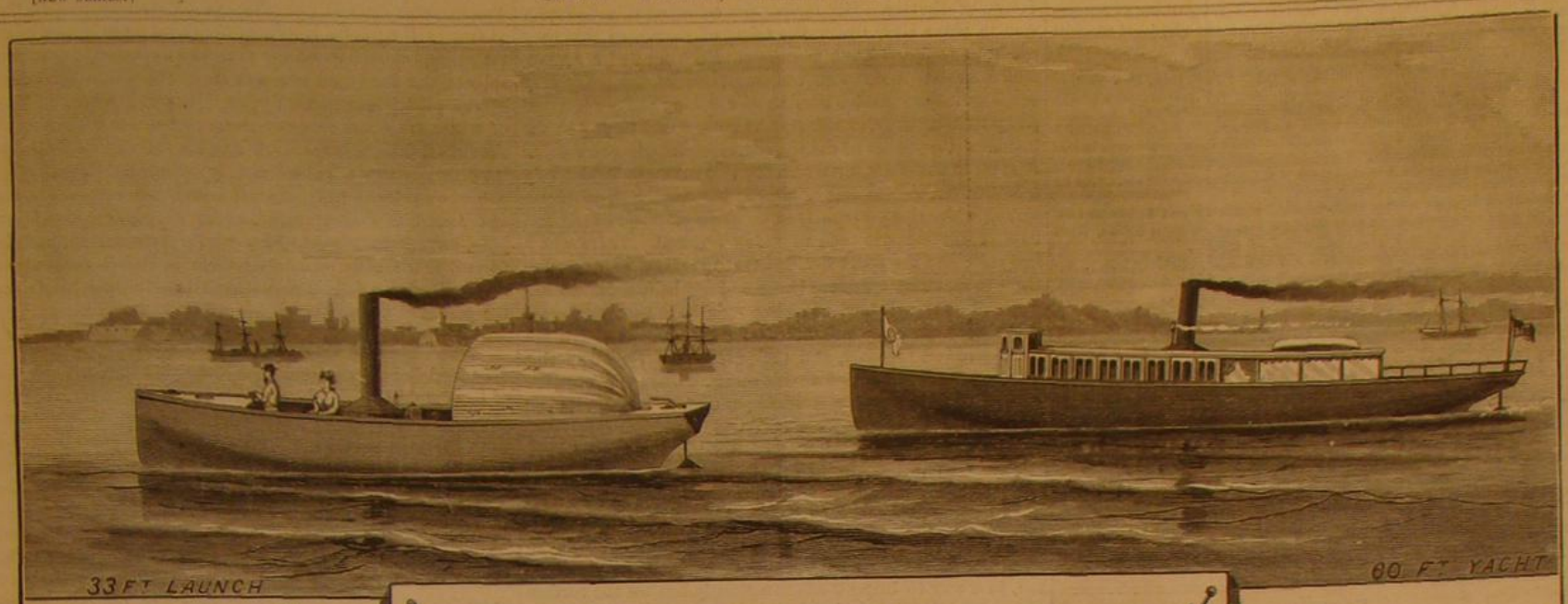

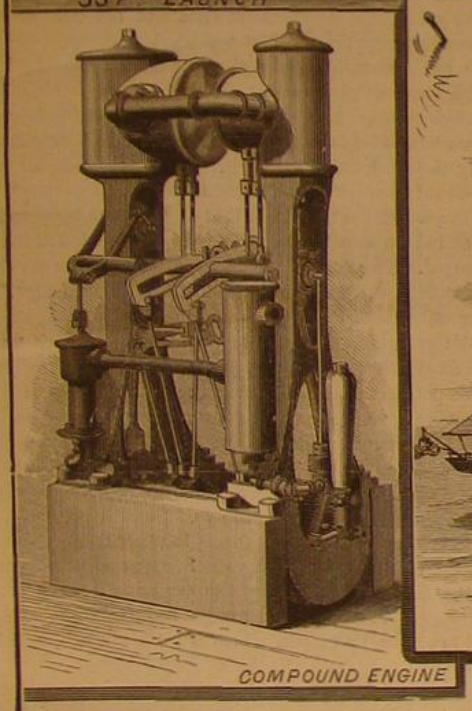

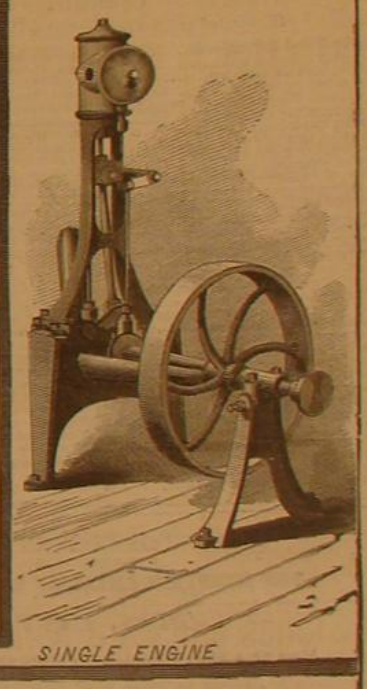

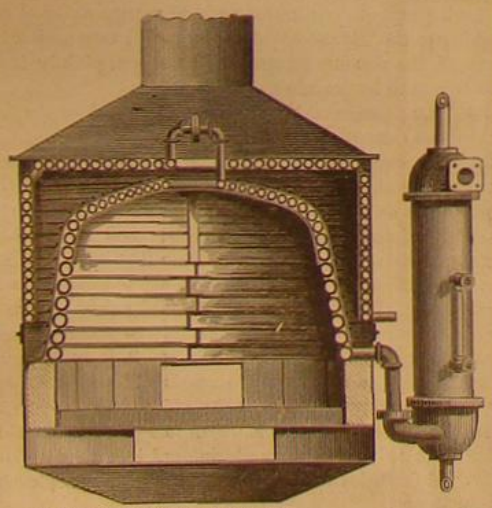

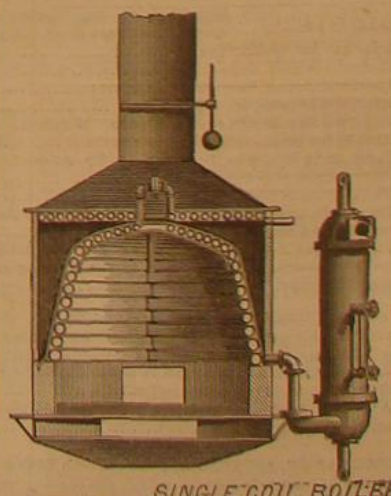

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NEW YORK, SATURDAY, FEBRUARY 12, 1881.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 267,

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PROGRESS OF PATENT LAW.

A prominent subject in the decisions recently reported is the degree of "invention" needful to support a patent. Patents must be new and useful; the rule is elementary; yet it does not seem—if one may judge from the number of cases in the courts—to be generally understood. The case of the whip tip patent is a striking illustration, for the reason that the invention, so to call it, was really useful, and the judge in deciding against it, said that he was sorry to do so, as the inventor had introduced a real improvement in the trade. This inventor had observed that driving whips, especially long ones without a lash, were expensive because they soon became frayed or broken at the tip end; while the stock remained good, the whole was worthless for defect of the tip. His device for relieving this difficulty was to make whip tips independent of stocks, so that they might be replaced when worn out. Each tip had a socket, which might be fitted to the small end of the stock very much as the successive lengths of a fishing rod are inserted one within another, except that he cut a screw thread on the inside of the socket of the tip, corresponding to one outside the end of the stock, by which the two might be held firmly together. A patent was obtained; but soon a rival began selling whip tips so contrived as to be clinched to the ferrule of the stock instead of being screwed. There was a law suit; and the court decided that the claim of exclusive right to make independent tips could not be maintained because it was not new. Fishing rods have been made for years upon the same principle. To be sure they have not been screwed together, and the patentee of the whip tips was pronounced entitled to his screw. But the competing company was not using a screw; therefore it was allowed to continue the business.

A more recent case is that of the "perfection window cleaner." The description of it is long and complex; but the device was substantially a rubber mounted upon a long handle, adapted to be used in reaching up to clean window panes and other glass surfaces. It consisted only in the adjustment of the rubber strip, supported by a tubular cushion, in a way to bring it advantageously against the surface to be cleaned. The decision of the court was that there was nothing new in the invention; the implement was nothing but a mop or scrubbing brush made of India-rubber.

A still more remarkable case was decided upon a patent for "improved kindling wood." In order to make kindling wood take fire easily and save the kitchen maids the trouble of cutting splinters and shavings, or of hunting for waste paper to set it alight, this inventor proposed to sell the wood in small bundles, in each of which should be tied a little lump of resin, tar, or some combustible of that sort, which would take fire from a common match, and set fire to the bundle. For this he obtained a patent, but the court said that there was no invention; his device was no more than selling tar or resin tied up in a bundle with kindling wood. It was no more patentable than would be selling a cigar with a match tied to it, or a drinking glass with a straw, or a can of food with a fork.

City readers are familiar with the fare boxes used in omnibuses, and in the street cars running unaccompanied by conductors. They are so arranged that a passenger may drop the coin for his fare into a sort of savings bank slit at the top of the apparatus, through which the coin will fall down upon a little movable shelf—what one might perhaps call a diaphragm—where it lies until the driver has inspected it to see that it is a genuine coin, is for the proper amount, etc. He then pulls a lever, which lets the shelf drop, and the coin falls into the company's savings bank below. Obviously the device requires a window for the driver to look through. Fare boxes as thus described have been in use for some time. Patents were more recently taken out for two improvements. One of these consisted in fitting a second window to the rear side of the apparatus; and the other consisted in arranging a reflector in the interior of the box, so that the headlight of the car might shine down and enable the coins to be seen conveniently at night. The Circuit Court has decided against the validity of both these claims. Inserting the additional window is nothing new; the old form of the box included one window, so that the improvement consisted merely in duplicating one of the features of a former device. This is not "invention;" nor is any invention involved in arranging a reflector near a lamp in such a manner as to cast light into a fare box near by it.

Seats for chairs, settees, railroad cars, ferryboat cabins, etc., are nowadays extensively made of veneers, or thin sheets of wood perforated. Strength is gained for the thin wood by gluing one sheet upon another crosswise, and the perforations, being arranged upon some simple design, give both ventilation and ornament. A patent was taken out for this mode of construction; but when it was contested, proof was produced of an earlier patent for gluing veneers together across their grains to make a thin, strong sheet; and also of another earlier patent for perforating sheet metal for making chair bottoms. The Circuit Court then said that the more recent patent for veneers glued together and perforated displayed no invention, and was void.

In two law suits which arose upon the patent for the giant powder, it became necessary to consider the question, How full and precise must be the description of a device in an earlier patent in order to forbid one who invents it anew at a later date from obtaining a valid patent? Judge Blatchford has stated the rule to be that the description in the prior patent must be sufficient to show with certainty how, by following its directions, the article can be made, and this must be a result within the intention of the description, not a mere accident. Showing that by following the directions of an earlier patent, a person might accidentally, through small variations in the process, have hit upon the same result, does not avoid a patent which has been granted to a subsequent inventor.

A noteworthy decision in this branch of the law, in which the patentee was more successful than in the preceding cases, relates to an improvement in water works for cities. Former devices for this purpose have been subject to the defect that the pressure of water from reservoirs, or from force pumps where they were employed, upon hydrants or spigots, was inconveniently variable; sometimes it would be deficient, and then so excessive as to burst the apparatus. The inventor devised pumping machinery so contrived that as fast as the pumps increased the quantity of water in the mains, and so increased the pressure upon the hydrants or spigots, the increased pressure should diminish the action of the pumps automatically; or, afterward, when the flow of water from use diminished the pressure, the diminution should set the pumps at work again more vigorously. The invention has been quite widely adopted. Recently the patentee's priority has been contested, and several English and American contrivances, having the same general purpose, have been brought forward for comparison, but the Circuit Court, after examining them in detail, pronounced them all substantially different and inferior, and sustained the patent.

THE SURPLUS PATENT FUNDS.

In 1868 Congress passed a law requiring the daily receipts of the Patent Office to be deposited in the Treasury, the support of the office to be provided for by annual appropriations from the patent fund. During recent years, under a pretext of economy, the appropriations for the conduct of the Patent Office have been unduly cut down, greatly to the disadvantage of the service, while the surplus fees have accumulated until they now amount to over sixteen hundred thousand dollars. In other words, the inventors of the country have paid in fees to the office, during the past ten or twelve years, this large sum in excess of the cost of the service rendered by the office.

There has naturally arisen the question, What shall be done with these surplus funds?

It is obvious that the most that can be asked of any branch of the public service is that it shall accomplish efficiently and fully the work intended by it. If the fees paid for service by those who are served amount to enough to pay the cost of such efficient service, that is so much more to its credit, and the utmost that can be justly demanded of it has been secured. The only department of the public service which stands in this unique position is the Patent Office. It has been and is self-supporting—and more.

If in doing this it has also done its legitimate work with the highest degree of efficiency, justice to the clients of the office, the patentees, demands that the fees should be cut down so as to cover the cost of the service, and no more. If the office has been prevented, through insufficient appropriations, from doing its work as well as it might, and this is plainly the case, the only alternative is to use the surplus fees for the immediate improvement of the service.

Any diversion of the surplus funds to other uses—as proposed in the bill lately passed by the Senate and now pending in the House, transferring the surplus funds of the Patent Office to an educational fund—is equivalent to laying a special tax upon inventors, which is certainly neither fair nor politic.

If the excess of fees cannot be used for the improvement of the Patent Service, there should be no excess of fees. Indeed, justice to our inventors, and a wise national policy looking to the advancement of the useful arts and sciences through the encouragement of invention, plainly indicate two things to be done in this connection:

1st. The passage of Mr. Vance's bill to reduce the fees on patents and caveats, or something like it; and

2d. The employment of the surplus fund now accumulated to improve the working facilities of the Patent Office. The office needs more room to work in; its library should be extended and classified as to matter and thoroughly indexed; a critical digest of the patents that have been issued should be made for the convenience of the public as well as that of the office; and all the patents issued before 1866 should be printed and made accessible to students and inventors at reasonable cost. This done, it is quite possible that the fees named in Mr. Vance's bill would suffice to cover the running expenses of the office with an efficiency of service impossible now, and still less possible should the office have to submit to a diminished income without the improved facilities which a proper use of the surplus funds would secure.

Burnt Clay for Railroad Ballasting.

The Chicago, Burlington, and Quincy Railroad Company are burning clay for ballasting their road. A small fire of bituminous Iowa coal is started on the surface of the ground, and, when burning freely, the fire is covered with a layer of lumpy clay, then alternately coal and clay, the coal decreasing in quantity until at the top it is as one to fifteen. The mass is formed like a cone. Three united cones, each 18 feet high and containing in all about 1,000 cubic yards of material, have been started near Red Oak. They will burn for months. Six hundred miles of road are to be ballasted with this crude pottery broken up. It resembles coal cinder, but is harder.

THE NATURAL HISTORY OF THE JEWS.

In recent issues of the SCIENTIFIC AMERICAN SUPPLEMENT there have appeared several articles with regard to the distribution, numbers, anatomical characteristics, etc., of the Jewish race, a race, we may add, which we hold in high respect for its vitality, energy, thrift, intellectual force, and, under favorable conditions, high moral worth. The last article, in the issue of January 1, contains an interesting comparison of the physical measurements of Russian Jews with corresponding measurements of other races inhabiting the dominion of the Czar.

The measurements were made by Dr. G. Schultz, Conservator of the Anatomical Museum of St. Petersburg, and indicate that the racial characteristics of Oriental Jews are as strongly shown in their physique as in their social and religious customs.

Unfortunately the writer, manifestly biased by the anti-Jewish craze which is showing itself so discreditably in certain parts of Europe, went on to assert that the bodily peculiarities of the Jews were accompanied by and served to account for certain alleged mental and moral traits the reverse of honorable. The incorrectness and injustice of these assumptions are pointed out very forcibly in the current issue of the SUPPLEMENT, in an article which is well worth reading.

From an American point of view the opposition to the Jews, which has lately been revived in Germany, seems to be due partly to a survival of the unchristian spirit of mediæval Christianity, but more immediately to the hatred which thrift always inspires in the unthrifty. The military ardor which has converted Germany into a great camp has drafted the flower of German youth into army barracks, and diverted the best energy of the people from productive pursuits. At the same time it has impoverished the masses by direct heavy taxes to support the military establishment, and still heavier indirect taxes in cutting off the supply of productive labor. Though many Jewish youth in Germany have proved the native courage of the race on recent battlefields, the more peaceful instincts of the race have led them to seek in commerce and in the professions the distinction which the Christian youths of Germany have looked for in military and official positions. And now the cry is that the Jews monopolize the sources of wealth, and that they crowd the professions and other pursuits of peace and profit. The charge is doubtless largely true, but that fact is as much to the honor of the Jews as it is to the dishonor of those whose lower civilization has allowed them to be distanced in the competitions of peaceful industry, intelligence, persistence, and thrift. If the physically and numerically weaker race can distance their stronger and more numerous competitors in the arts of peace, the fact must be taken as evidence that mind counts for more than stature, and thrift and labor for more than military ardor, in the free conflicts of modern civilization.

DIAGONAL AVENUES IN CITIES.

The rectangular method of laying out cities leads not only to architectural monotony, but also to a great loss of time and travel as soon as the area covered becomes at all extensive. The tendency to go across lots, to save time and distance, is one condition of civilization; and when thousands of people are concerned the thwarting of the tendency is the reverse of profitable. A rectangular system of streets, with diagonal or radiating avenues, like those of Washington, is vastly more convenient.

In a paper read before the Philadelphia Engineers' Club, Professor Haupt, of the University of Pennsylvania, shows that the combined system is also vastly more economical. In a city like Philadelphia, where half a million people live at least a mile from the business center, the checker-board plan leads to an enormous waste of time and effort. To those whose homes lie in a direction diagonal to the run of the streets, the zigzag course they have to take increases their travel more than a third. A diagonal street through the heart of the city would save a mile and a third. The street car lines of the city carry something like 100,000,000 passengers a year. Upon this and the average yearly expense to the people of travel, Mr. Haupt calculated that every mile less in distance was a saving to them collectively of $1,500,000 in money, 4,000 years in time, and something like 3,300,000,000 foot pounds of energy.

Two diagonal avenues were recommended for Philadelphia, with "cut-offs" or diagonal lanes for pedestrians.

SUBAQUEOUS GOLD MINING.

A few days ago a schooner sailed from Bristol, R. I., laden with a small river steamer, a steam launch, and an outfit of mining machinery for working the auriferous bed of the Atrato River, South America. It is well known from the careful surveys made of the Atrato, in the interests of the proposed ship canal by that route, that the river sands in many places are rich in gold and platinum, and it is the purpose of the company which has sent out this expedition to work the river bed by a system of subaqueous hydraulic mining. In this way gold-bearing sand and gravel, at depths too great to be reached in the ordinary way, will be sucked up by steam machinery and the precious metal separated by washing. The machinery, devised by Mr. Samuel S. Webber, was built by the Herreshoffs at Bristol. The expedition appears to be well organized and capably officered. If it succeeds the venture is likely to be followed by similar assaults on other gold-bearing river beds whose wealth has been out of reach hitherto. The Atrato is the most westerly river which flows northward in South America. It drains a long reach of auriferous country and empties into the Gulf of Darien.

THE TECHNOLOGICAL, INDUSTRIAL, AND SANITARY MUSEUM OF NEW SOUTH WALES.

The World's Fair at Sydney has led to the establishment in that rising city of a museum devoted to technological, industrial, and sanitary matters. It is intended to contain typical collections of all materials of economic value, representing every stage of progress from the raw material to the manufactured product, with processes, machinery, and so on. Its scope includes every variety of animal products of use in the arts, vegetable products, waste products, and foods; specimens of useful and injurious insects and other representatives of economic entomology; economic geological specimens representing the products of mines, quarries, etc., in every stage of preparation and manufacture; educational apparatus and appliances; sanitary and hygienic appliances and systems; machinery and tools of every sort; models, drawings, and descriptions of patents, especially such as are likely to be of use in the colony; specimens of ethnology; ancient and modern industrial art work, with copies, photographs, etc.; exhibition catalogues, trade journals, price lists, and other vehicles of industrial information.

The project, if properly carried out, cannot fail to be of great educational and industrial value to the colony. It may furnish also an advantageous means of placing before the people of the colony specimens of tools, machinery, manufactured articles, or industrial processes likely to find a market there. The trustees of the Australian Museum, under whose direction this special museum is being formed, solicit contributions of trade journals, price lists, catalogues, and specimens of raw materials and manufactured articles likely to add to the interest of such a museum.

Our merchants and manufacturers who may be charitably inclined, or who may be seeking an extension of their trade with Australia, will find in this museum a convenient and comparatively inexpensive way of benefiting their Australian cousins, or of keeping their goods in a favorable position before the people they wish to trade with. No expense will be attached to donations, the trustees undertaking to pay freight and other charges on the arrival of the goods in Sydney.

The Erie Basin Dry Docks.

It is announced that the Erie Basin Dry Docks, which were recently purchased by the president of the Balance Dry Dock Company, are to be pushed to speedy completion. It is intended to make both docks at least 600 feet long, thus making them the largest establishments of their kind in America. The new dock at Baltimore is but 450 feet long, and Cramp's Dock at Philadelphia 462 feet. The Erie Basin Docks will be divided by a pontoon into two compartments of 300 feet each, either of them being large enough to admit the Pacific Mail steamers. The object of this is to really double the capacity of the docks. If a vessel of 600 feet is to be admitted, the pontoon will be raised, but if two vessels of 300 feet each wish to enter, the one that is to undergo the most extensive repairs will enter first, the pontoon will be closed, and then the other will be admitted. The inner compartments may be closed for an indefinite period during a long job, while the outer compartment may at the same time be opened and shut to a number of vessels. It is said that to complete the docks will require an expenditure of from $300,000 to $400,000. When finished the docks will accommodate, with one or two exceptions, the largest merchant vessels afloat.

The Lick Observatory Telescope.

The trustees of the Lick Observatory have finally closed the contract for the optical part of their great telescope. There has been considerable doubt whether a refractor or an enormous reflector would be selected, but the decision is in favor of the former. The object glass is to be three feet in diameter, and the Clarks of Cambridge, Mass., are to make it for $50,000. The mounting for the instrument is not yet provided for. Proposals will be obtained from the principal instrument makers of Europe and this country. Probably the mechanical part of the instrument will cost as much as the optical. It may be three years before the telescope is finished. If the instrument proves successful, it will be the most efficient ever pointed at the heavens. Its power will exceed that of the Pulkowa glass by forty-four per centum, and it will be almost twice as powerful as the great telescope at Washington, which at present is the best of its kind.

The First American Railway in Asia.

The first section of railway built by Americans in Asia was opened for traffic the first week in January, just twelve months from the date of the order for its construction. The completed division is twenty-three miles in length. The line is from Otarunai Harbor, on the west coast, via Lapparo, the capital of the Northern Island, Yezo, to the Paroni coal fields. It cost $20,000 per mile, which includes rolling stock, motive power, machinery for terminal repair shops, etc. The English line built between Tokio and Yokohama cost nearly $200,000 per mile, and it took five years to complete eighteen miles. The Japanese officials are said to be greatly encouraged by the prospect of an American system of rapid transportation.

Stones Clinging to Under Side of Ice.

When the severe cold weather came upon us so suddenly in November last my attention was called to a curious phenomenon in the Susquehanna River here. Upon Thanksgiving Day, not far below the dam which crosses the river here, I noticed a large number of stones clinging to the under side of the ice. The river there was two or three feet deep, the ice at that time about three inches thick. The stones were the rounded river stones, and evidently came from the bottom of the river. They were of all sizes, up to those weighing probably two pounds.

The phenomenon is not a new one, but it was displayed here upon so large a scale, and the conditions accorded so perfectly with those that the scientific explanation demands, that it seems to be worth while to call attention to it.

More than two hundred years ago Dr. Plot, of Oxford, England, described similar occurrences in the Thames, and gave at least a partial account of their true cause. It is well known that water, like most other substances, contracts under the influence of cold until it is reduced to a temperature of 39°. But if its temperature is lowered still further it *expands* until reaching 32°, when it freezes, by which its bulk is increased much more than by its cooling from 39° to 32°. Hence it is that water begins to freeze at the surface, since, when near the freezing point, the coldest water, being the lightest, is found upon the top, and it is that which freezes first.

But when the weather is very cold, and the different parts of the stream are thoroughly mixed by rapids or some such mechanical action, the water may be about the same temperature at all depths, and be lowered altogether nearly to the freezing point. In this case the water will *begin to freeze at the bottom*, because it is stiller there, and perhaps because the stones and bottom have lost some heat by free radiation and by contact cool the water. Although so much lighter than the water this ice would not rise as soon as formed, for it would be frozen fast to the bottom and the stones lying upon the bottom. But as soon as its size gave the cake of ice buoyant power enough it would tear itself loose from the bottom and the larger stones and rise to the surface, carrying with it the smaller stones and gravel. Then it would be frozen in with the surface ice, keeping its curious load frozen fast to its under surface.

In November the weather suddenly became very cold, the thermometer sank to 3°, and the river here was frozen over in one night, a very unusual occurrence. Moreover, the place where the phenomenon occurred was just below the dam, where the current was swift and the river rather shallow. All of these would tend to mix up thoroughly the whole mass of the water. These circumstances seem to show the above to be the true explanation.

In the Thames stones weighing as much as eight pounds have been known to be raised up from the bottom of the river in this way. Under favorable conditions, and acting through a long time, the ice by carrying these materials down streams must cause geological effects which are not inconsiderable.

G. M. PHILIPS.

Lewisburg, Pa.

The Expansion of Steam.

To the Editor of the Scientific American:

Page 321, last volume SCIENTIFIC AMERICAN, contains an article on "The Expansion of Steam," by Prof. Thurston, and page 360 one from William D. Marks, Dyn. Eng., etc., on the same subject. Quoting little from either, allow me to say that steam or any gas in expanding *does* trace a *strictly* mathematical curve of pressure. But it is *not* an "equilateral," or any other sort of hyperbola. The Boyle and Mariotte law, that the "pressure by the volume gives a constant product" is identical with one of the equations of the hyperbola ($xy = M$). But this law will only hold good upon the *impossible* condition that the temperature remains constant. In the equation of the hyperbola there are only two variables or factors—in the true curve there are three, corresponding respectively to the volume, the pressure, and the temperature of the expanding gas; and the equation of this curve *exactly* expresses the relation of the volume, pressure, and temperature of saturated steam or any gas, although each gas traces its own curve from the fact that the variable expressing temperature must be assigned a value corresponding to the specific heat of the gas considered. To find the pressure at any given point in the stroke of the engine after cutting off, let the practical engineer compare the volume (including clearance) at the given point with the volume at cut-off point, and from the tables in any book on modern steam engine he can find the corresponding pressure (always counting the atmospheric in addition to gauge pressure). An engine should expand the steam only so far as that the direct pressure on piston will exceed the back pressure to not only overcome the friction of the engine, but also the resistance of the driven machinery, and perform an appreciable amount of useful work besides. Prof. Thurston's formula is only claimed to be approximately true, while Mr. Marks is neither approximately, theoretically, nor practically correct.

B. F. MCKINLEY.

Lexington, Ky.

Professor Watson's Successor.

Prof. Edward L. Holden, of the Naval Observatory, Washington, has been appointed to the place in the directory of the Washburne Observatory at Madison, Wis., made vacant by the death of Prof. Watson.

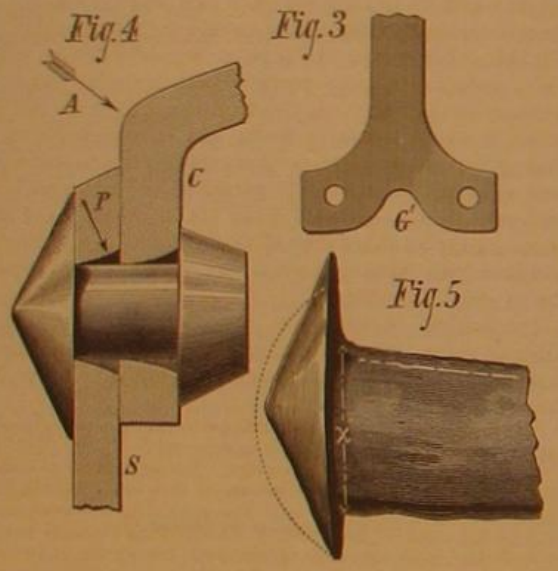
ANOTHER "MYSTERIOUS" BOILER EXPLOSION.

BY JOSHUA ROSE, M.E.

James McCreery & Co., whose well known dry-goods store is situated at the N.W. corner of Broadway and 11th street, in this city, have beneath the sidewalk in West 11th street a pair of cylindrical multitubular boilers, exactly alike, and by the same builder. They are used to heat the store and drive the elevators. On Saturday night, January 15, the engineer in charge banked the fires as usual and left them, returning on Sunday at 12:30 P. M. to see that all was right. He cleaned the fires, banked them again, and says he examined the dampers and saw that they were closed; examined the pressure gauges and found them to indicate 3 lb. of steam; saw that there was plenty of water in the boiler, and left, leaving all so safe that, as he states, he would willingly have slept on top of the boiler. In all this he is corroborated by the fireman, who was present at the time. The watchman reports that he is positive the dampers were closed, because he noticed the presence of coal gas in the building, the smell being so offensive that he notified the burglar alarm office, at 4:30 P.M., that he was about to open the windows to let it out, which he then did. Shortly afterward, however, a terrific boiler explosion occurred, tearing away the massive girders overhead, blowing up the sidewalk above them, but fortunately, being Sunday, when that part of the city is deserted, nobody was hurt. The boiler was ten years old, and was tested in August last by hydrostatic test at 105 lb., and licensed for 70 lb. It was usually worked at about 50 lb.

The daily papers have called this a "mysterious explosion," and so it is to the superficial observer, but close examination dispels the mystery.

On visiting the scene of the explosion I found that the crown sheet of the dome of one of the two boilers (which



RIVET, JOINT, AND BRACE-END.

were connected by a steam pipe) had blown off completely, leaving a ragged fibrous edge right in the flanging bend, as shown at A, Fig. 2, which is taken from the dome on the uninjured boiler, and is a sectional side elevation. An inspection of one half of the exploded dome head, one half of which is at police headquarters and the other half (shown in Fig. 6) in the engine house, showed that the dome crown, in addition to tearing around the edge, at A, had torn across at B, being in two completely severed pieces. The iron at the fractures was in all cases of excellent and fibrous appearance. Two things, however, attracted attention: First, that the plate showed lamination in places varying from an inch to two inches in length, and running around the bend of the flange, at A. Second, the crack around A was too rusty to warrant the conclusion that it had been of recent formation. The greater part of this fracture was clean enough to admit of inspection, but some parts were not, and the dirt was so embedded in the fibers of the iron as to preclude its inspection. The edges of the two halves, however, appeared to have been fractured recently, probably at the time of the explosion.

The six stays, three of which are shown in place at C, Fig. 2 (drawn to a scale of one eleventh full size), were all in position in the dome, and it was observable that their surfaces having contact with the dome were covered where they fitted with a black polish, evidencing movement and some slight abrasion. These marks, however, did not, except in one case, extend all around the hole. During a visit to the boiler works the ring, A, of the crown sheet was bent and doubled, showing strength and ductility. I then chipped a piece along the edge, and the iron showed toughness and strength as far as such a test would determine, leaving no doubt in my mind, from all the appearances, that the iron was *good*.

During the inspection of the half crown sheet at police headquarters, I expressed to Inspector Horton the opinion that the crack around the edge, A, was decidedly not of recent origin, in which opinion he entirely concurred.

In considering what could have caused this fracture, the following points suggest themselves:

The stays, C, joined the cylinder of the dome 11 inches from the top (as marked in Fig. 2), and the crown sheet 7½ inches from the dome cylinder edge. Now, as the temperature of these stays increased they would expand and lengthen, exerting a pressure on the crown sheet in the direction of

HALF OF THE CROWN OF THE DOME.

H. The steam pressure acting on the under surface of the crown sheet would also be in a direction to lift it; hence, as the pressure and temperature increased and decreased the crown sheet would lift and fall, bending it on A as a center of motion. The stays being at so great an angle would not be in a good position to resist this movement of the sheet; thus taking I as a center, the movement of the other end of C would be in the direction of F, while at D the direction of motion would be toward J, hence the direction of motion of the two would to a great extent coincide. That this view is accepted is proven by the fact that ten stays are now to be used instead of six, and that they are to be longer and more nearly in the line of strain, being as shown at G.

The old stays had a single rivet; the new ones have two rivets, the foot, G, one, being a crow foot, as in Fig. 3. The exploded dome shows an indentation at I, due to the motion of the foot of the stay, but this the two rivets will prevent.

If G′ be taken as a fulcrum the motion of the other end of that stay would be as denoted by E, offering a greater resistance to motion in the direction of K, and this increase of resistance would augment in proportion as the body of the stay stood more nearly vertical or more nearly in the line of the strain.

Now let it be noted that if a stay stands at an angle it will, under any increase of temperature above that at which it was riveted up, tend to push the two plates it connects apart (instead of holding them together) until the weakest plate has moved a certain amount. Thus, if the old stay, C, measures 15 inches, it will expand a certain amount per inch through a length of 15 inches; but the shell of the dome will expand through a distance of its vertical height from the hole at I, or in this case 11 inches only; hence to the amount that C would expand in 4 inches in length it would push against the crown sheet and help the steam to lift the crown sheet, and not until the crown sheet endeavored to move still further would C begin to act as a stay. The same effect will be produced in proportion as the line of the stay varies from a right angle to the surface it is to stay, hence the stays, C or G, should be as near vertical as possible.

Another error in the design of this boiler is that the diameter of the dome shell is 34 inches, and a circle of iron about 28 inches in diameter is punched out of the shell at D. This opening is required only to admit an inspector or workman to the interior of the boiler, hence it is several inches wider than it should be, which unnecessarily weakens the boiler. Yet another defect is that the shell of the dome has the wide side of the punched holes on the inside, as shown in Fig. 4, in which S represents a section of the shell and C of the crown sheet, the wide side of the hole being at P. As a result, the rivet has less hold upon the shell, and to whatever extent the rivet fills and binds against the walls of the shell it tends to force the two plates apart instead of binding them together. The extent to which the body of a rivet swells under even hand riveting is shown in Fig. 4, which is drawn from one of the only two rivets (that held the crown sheet to the shell) of the stays that have been found. The holes for these rivets were, as they should be, punched from the inside, and are therefore widest on the outside, the swell of the rivet at X showing how it expanded under the riveting blows and filled the hole. In this case the taper of the hole helps the rivet to bind the plates together. Here it is well to call attention to another fact, which is that in hand riveting pointed rivets are usually made, and these rivets do not present so strong a form of head as rivets riveted by machine, which have a button-head, as denoted by the dotted line in Fig. 5.

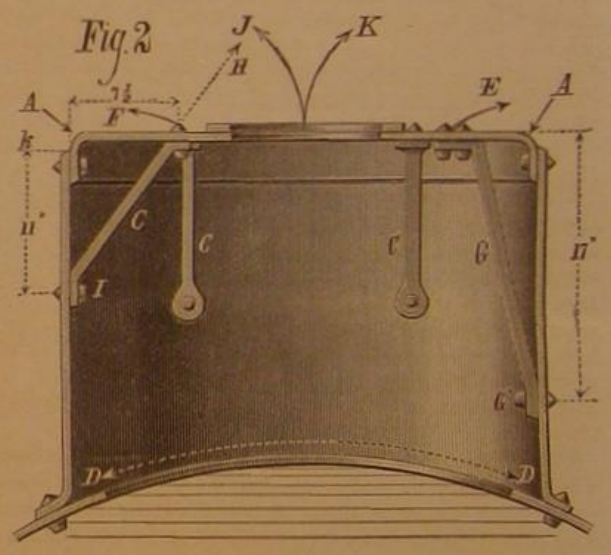
Now, while this explains why the crack at A, Fig. 1, was induced, and therefore one of the elements causing the explosion, it does not explain how it should happen that a boiler tested in August last at 105 pounds, and used daily during the week before the accident at pressures varying at from 40 to 50 pounds, should explode under a lesser pressure, or even under a pressure of 60 pounds, especially as it had a safety valve set to blow off at 60 pounds.

On questioning this part of the subject the engineer was questioned a second time, giving me the following information:

On his last visit previous to the explosion he "cleaned the dirt out of the fire and put fresh coal on, leaving the fire covering the bars," which was his usual method of banking, and the method practiced before he took charge.

He usually left from 3 to 5 lb. of steam after banking at night, and found from 20 to 25 lb. when he arrived in the morning.

This method of *banking*, under which a steam pressure is slowly raised, is a decidedly dangerous one, because a little



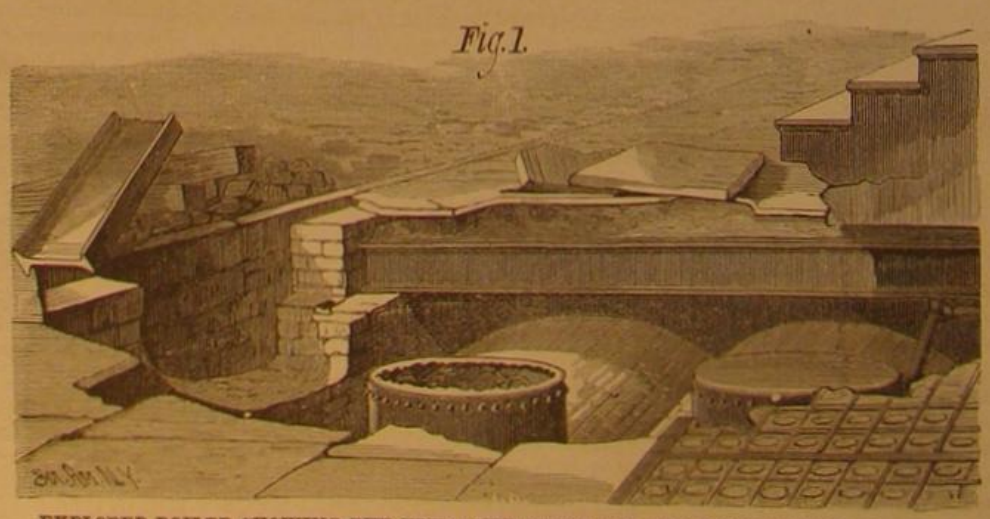
VERTICAL SECTION OF DOME.

extra cleaning of the fire, the use of larger coal than usual, or leaving a rather better fire than usual, would simply cause a more rapid production of steam, whereas it appears that it was not uncommon to find the boiler in the morning with a pressure of within 15 lb. of that under which it was daily used.

The proper way to bank a fire is to pile it at one end of the grate bars, leaving nearly two-thirds of them bare, so that cold air would pass in freely if the fire burned up, and check any undue combustion, even if the dampers were left open. The practice of smothering a fire by leaving it spread over the bars and simply giving it a fresh covering of coal and closing the dampers, is a common and unsafe practice that ought to be prohibited. But one more point remains to be explained, which is; how did it happen that the test made in August did not develop the weakness of the crown sheet?

The New York *Sun* credits Inspector Horton with saying as follows: "Possibly the expansion and contraction of the drum (shell) as the volume of steam was increased or diminished, had weakened the edges at the point of contact of the crown plate. This weakness, he stated, might not be developed by the hydrostatic test. Possibly the hydrostatic test might have weakened the iron to the point of breaking, leaving the first accumulation of high pressure to cause an explosion. But if the engineer's statement is true, the safety valve ought to have prevented an explosion, even if the fires were not banked and the steam ran up by the unexpected starting of the fires."

There has been for years a discussion carried on as to

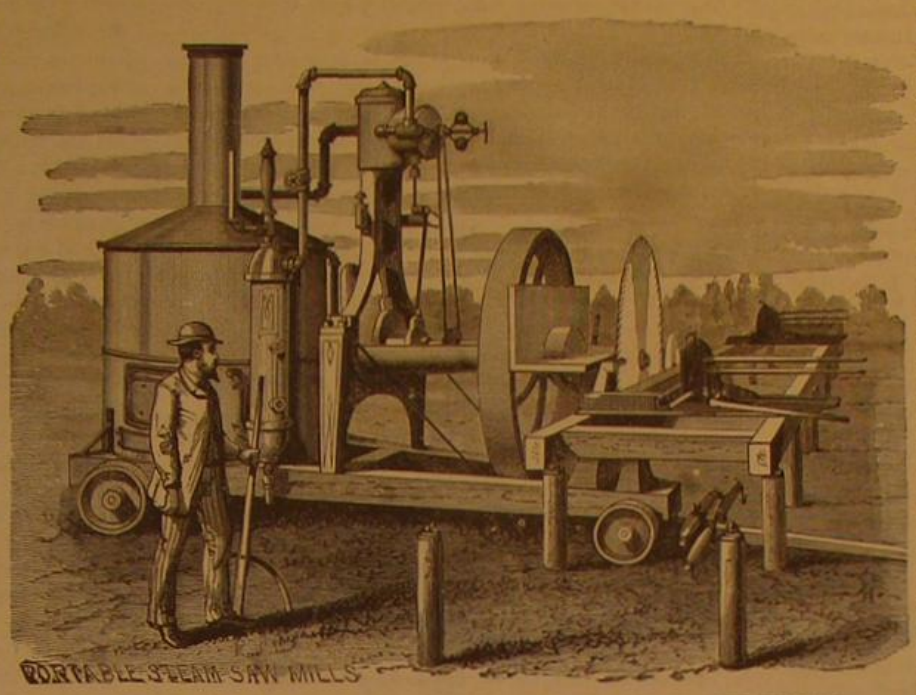


EXPLODED BOILER SHOWING THE UPHEAVED SIDEWALK AND BROKEN IRON GIRDERS.

whether the hydrostatic test was sufficient alone, or whether the hammer test was not a necessary adjunct to the hydrostatic one, some indeed claiming that the hammer test alone is more reliable than the hydrostatic test. In this city the hydrostatic test alone is employed, and since so high an authority as Inspector Horton says that it may not discover an existing defect, but may induce a dangerous one, it is about time that it was supplemented with the hammer test. There is no doubt that the hammer test would have disclosed the defect in this boiler, and that Mr. Horton's views are entirely correct.

The writer endeavored to ascertain what amount of coal and refuse was found on the fire bars after the explosion, and how much was left on at 4:30 P.M. on Sunday, so as to see how much fuel consumption had taken place, but the bars had been cleaned.

Finally, as the safety valve was set to blow off at 60 lb., and the boiler was daily used at from 40 to 50 only, there is nothing to indicate that the boiler was, at the time of the explosion, capable of carrying say, 55 lb., hence the explosion might occur when this pressure was reached without being relieved by the safety valve. This would leave the pressure to run up, under unusually favorable conditions, probably to but 30 lb. more than it sometimes was found at in the morning, which would easily be accomplished with no consumption or circulation of steam through the building taking place. The thoroughness of the crown sheet fracture is shown in the one-half of it presented in Fig. 6. The iron is what is termed three pile, that is to say, the mass from which it was originally made was composed of three thicknesses welded together, and it was defects in this welding, from the presence of dirt or other foreign material, which, when rolled out, formed these laminations. Now, in an unbent sheet the laminations would not form such serious defects, but in flanging or bending the edge, the laminations would tend to separate, and undoubtedly to some extent did so, weakening the plate at A, where the bend and the fracture took place.



PORTABLE STEAM SAW-MILL WITH HERRESHOFF BOILER AND ENGINE.

AMERICAN INDUSTRIES.—No. 65.

THE HERRESHOFF LAUNCH.

The remarkable little steam vessels turned out by the Herreshoff Manufacturing Company, of Bristol, R. I., have attracted world-wide attention, and in a very few years have earned a reputation which is truly enviable. These boats have not only been indorsed by the Bureau of Steam Engineering of the United States Navy, but their merits have been acknowledged by European engineers, and the English government has given its opinion in an emphatic way, by ordering a number of the boats to be used in the English navy.

The works of the Herreshoff Manufacturing Company were established in 1864, and consist of several machine and constructing shops, in which are employed about one hundred men. The works are on the shore of the Narragansett Bay, whose waters present a ready field for experiments in naval engineering, and afford facilities for developing, by actual trial, the best models for steam and sailing craft.

The Herreshoff Brothers possess, by inheritance, great talent for mechanical construction, especially as applied to marine engineering, and this talent has been developed by practical experiment supervised by these indefatigable inventors. From first to last success has followed their efforts, and, judging from the present showing, a prosperous future is before them.

During the first years of the operations of this company the business was chiefly confined to the construction of sailing craft of various descriptions, principally yachts and smaller pleasure boats, which were known all over the Atlantic coast for the fineness of their models, and their yachts became famous for their fast sailing, the beauty of their lines, and excellence of workmanship and material. Among the best known of the yachts built by the Herreshoff Company are the Clytie, Kelpie, Quivive, Sadie, Orion, Shadow, Triton, Faustine. These, together with a number of smaller yachts, are all noted for their speed, and have taken many prizes in our club and open regattas. About five years since the demand for steam launches and steam yachts sprang up, and this company, ever on the alert to meet the wants of the people, turned its attention to perfecting and constructing this class of vessel. In this their success has been remarkable, and to-day they turn out the fastest, safest, and handsomest vessels that ply either in our own waters or those of any other country. The distinguishing feature of the Herreshoff system of marine steam machinery, is the safety coil boiler, which has been brought to great perfection and patented by the Herreshoff Brothers, and which is shown in two forms in our first page illustration. The boiler consists of a spiral coil made of iron tube arranged with proper spaces between the coils for the escape of the products of combustion. The coil is made of conical form and surrounds the combustion chamber, presenting an effective heating surface to the fire. The heated gases proceeding from this chamber are made to pass through the spaces of a flat coil at the top, which heats the feed water before its entrance to the boiler proper. The feed water is forced in at the cooler end of the flat coil, through which it passes to the top of the main coil, and descending, is finally discharged into a vertical cylinder, which is called the separator, and in which the steam and water discharged from the coil are divided, the water falling to the bottom, the steam being taken from the top and passed through a superheating coil located above the main coil, which completely dries and superheats the steam. Generally a single coil is used as the steam generator; but when the greatest economy is the main consideration a double coil, in which one is placed within the other, is employed. Both forms of boiler are shown in the engraving.

The advantages possessed by the coil over the shell boiler in any of its forms are marked and are apparent almost at first sight. The coil is absolutely safe from destructive explosion, and weighs less than one-half as much as other boilers of the same capacity, and in point of economy its superiority is undoubted. It is capable of raising steam from cold water in from five to seven minutes. This is an important feature, especially in steam launches and torpedo boats, where time is an all-important matter.

The engines used in the Herreshoff system for marine purposes are of the compound condensing type, having feed and air pumps attached. The machinery of this system is especially noteworthy for its extreme lightness and for the judicious distribution of material, all of the parts having ample strength, and no portion being loaded with useless metal, which would rather detract than add to the efficiency of the machine. These engines use the steam with the highest economy, actual and prolonged tests having proved the efficiency to be at least 40 per cent greater than that of the non-expanding type. As to mechanical details of construction, finish, proportion, and general design these engines leave nothing to be desired.

Of the several steamers shown in our engraving, the one hundred foot size—of which a number have been built—is considered by yacht men as the most advantageous size for coastwise cruising. It can be handled by a few men, consumes a minimum of fuel, and, what is more important than anything else, the interest on first cost is small in comparison with that of the large iron steamers recently added to our fleet of pleasure vessels. The plan view in the front page engraving shows the arrangement of the interior of one of these yachts so accurately that no further description is required.

The maximum speed of the 100-foot yacht is 18 miles per hour, and in that time it burns only 200 pounds of coal. Three men manage the vessel easily. The 60-foot yachts are planned with a view to river, bay, or lake navigation, and are arranged to accommodate a number of persons for short excursions. Yachts of this size will steam 15 miles an hour, and in that time will consume about 90 pounds of coal.

The Herreshoff torpedo boats have features peculiar to themselves, which distinguish them from everything else of the same class, and have earned for them a well deserved reputation. They are at least three tons lighter than those of foreign make; they will go astern as fast as ahead, and can stop in half their length from full speed. They are capable of turning in a circle whose diameter is three times the length of the boat. All these desirable qualities are due to the lightness of the entire structure, including the boiler and machinery, and to the position of the screw, it being located under the hull at about one-third of the distance from the stern to the bow. The quickness with which steam can be raised is of inestimable strategic importance in naval warfare, as it admits of repelling sudden attacks of an enemy, the boat being always ready and capable of being put under full steam by the time its keel touches the water. These boats are fitted for the use of either spar or Whitehead torpedoes, and are supplied with four spars, two at each end, when the spar torpedoes are employed. By this means the efficiency of the boat is immensely increased, their remarkable quality of backing as readily as going ahead rendering the use of stern spars perfectly practicable.

The length of the torpedo boat is 60 feet; width, 7 feet; depth, 5 feet 6 inches. Their weight when ready for service is 6 tons, and they are capable of steaming 23 miles an hour, developing 150 horse power.

In the whole range of the manufactures of this company, perhaps the most successful craft is the navy or government launch, shown in the engraving. It is 33 feet in length, 8 feet 6 inches in width, and is furnished with a folding tent or awning over the standing room, either or both sides of which may be raised to protect passengers from rain, spray, or wind. When not in use the tent folds down snugly on either side of the boat outside the rising. Either or both sides of the tent may be elevated, thus making an awning proper.

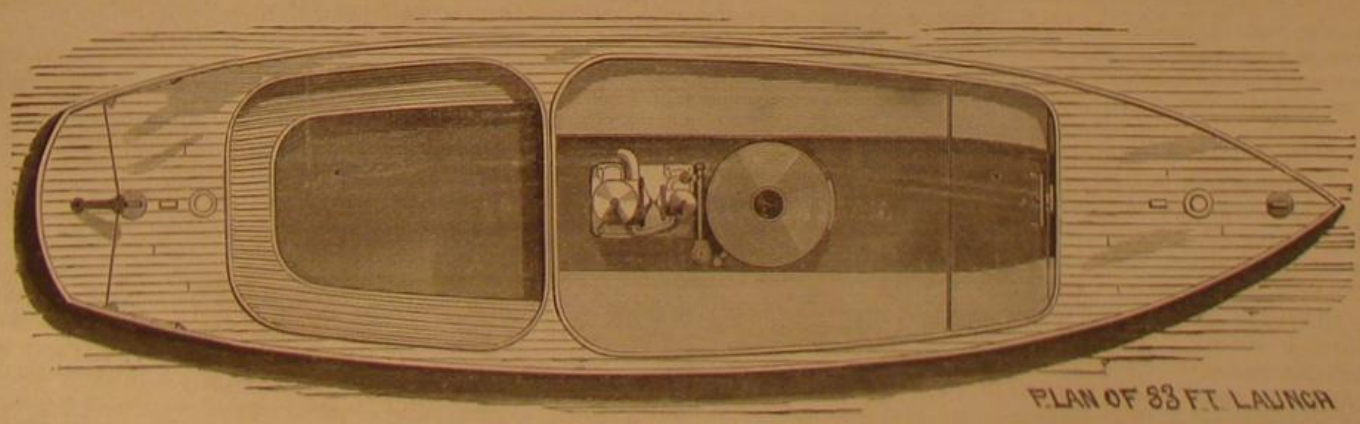
The general advantages of the Herreshoff launch are summed up in the preliminary report of Chief-Engineers Isherwood, Zeller, and Carpenter, from which we make the following extracts:

"The following general opinions, arrived at by close observation during long and exhaustive experiments, can be depended on.

"1. As regards the hulls of the launches. The models of the Herreshoff launches and the distribution of their weights have been so perfected by long and intelligent experience and experimenting, as to scarcely leave room for improvement, the Herreshoff Manufacturing Company having for many years made a specialty of designing, constructing, and testing steam launches, steam yachts, steam torpedo boats, and similar vessels. The material is of the best quality, well seasoned, and carefully selected. It is so distributed in the construction of the hulls that the required strength is obtained, with the least weight; the thoroughness and perfection of the fastenings being depended on, instead of masses of material poorly secured. The workmanship cannot be excelled in neatness, finish, and skill. These hulls combine the maximum of strength with the minimum of weight, which is the end to be attained in this class of vessels where lightness is of the first consequence for stowage on board ship, carrying capability, small draught of water, and speed. In all these particulars of model, construction, combination, strength, finish, lightness, quality of materials and workmanship, the Herreshoff steam launches are incomparably superior to the navy launches, a superiority resulting from the fact that the latter are only occasionally designed and built at the navy yards, and then by persons whose skill and experience lies in the designing and constructing of large vessels, and who devote little or no attention to what is considered as comparatively a small matter, but which, if the highest excellence is to be attained, requires much special training and experience.

"2. As regards the machinery. The system of machinery employed in the Herreshoff launches is quite original in most of its details. It is diametrically opposite to that which is used in the navy launches and is in every particular greatly superior to the latter. In the navy launches a single cylinder is employed, and the starting and stopping are consequently uncertain and slow, with the risk of damage and accident from running into wharves and vessels, and also loss of time.

"In the navy launches, steam of high pressure (80 to 100 lb. per square inch above the atmosphere) is used almost without expansion, and it is generated in a type of boiler whose strength is only moderately in excess of the pressure. This steam is not condensed, but is exhausted direct into the chimney of the boiler to cause sufficient draught for generating the disproportionately large quantity of steam required with this system.



PLAN OF 33-FOOT LAUNCH

"In the Herreshoff launches the engines are by preference of the compound type and of the simplest design; the two cylinders are connected at right angles, and the control of the vessel is thus made complete, there being no time lost and no uncertainty in the starting, stopping, and backing. There are no independent cut-off valves, the difference in the areas of the pistons of the two cylinders giving, without that complication, an expansion of from four to five times, so that all the economy possible from this source is attained. The boiler is practically inexplodible, being composed of a coil of iron pipe from two to three inches in outside diameter according to size of boiler. The steam pressure carried, however, is comparatively low, ranging for ordinary use from 40 to 60 lb. per square inch above the atmosphere; the engines being made strong enough to run under a pressure of 150 lb., or as much as the boiler can be made to furnish. This boiler has a forced circulation, is absolutely safe both on account of its strength and of the very small quantities of steam and water which it contains; it is operated by natural draught, which, however, can be increased by a small steam jet thrown into the chimney whenever there may be a demand for the maximum quantity of steam. The economic vaporization is as good as that of any other marine boiler. This boiler, owing to its forced circulation, with the feed water entering at the top of the coil while the steam is drawn off at the bottom, can be successfully employed with the highest rate of combustion given by a powerful fan blast delivering the air into a closed ashpit; that is to say, with a combustion of 50 lb. of coal and over per square foot of grate surface per hour; being in this respect the only boiler composed exclusively of tubes that can be worked at exceptionally high rates of combustion. In all other boilers of this kind the rate of combustion is limited by the fact that as soon as the quantity of heat thrown in a given time on the tubes reaches a very moderate amount, the water is driven from the iron, which, deprived of that protection, speedily burns out.

"The coil boiler is the lightest ever constructed for its power, and the weight of water contained in it is the least. This boiler is the peculiar feature of the Herreshoff system and the only part patented.

"The engine is condensing, the steam from the cylinder being exhausted into a surface condenser of the simplest design and lightest execution, formed by a copper pipe secured to the outside of the hull just above the keel. By this means the boiler is supplied with fresh water, and the slight quantity lost by leakage is restored from a small tank situated beneath the boiler.

"The continuous service of the launch is thus limited by only the weight of coal it can carry, and not by the weight of water it can carry. The bunkers can easily and quickly be refilled from other vessels at any locality, but the filling of tanks with fresh water can only be done where fresh water can be obtained.

"The use of condensing engines with surface condensers renders the Herreshoff steam launch of real military value, from the length of time it can continuously steam, and from its freedom from noise. When the engines are stopped temporarily, the steam is then blown from the boiler directly into the condenser and there condensed, the condenser, under the circumstances, cannot be overheated, as the outboard pipe is in continual contact with continuously changing outside water even when the vessel is at rest.

"The navy launch carries 960 pounds of coal in the bunkers, and 2,500 pounds of water in the tanks, and in smooth water can maintain a speed of 7 statute miles for four consecutive hours, after which the tanks must be refilled.

"The Herreshoff launch carries 1,120 pounds of coal in the bunkers, and can maintain a speed of 7 statute miles for twenty-eight consecutive hours, after which the bunkers must be refilled. But if there be added to the fuel weight the 2,500 pounds in water in the navy launch, then the consecutive steaming of the Herreshoff launch can be extended to ninety-eight hours.

"The maximum speed of the navy launch was 8·5 statute miles per hour, and of the Herreshoff launch 11 statute miles per hour.

"When the two launches were tried together in very rough water, against a strong head wind and sea, the superiority of the Herreshoff launch was much more marked than in smooth water. While the navy launch took in so much water over the bows as to endanger her safety, and to require constant bailing with buckets, the Herreshoff launch was dry. She was much better trimmed, lighter, more buoyant, and every way superior in nautical qualities to the navy launch, at the same time making double the speed.

"As regards economy of fuel, the Herreshoff launch develops the indicated horse power with less than half the coal required in the navy launch. In every particular the superiority of the Herreshoff launches to the navy launch was so marked as to be apparent to the most cursory observation. Their weight was one-half and their economy of fuel was double; their nautical qualities were much finer, their carrying capacity was greater, their finish and general arrangement were better, they were noiseless, and their capability of continuous service was enormously greater. The superior adaptability of the Herreshoff system to that of any other known to us for steam launches, steam yachts, steam pinnaces, torpedo boats, small gun boats, etc., is so unquestionable, that after the most extensive experiments and thorough examination of the subject, we are constrained to recommend it, though comparatively new, to the serious attention of the department for such classes of vessels. The management of the boiler differs from the management of boilers of other types, but is soon acquired by the humblest intelligence, and we believe the engineering of the Navy should be familiarized with it as speedily as possible, as its use is certain to extend as its merit becomes understood."

In addition to marine work the Herreshoff company are at present giving particular attention to engines for electric light. The quickness with which steam may be raised, the freedom from danger of explosion, the lightness of both boiler and engine, and the perfection of the mechanical details, render this system valuable for this purpose, and admits of placing powerful machines in the midst of crowded cities without danger to life or property.

This system has also been successfully employed in working bridge draws, dummy engines, portable and stationary pumping engines. For saw mills it has peculiar advantages. Its safety, portability, and its quick and powerful steaming qualities, give it the precedence over other steam motors.

The entire range of the manufactures of the Herreshoff company exhibit careful and intelligent supervision, and workmanship that is in every way superior.

Manufacturing in New York City.

Of late years Philadelphia has justly boasted of being not only the largest manufacturing center in the United States, but the largest in the world. If the chief special agent for the collection of manufacturing statistics for New York, Mr. Charles E. Hill, is correctly reported, our city now takes the first place in productive industry as well as in commerce and population. Mr. Hill estimates that the final footings will show the value of our manufactured products to be fully $400,000,000, or nearly $77,000,000 more than Philadelphia's product. This excludes the numerous factories situated in what are practically suburbs of the city, and operated by New York capital and brains.

DECISIONS RELATING TO PATENTS.

United States Circuit Court—Northern District of Illinois.

BARBED WIRE FENCES.—WASHBURN & MOEN MANUFACTURING COMPANY *et al. vs.* HAISH. WASHBURN & MOEN MANUFACTURING COMPANY *vs.* SAME.

Drummond and Blodgett, Judges:

1. An assignment purporting to convey all the right, title, and interest in letters patent "excepting thirty-two or thirty-three counties, heretofore sold and assigned," without designating the counties thus previously sold, is not so far ambiguous as that nothing passes thereby, the reservation being such as is capable of being made certain by competent evidence, showing what counties have been actually conveyed.

2. The action of the Patent Office in reissuing a patent to assignees raises a presumption of title in the assignees named, and if the defendant wished to raise the question as to whether a reservation contained in an assignment included the territory in controversy, he should have raised it in his answer, or at least have put in proof tending to show such fact.

3. Evidence almost wholly made up of the recollections of witnesses revived after the lapse of many years, and contradicted in most instances by explicit testimony of other equally credible witnesses, leaves so much doubt as to the actual existence of the device as to make it unsafe to defeat a patent on the ground of public use thus sought to be established.

4. Evidence of the state of the art showing the prior existence of analogous devices for substantially the same purpose, but not fully exhibiting the device patented, operates to narrow the field for the exercise of inventive faculty and limit the range of the patents.

5. A device, in order to be patentable, must be the result of invention, but the mere mechanical adaptation of old things to new uses is not usually invention, unless in combination.

6. Invention appearing, the law does not attempt to measure its extent or degree.

7. Utility is suggestive of originality, and the fact of the acceptance of a device or combination by the public and putting it into extensive use, is accepted as evidence that it was the product of invention.

8. An inventor may, in his reissue specification, make his description more full and accurate; but he must not substantially change it so as to describe another device or cover anything not in the original.

9. The original patent was for "the method of providing the wires of a wire fence with a series of spur wheels," and a reissue was obtained for a "fence wire provided with spurs for the purpose specified;" *Held*, not to be a departure from the original invention, the only changes in the specification serving merely to give point or direction to the invention claimed.

10. Matter so described in the original specification that it might have been claimed in the original patent, may properly be claimed in the reissue.

NEW INVENTIONS.

Mr. Rush E. Avery, of New York city, has patented a folding cot which can be folded or erected without attaching or detaching or coupling any of its parts. It is very convenient for transportation, occupying only a very small space when folded.

A safety attachment for watches has been patented by Mr. James Roberts, of Brooklyn, N. Y. A plate or ring, having scalloped edges, is slipped over the stem of the watch, projecting horizontally, and so nearly filling the pocket that when a thief attempts to extract the watch the projecting plate will catch in the lining of the pocket and alarm the owner. Or, if the thief attempts to take hold of the plate itself, the pressure of his fingers in the narrow space between the plate and the pocket will alarm the owner.

Mr. William Hoffmeister, of Mossy Creek, Tenn., has patented a double try square. Two ordinary try-squares are joined together side by side, a suitable and adjustable distance apart, by a metal plate and screws or equivalent means, by which means the square may be made to straddle boards of different thicknesses. The scope of the tool is by this means much increased, and kinds of work performed with it which are not possible with the ordinary try-square.

Mr. Wilhelm Espig, of Berlin, Germany, has patented a billiard table, which provides means for adjusting the bed to different heights from the floor, and also for extending its frame for the reception of table boards whereby it may be converted into an ordinary dining table.

Mr. Francis Hopkins, of New York city, has patented an improvement in eyeglasses, the object of which is to obtain a firmer gripe upon the nose without tightening the spring, to prevent the glasses from slipping forward on the nose, and to hold them on the nose nearer to and on the same plane with the eyes. This is accomplished by forward projecting arms to which the spring is attached.

Mr. William H. Older, of Packwaukee, Wis., has patented an improved construction of buildings designed especially for barns upon prairies and other parts of the country where timber is scarce. A peculiarly constructed frame of timber and wire, the timbers being secured by bolts, is the principal feature of the invention. The outside may be covered with straw thatch, tarred paper, etc. A serviceable building can thus be constructed with little timber and at a small cost.

In a thill coupling patented by Mr. Levi B. Stuart, of Seymour, Conn., a grooved cushion and centrally grooved plate are claimed to provide a more durable and more easily adjustable spring to prevent rattling of shafts on their bolts than has hitherto been supplied.

A log tripper patented by Mr. Levi Gunter, of Gunther's Mills, S. C., consists of a novel arrangement of levers and an improved hook, whereby a saving in power and labor for turning logs in saw mills is effected.

Mr. Samuel White, of Eau Claire, Wis., has patented an improved head block for sawmills which comprises improvements in the jacks or standards of the head blocks, the dogs for holding the logs upon the carriage, and the means for receding the jacks upon the head blocks.

Mr. Charles P. Batt, of Phœnixville, Pa., has patented a pendulum scale which consists in a novel combination and arrangement with each other of a pair of weighted levers, a pair of connecting bars, and a vertically operating scale-beam and indicator.

Mr. Edwin B. Hutchinson, of Detroit, Mich., has patented an improved account-book, which saves time and work in making up trial-balances from a ledger. The book is bound with half leaves that are ruled for an index, and fitted with a removable pad provided with leaves ruled in columns for account totals, arranged for two or more balances, which pad when in place forms, with the bound half leaves, a complete trial-balance book, into which the headings or names can be copied on the bound portion and the accounts carried out upon the pad leaves for two or more balances, and the pad renewed by another when exhausted, all with but one entry of the names or headings.

Mr. Ura H. Palmer, of Elizaville, Ky., has patented a wheat heater for flour mills, in which the grain is heated by the direct contact of hot air, the air being heated by a lamp and circulated in currents through perforated tubes, among which the grain passes by virtue of its own gravity.

Mr. Prosper Humbert, of Austin, Texas, has patented a three-wheeled vehicle which has one or more seats so arranged that the forward seat turns with the horses so that the driver is always directly in the rear of the horses, and holds the reins at the same length no matter how much the horses may turn to either side.

Mr. George B. Taylor, of New Brunswick, N. J., has patented a feed-water heater for steam engine boilers and locomotives. The heating chamber is formed of two plates attached to a frame, and its interior is divided into zigzag form by strips extending alternately from the top to the bottom, and from the bottom to the top. The heating is accomplished by the products of combustion as they pass through the smoke box.

Mr. Charles Niederauer, of La Grange, Texas, has patented a cultivator in which the standards may be adjusted to regulate the depth of the cultivators or plows to avoid obstructions. Each cultivator or plow standard has attached to it an adjustable segment, and the standards are all operated together by a lever and link connections. The plows are thus raised, while the main frame upon which the operator rides is not raised.

Mr. Gottlieb Kinsey, of Lock Seventeen, Ohio, has patented an attachment for reapers and mowers which is a substitute for ordinary reel, and which, while less expensive, is claimed to be equally as effective. It consists substantially in a rake which is automatically raised, swung forward, lowered, and drawn back as the machine advances to draw the grain or grass against the cutter bar.

Mr. Jacob Gilstrap, of La Plata, Mo., has patented a wind wheel of that class in which the access of wind is controlled by hinged valves regulated by the action of a governor. Instead of two cords and rings for connecting each valve to the governor Mr. Gilstrap uses only one cord to operate the valve in one direction, its movement in the other direction being controlled by a spring. By this means the number of parts is greatly lessened and a consequent reduction in friction results.

Mr. John Coyle, of East New York, N. Y., has patented a combined lampwick-trimmer and burner and chimney cleaner constructed of a brush, a square staple, and a serrated disk, whereby the charred portion of the wick can be removed, the wick and burner brushed off, and the inner surface of a lamp chimney cleaned.

Mr. William Jones, of Nashville, Tenn., has patented a machine for making rim tops of vessels. It operates upon a straight strip of metal, flanged at one edge, to convert it into a hoop of the desired dimensions and of such shape in cross-section as renders it peculiarly suited to form the flange for the cover of sheet metal vessels.

Mr. Bolivar J. Quattlebaum, of Williston, S. C., has patented a portable dental engine which may readily be set up in small compass and readily taken down and packed in small compass for transportation. The frame of the machine can be adjusted to form a case for the working parts when packed.

Separation of Cobalt and Nickel.

Reichel gives the following new method for the qualitative separation of these two troublesome metals, especially when there is but little cobalt in the presence of a larger quantity of nickel. Both metals are precipitated with potassic hydrate solution and filtered. The unwashed precipitate is thrown into a test tube and heated with very strong potash until it boils. Under these circumstances the cobalt dissolves with a *blue* color, thus proving its presence in a very simple manner.

Z. A. C.

Scarlet for Felts.

The following two processes give shades which bear soaping. The dyeing is done in a well-tinned pan or a wooden cistern; the goods are entered, at 115° Fah., in water, to which 1½ lb. white argol is added, and boiled strongly for a long time, turning occasionally. Lift, and add the dissolved coloring matter; re-enter, turn, and add gradually, lifting the goods before each addition of 11 lb. tin composition. The beck is then brought to a boil again, which is kept up for half an hour. Lift, cool, and wash well.

If the argol does not loosen the tissue sufficiently, it is recommended to add a small quantity acetate of soda.

The tin composition is prepared as follows: Muriatic acid, 3 lb., nitric acid, 1 lb.; water, 1 lb.

To every 6 lb. of this mixture 1 lb. of granulated tin is added, with the aid a gentle heat.

Sulphuric acid may be used instead of the tin spirits, but the shades are less pure.

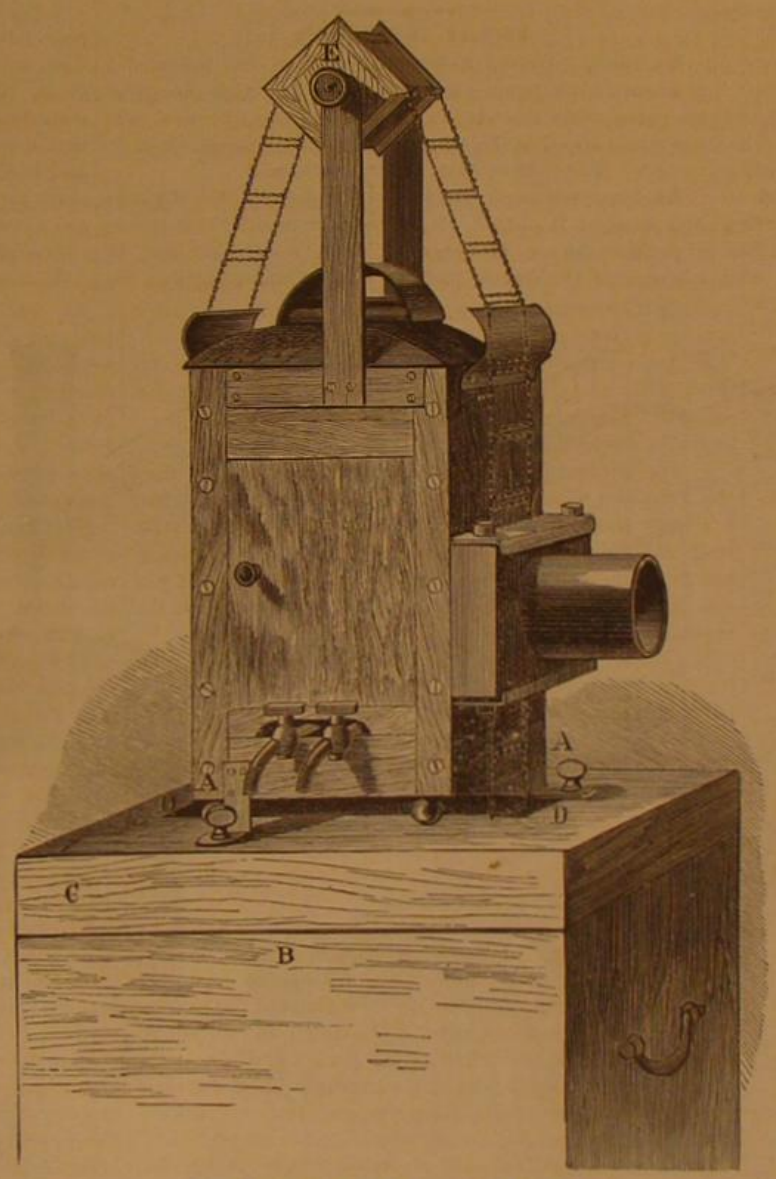
The first method consists in dyeing the goods thus mordanted with the "Ponceau 2 R" of the Aniline Color Company of Berlin. In the second the goods mordanted in the same way are dyed with "Ponceau S extra," made by the same company.—*Muster Zeitung für Faerberei.*

CONTINUOUS-SLIDE LANTERN.

The engraving shows a lantern which possesses certain advantages, and is specially adapted for lectures where the subjects follow each other in an unbroken series. Mistakes arising from the insertion of a wrong slide, or an inverted subject, are apt to mar an evening's entertainment. But, as will be seen, errors of this nature are altogether avoided, and by a simple mechanical arrangement, the slides present themselves in perfect order and at their allotted times.

The instrument is fixed to the top of the packing case, B, by the screws, A A; the lid of the case, C, serves to elevate or depress the lantern, which may be fixed in position at any angle. Reared above the chimney are two metal uprights, secured to the sides of the lantern. These carry at their apex a wooden cube covered with fine leather; each side of this cube corresponds with the size of the slides. But, by the aid of strong ribbon binding, the slides are so united as to form a flexible band which traverses the cube and descends into the case, B, through slots, D D. The cube turns on its axis, E, to which is attached a milled head. The band is made so that the slides can be detached and replaced by a new series at will.

The advantages of this simple arrangement are so obvious as hardly to require further comment. The operator has only to turn the milled head of the cube in order to bring his subjects, one after the other, into position. This system might be applied also to the dissolving view apparatus. The heat from the chimney is never so intense as to interfere in any way with the slides, while it clears them of surface moisture, by which they might be obscured during cold weather.



CONTINUOUS-SLIDE LANTERN.

An Aluminum Battery.

A curious and novel voltaic cell has been devised by Herr Wöhler, and described in *Liebig's Annalen*. The chief peculiarity is that both plates are of the same metal—aluminum—and a tolerably strong current is supplied. The cell consists of a glass vessel six inches high, filled with very dilute hydrochloric acid, or caustic soda, and containing an inner porous pot filled with concentrated nitric acid. In each compartment is placed a cylinder of aluminum provided with a projecting lug which passes through the cover of the vessel, and acts as a contact piece for the electrodes or conducting wires. As soon as the aluminum cylinders are plunged into the acids, a current is given off sufficiently powerful to heat a platinum wire red hot.

To Make Chloride of Gold and Nitrate of Silver.*

Procure 8 grammes = 5 dwts. of fine gold, and after rolling out to thin plate, cut into small strips. Get an olive oil flask, and clean it well with a warm and saturated solution of soda and water. Fill the flask half full of water, and set on a sand bath over a heat that will slowly bring the water to boiling, which will both temper and test the flask; if it stands this test it is fit to be used. Put the pieces of gold into the flask, then mix in a small bottle half an ounce of pure nitric and two ounces of muriatic acid, and pour some of this into the flask to cover the pieces of gold, place it in a sand bath over a gentle heat, and put over the mouth of the flask a small piece of glass to prevent the solution from spirting out while in action. As soon as the acid ceases to act on the gold, and if any remains undissolved, add more of the mixed acid, and continue to add little at the time as often as it stops acting on the gold until all is dissolved; remove then the flask from the sand bath and let it cool, then add to it about its like quantity of water, and boil over a heated sand bath until about half of it is evaporated; remove and pour the solution into a glass or porcelain dish, cool; then pour off the liquid into a porcelain dish, add a little more acid to the remaining silver in the flask, and place it again over heat until dissolution of silver ceases, and keep on repeating the decanting, and adding until all the silver is dissolved. By this method an excess of acid is avoided. After the solution has cooled add to it about half its quantity of water and filter it through asbestos broken up and placed in the filter in the neck of the funnel; after filtering pour into an evaporating dish and place it on a heated sand bath and evaporate until you perceive a light scum on the surface of the liquid, when it is removed and allowed to cool, and when nearly cold is placed on ice covered over and left undisturbed for twenty-four hours, when crystals of nitrate of silver will form; the crystals are removed with a pair of platinum pincers into a glass funnel placed into the neck of a bottle, and as soon as the crystals have given over dripping pour quickly about an ounce of water over the crystals, and after done dripping repeat it twice more; take the crystals out of the funnel and spread them out on a china plate and place on a warm stove to dry. Pour then the washings of the crystals back to the remaining silver solution not yet crystallized, evaporate and filter the same as before and set by to crystallize, and repeat the process until nearly all the silver is disposed of. The small remainder of silver solution may be decomposed into chloride of silver by adding gradually small quantities of salt water.

*From the *Deutsche Chemiker Zeitung*, by H. Bush, Hull.

In order to obtain crystals of large size, the moment of forming the scum on the solution has to be watched during evaporation and advantage taken of by removing it from the sand bath at this point. Another advantage of greatly accelerating the formation of crystals is to put a piece of nitrate of silver into the solution before placing it on the ice. This method will produce nitrate of silver of a better and purer quality than generally bought of dealers.

MISCELLANEOUS INVENTIONS.

An improved end gate for wagon bodies, patented by Mr. Thomas Dwyer, of Kendall, Ill., supplies drop end gates which may be turned down and supported in horizontal positions to serve as platforms for convenience in shoveling oats out of wagons. It may also be turned down in a vertical position out of the way. Quadrantal wings with stop devices enable these adjustments to be easily made, and hold the gate securely when adjusted.

Mr. George T. Hedrick, of Weaverton, Ky., has patented a nozzle and stopper for grain bags. It is metallic, and the bag is gathered and attached to it by a draw string. The stopper is a metallic disk with a spring catch which engages interrupted flanges on the interior of the nozzle.

A lock and latch combined, patented by Mr. Charles F. Batt, of Phœnixville, Pa., is so constructed that the lock cannot be readily picked, and both the bolt and the latch can be operated by the same key. It also allows the latch to be thrown out of or into gear with the spindle.

Mr. Earnest J. Krause, of Carlisle, Pa., has patented a fire escape ladder, which provides means for adapting the hooks of a fire escape ladder to window sills of all widths, and for holding the ladder as firmly on narrow sills as on broad ones.

Mr. Orlando H. Jadwin, of Brooklyn, N. Y., has patented an improved cable traction for street cars. A peculiar clutch attached to the car serves, at the will of the conductor, to attach the car to the traveling cable, which runs in a channel or trough formed in the ground. Devices are also supplied to hold the cable in position at street corners, etc. The clamping of the cable by the clutch is gradual and uniform.

Mr. James Pardee, of Phillipsburg, Montana Territory, has patented an improvement in rotary ore-roasting furnaces, intended to increase the capacity, effectiveness, and working economies of this class of furnaces, and more especially applicable to what is known as the Howell rotary furnace. The improvement consists in a diaphragm or partition placed in the rear of the furnace feed pipe, by which means the crushed ore is given time to become heated and aggregated before dropping through the moving current of air and flame, and in this condition is not carried by the draught into the dust chambers in such quantities as heretofore.

Mr. James M. Totten, of Sharon, Wis., has patented an improved adjustable wrench. The shank has a socketed mortised block at the lower end, and a cross bolt passing through the shank, which holds side sliding plates. By sliding out the side sliding plates from the block and fastening them by the bolt, the wrench may be made to fit various sizes of nuts.

Mr. August W. Klamer, of Cahoka, Mo., has patented a draught equalizer for side reaping machines. A rectangular framework is adjustably secured to the tongue or pole of the vehicle, projecting on one side thereof and carrying the whiffletrees, thereby affording the horses a powerful leverage against the side pull of the machine.

Mr. Charles Steinfels, of Elizabeth, N. J., has patented a screw polishing machine, which automatically seizes and properly presents the heads of the screws to polishing wheels, the screws being fed to the machine in mass.

Mr. Heinrich Trenk, of Berlin, Germany, has patented a composition for use in tanning, consisting of a concentrated solution of crude tartar or argol, to which a small quantity of chloride of zinc or analogous chloride has been added. This composition is used after the hides or skins have been treated by the tanning liquor, and its action is to make the finished leather more dense and compact.

A hitching strap, patented by Mr. John D. Stotlemeyer, of Hancock, Md., prevents horses, when hitched, from falling, and assists them in recovering their feet when down. A portion of the strap is made of a strong strip of elastic rubber, provided with a snap hook, and suitably attached to the leather portion of the strap.

In an apparatus for watering stock, patented by Mr. James Ray, of Huntsville, Mo., a trough or receiver is provided with a device whereby water flowing into it from a pipe is automatically prevented from flowing as soon as the water reaches a prescribed level in the trough. The troughs may be arranged in a series, delivering water one to another, in such manner that none shall be wasted by overflow. A novel arrangement of float lever valves and float valves is used to accomplish the end sought.

A cheese cutter, patented by Mr. Lionel J. Smith, of Peshtigo, Wis., is so constructed that cheeses can be easily, accurately, and quickly cut into pieces of any desired size.

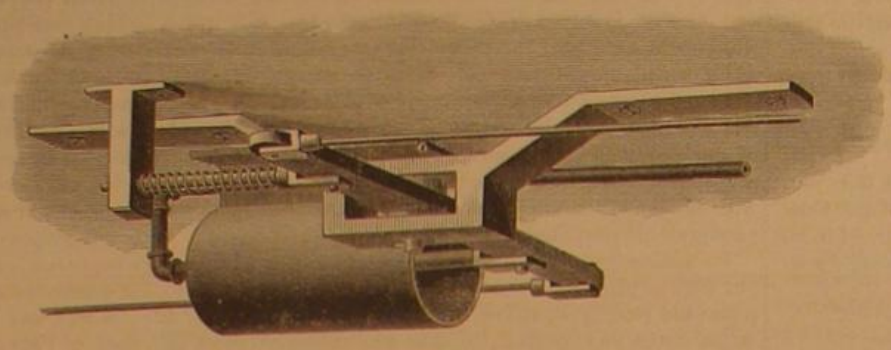
IMPROVED AIR BRAKE.

The construction of the brake shown in the annexed engraving is exceedingly simple, all unnecessary complication having been carefully avoided. As a consequence the first cost has been greatly lessened, the weight diminished, and the friction reduced, so that the apparatus may be made smaller than the ordinary form without detracting from its efficiency. The amount of the reduction of the weight amounts to about 140 lb., and the moving parts are reduced to a simple lever and a piston.

The arrangement of the mechanism is clearly shown in the engraving. The air cylinder receives air under pressure from a pipe extending from the engine through the entire length of the train. The forked end of the piston rod is connected with the lever by a pin passing through the fork and through a slot in the lever. The lever is retracted by a spring after being moved by the piston. Opposite ends of the lever are connected with the brakes at opposite ends of the car by the usual brake rods.

This simple mechanism may as readily be operated by a vacuum as by air pressure. The piston is moved more or less, and with greater or less force according as the air pressure is increased or diminished, and the brakes of the entire train are under the control of the engineer.

Further information may be obtained by addressing Messrs. Glenn, Cole & Jaques, Ottumwa, Iowa.



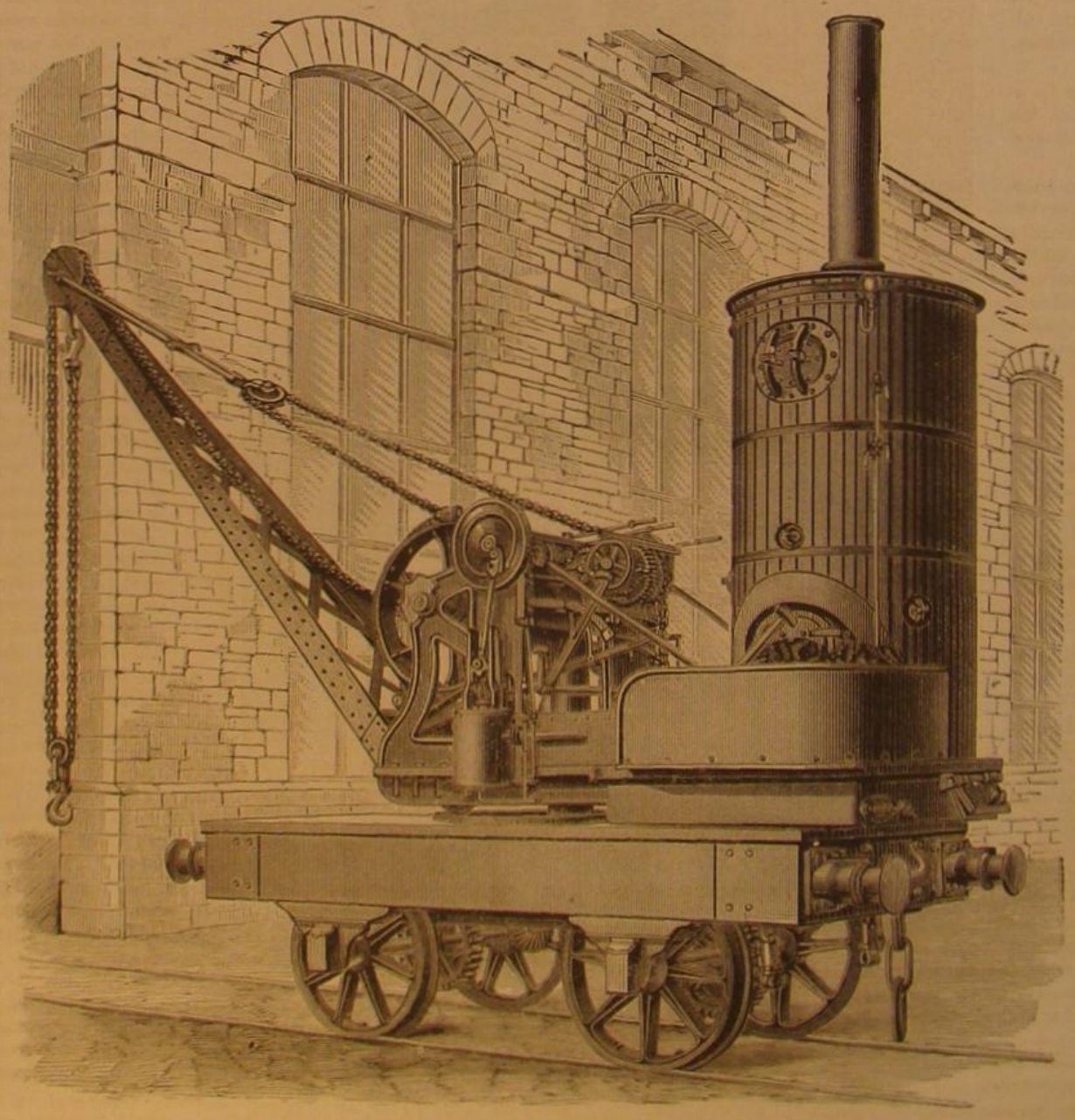
GLENN'S AIR BRAKE.

LOCOMOTIVE STEAM CRANE.

We give engravings of a locomotive steam crane designed and constructed by Mr. Thomas Smith, Steam Crane Works, Rodley, near Leeds, which is now working at the Barrow Shipbuilding Co.'s Works, and where it is employed in the erecting and fitting shops, also in the yard for shunting purposes. This pattern of crane was originally designed for Messrs. Pawson Brothers, of Morley, near Leeds, who have had one at work for a period of five months, loading material into ordinary railway trucks, and also for drawing two fully loaded trucks up an incline of 1 in 20, at the rate of four miles per hour, a distance of a quarter of a mile, the distance traveled altogether (and on which there are some sharp curves) from their works on to the main line being about a mile. The crane is fitted with two speeds for propelling (this motion being specially designed to meet the requirements of the case) quick and slow; the quick speed travels at the rate of seven miles per hour with a less weight or on the level road. To obviate the shock to the spur gearing, India rubber springs are placed over the axle boxes, and the wheel base is such as to allow the crane to travel easily over ordinary curves. The gauge is the usual railway gauge.

The crane has single purchase hoisting motion, fitted with a powerful friction brake and catch, so that when required the crane can be propelled with the load suspended. The revolving motion is worked with a double friction cone, so that the crane can be made to revolve in either direction without stopping or reversing the engine, and to keep the crane from slewing round when on the incline, a small brake is attached on the first motion shaft. All the gearing is of the best crucible cast steel, and the central pillar is of best forged scrap iron.

The engines consist of a pair of cylinders 8 inches in diameter by 10 inches stroke, and are each fitted with link reversing motion, and crank shaft of steel. All the bearings are bushed with phosphor-bronze, and are adjustable. The boiler is of the ordinary vertical type, with three cross tubes through the fire box; the internal parts being of best Yorkshire iron. All the vertical seams are double riveted, and all the rivet holes are drilled in position. The boiler is fitted with the usual mountings, and also with a feed pump and a Giffard's injector. The tank is capable of holding a large supply of water, a great desideratum in a crane of this description, as it avoids the necessity of having to go for a supply between the ordinary meal hours. The crane is made to lift and propel with a load of five tons at a radius of 16 feet, and will lift heavier weights at a proportionately less radius, the power of the engine and strength of the gearing being such as to allow it to do this. The above mentioned weight can be lifted without fastening the crane down to the rails by means of clips. All the motions are within easy reach and control of one man, and the design generally is excellent. The total weight of the crane is twenty tons.—*Engineering.*



LOCOMOTIVE STEAM CRANE AT THE BARROW SHIPBUILDING COMPANY'S WORKS.

RECENT INVENTIONS.

Mr. George Egart, of Mooleyville, Ky., has patented a combined apple parer, corer, and slicer, by which the apples are pared as the mechanism is moved in one direction, and cored and sliced as the mechanism is moved in the other direction. The construction is very ingenious.

An improved neck yoke tip, patented by Mr. Charles Schuman, of Rockford, Ill., is both ornamental and useful. It permits the use of brass, or other metal that can be plated, for the ferrule plate or ring, while using iron for the loop; and also permits finishing the ferrule or plate in a lathe. The invention consists of a ring with a recess and a loop with a hook at one end, the hook end of the loop being placed in the recess of the ring, both ring and loop being then driven over the end of the neck and secured by a screw or rivet passed through the free end of the loop.

Mr. Seymour Van Nostrand, of Stormville, N. Y., has patented a vehicle spring, claimed to be of superior elasticity and strength, and having the important feature that by ingenious devices the elasticity of the spring can be increased or diminished at will to suit different loads.

Mr. James Smith, of Thornliebank, county of Renfrew, North Britain, has patented a dye and bleach vat more especially designed for the series of processes known in calico printing as dunging or treatment with dung substitute, but which is also applicable to bleaching and dyeing processes, etc. The apparatus is claimed to be far more convenient and compact than that heretofore used.

Mr. Heinrich Trenk, of Berlin, Germany, has patented a composition for tanning hides and skins. Two solutions are employed, mixed in the proportion of two of the first to one of the second. The first solution is composed of 25 parts pyroligneous acid, 25 parts chromate of alumina, in 1,000 parts of water. The second is a concentrated solution of crude tartar and a small quantity of chloride of zinc or analogous salt.

Mr. John McLeod, of Auckland, New Zealand, has invented a self-adjusting mast which is intended to increase the safety and improve the sailing qualities of boats and vessels. The mast is hung on trunnions on a thwart of a boat or beams of a larger vessel, and its foot rests on a curved tube with strong springs coiled around it. A counterbalance is secured about the foot of the mast to increase the inertia and to operate as self-adjusting ballast, and strong springs are also attached to the shrouds to assist in holding the mast in an upright position.

A pocket register for recording one's daily expenses has been patented by Mr. Frederick Horn, of St. Louis, Mo. Two small disks are marked with numerals on their outer faces, placed back to back and united at their edges for about three-quarters of their circumference. A movable disk that may be held fixed by a spring, has numbers, lines, and indentations on and about its edge, and is inserted on a pivot between the fixed disks. By turning the movable disk the amounts of separate expenditures are added to those previously recorded.

A root cutter, for cutting roots of trees, patented by Mr. Thomas Davies, of Fall River, Mass., may be used for the cutting of roots in felling trees without dulling the cutters, for cutting limbs from fallen trees, for splitting wood, and other purposes.

A water indicator for boilers, patented by Mr. John Bridges, of Leon, Iowa, consists of an arrangement of float pipes, levers, and an indicator, which operate in combination with a water supply tank, feed pump, and boiler for automatically regulating the height of water in the boiler and indicating the water level.

Mr. Louis D. Clairoux, of Detroit, Mich., has patented a fruit gathering apparatus, which consists in a novel construction, arrangement, and combination of a framework, apron, trough, and other devices, which provide for readily applying the apparatus to a tree and adjusting it to different positions. The fruit is received upon the yielding surface of the flexible apron, and, rolling to the center, passes into a trough, which conveys it, without bruising, to the ground.

An apparatus for conveniently retailing nails, nuts, and other articles sold by the pound and which facilitates the handling of such goods in getting them out and weighing them, has been patented by Messrs. Henry C. Draper and Thomas Bowyer, of Oswego, Kansas. The receptacles which hold the articles are hung on trunnions in a novel sort of frame, so that they can be turned down into a horizontal position for the more effective employment of the scoop or other implement used to take them out.

A device for extracting cartridge shells, patented by James F. Marvin, of Fort McDowell, Arizona Territory, provides a means whereby, when the heads are pulled off of cartridges, the shells may be easily extracted. A slotted expanding tube, with flanges and shoulders, and an expanding pin, is inserted into the shell. The closing of the breech expands the device into engagement with the metal of the shell, and when the breech is again opened the whole is extracted together.

HELMET CRESTS.

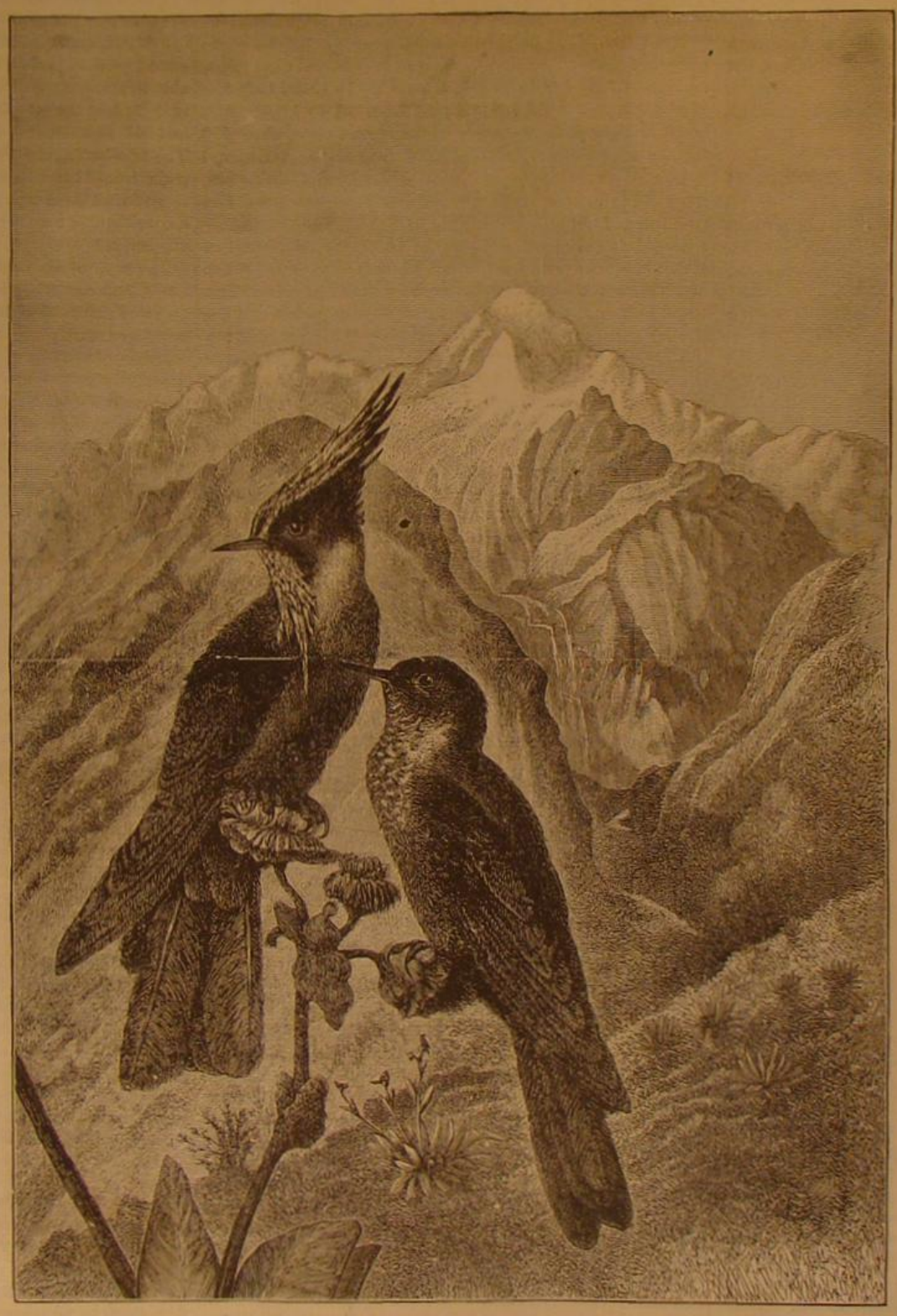
The helmet crests are very curious birds, and are at once known by the singular pointed plume which crowns the top of the head, and the long beard-like appendage to the chin. They all live at a very considerable elevation, inhabiting localities of such extreme inclemency that few persons would think of looking for a humming bird in such frozen regions. There are several species of helmet crest, and their habits are well described by Mr. Linden, the discoverer of Linden's helmet crest, in a letter written to Mr. Gould, and published in his monograph of the humming birds.

"I met with this species for the first time in August, 1842, while ascending the Sierra Nevada de Merida, the crests of which are the most elevated of the eastern part of the Cordilleras of Colombia. It inhabits the regions immediately beneath the line of perpetual congelation, at an elevation of from 12,000 to 13,000 feet above the level of the sea. Messrs. Funck and Schlim found it equally abundant in the Paramos, near the Sierra Nevada, at the comparatively low elevation of 9,0 0 feet. It appears to be confined to the regions between the eighth and ninth degrees of north latitude.

"It occasionally feeds upon the thinly-scattered shrubs of this icy region, such as the hypericum, myrtus, daphne, arborescent espeletias, and towards the lower limit on befarias, but most frequently upon the projecting ledges of rocks near to the snow. Its flight is swift, but very short; when it leaves the spot upon which it has been perched, it launches itself obliquely downward, uttering at the same time a plaintive whistling sound, which is also occasionally uttered while perched, as well as I can recollect. I have never heard it produce the humming sound made by several other members of the same group, nor does it partake of their joyous spirit or perpetual activity. Neither myself nor Messrs. Funck and Schlim were able to discover its nest, although we all made a most diligent search.

"Its food appears principally to consist of minute insects, all the specimens we procured having their stomachs filled with small flies."

The head and neck of the adult male are black, a line of white running along the center. The long plumes of the throat are white. Round the neck and the back of the head runs a broad white band. The upper surface of the body and the two central tail feathers are bronze-green, and the other feathers are a warm reddish bronze, having the basal half of their shafts white. The under surface is a dim brownish bronze. The length of the male bird is about five and a quarter inches. The female is coppery brown upon the head and upper surface of the body, and there is no helmet like plume on the head nor beard-like tuft on the chin. The throat is coppery brown, covered with white mottlings, and the flanks are coppery brown washed with green. The length of the female is about one inch less than that of her mate.—*Wood's Natural History.*



LINDEN'S HELMET CREST OR BLACK WARRIOR.—(*Oxypogon Lindenii.*)

Novel Employment of Elephants.

Recently, at Bridgeport, Conn., a switch locomotive having run off the track, two of Barnum's largest elephants were brought out and made to push the locomotive with their heads. They succeeded in righting the machine after one or two attempts, but their exposure to the winter air gave the animals bad colds, and to cure them it was necessary to give them several gallons of whisky.

White Negroes.

At a recent clinical lecture at the College of Physicians and Surgeons, Professor George Fox intoduced the "African leopard boy" now on exhibition in this city. According to Dr. Fox the boy is eleven years old and of pure negro parentage, and at birth was entirely black. White patches began to appear on his body when he was three years old, until now a large part of his arms, chest, abdomen, and legs, in irregular blotches is white, and the skin around the blotches is a *cafe au lait* color. There is also a white spot on his forehead, extending several inches back on his head, and the hair on the white spot is also white, although as kinky as a colored boy's hair should be. Except as to color, the skin is entirely normal. The face, neck, hands, feet, and back are entirely black. The white area is increasing annually, and Dr. Fox predicted that some day the boy would become an entirely white negro. His diagnosis of the disease was leucodermis, and he said it was not rare, as half a dozen entirely or nearly white negroes, he presumed, could be found in this city. The disease was one, like albinism, to which all races and many animals are subject. But most cases of white crows, blackbirds, rats, mice, and elephants are cases of albinism. Albinism differs from leucodermis in that it is congenital, and patches do not increase or decrease. Children of an albino negress and a black negro are always either entirely white or entirely black.

The Mastodon.

Prof. G. C. Brodhead contributes to the Kansas City *Review* an interesting paper, in which he enumerates all the discoveries that have been made of mastodon remains in the United States. This huge animal appears to have had a wide range in this country in past ages. The earliest record that we have of the finding of the bones of the mastodon is contained in a letter from Cotton or Increase Mather to the Royal Society of London, between 1650 and 1700, describing the portions of the skeleton of one of these animals discovered near Albany, N. Y. Since that period skeletons nearly entire, detached bones, teeth, etc., of the mastodon, have been found in nearly every State in the Union, including those of the Pacific slope. The evidence thus far obtained goes to show that the mastodon first appeared in America in Miocene times, was abundant in the Pliocene, and lingered until the close of the Glacial period, and disappeared in the early Loess. We also find that he roamed at will from Canada to South America, being found as far north as 66° N. latitude on our Western Coast.

Cape Breton Oil Wells.

The oil belt at Lake Ainslie, Cape Breton, is being prospected with considerable promise. The Cape Breton Oil and Mining Company are now sinking a well half a mile from the western shore of the lake, and have reached a depth of 1,000 feet. The prospects are said to be good, the oil being of a quality exceptionally valuable. The local manager of the company intends, he says, to sink twelve wells in his district. Three other Boston companies have entered the field, one having contracted for ten wells, the other two for three wells each, so that in the course of the year it is expected that twenty-eight wells will go down. The Cape Breton oil is a heavy lubricating oil.

Improved Caustic.

It sometimes becomes necessary to remove certain morbid growths in the throat and elsewhere, and for this purpose a stick of fused nitrate of silver secured in a quill is generally employed. Unfortunately it not unfrequently happens that the caustic breaks off and slips down the throat. To prevent this a Russian surgeon melts together 5 parts nitrate of silver and 1 part nitrate of lead. This composition does not break easily, and can be sharpened like a lead pencil. It should be fastened in a quill made of metallic aluminum, which is not corroded by the caustic as metallic silver is.

Joseph Smith's Tree Root Museum.

Mr. George Jacob Holyoke describes, in the Manchester *Co-operative News*, a remarkable museum of oddities carved out of laurel roots by Joseph Smith, Wissahickon, Pa., the most original thing he saw in America. Mr. Holyoke expected, from his early acquaintance with the man, to find the museum commonplace and pretentious. Instead he found a number of rooms bearing the appearance of a forest of ingenuity, which a day's study would not exhaust. There was nothing tricky about it. Its objects were as unexpected as the scenes in the Garden of Eden must have been to Adam. Noah's ark never contained such creatures. Doré never produced a wandering Jew so weird as the laurel Hebrew who strode through these mimic woods. Scenes from the Old Testament, groups of American orators, statesmen, and railway directors started up in the strange underwood, or held forth in the branches of trees. Dr. Darwin would require a new theory of evolution to account for the wonderful creatures—beasts, birds, and insects—which confront you everywhere. An American Dante, if there be such a one, might find ample material for a new poem in this wooden inferno. The mind of man never conceived such grotesque creatures before; yet this was the work of an old agitator, executed between his seventieth and eightieth year, with no material but roots of trees, with no instrument but his pocketknife and a pot of paint, and no resources but his marvelous imagination. There were snakes that would fill you with terror; stump orators that would convulse you with laughter. His Satanic Majesty strode on horseback; Mrs. Beelzebub is the quaintest old lady conceivable. The foreign devils all had a special individuality. There was the Mohammedan devil, the Indian devil practicing the Grecian bend, the Russian devil eating a broiled Turk, the Irish devil bound for Donnybrook Fair, the French devil practicing polka, the Dutch devil calling for some beer, the Chinese devil delivering a Fourth of July oration. Mr. Holyoke saw no American devil, and hoped we were without one. Mr. Smith's description of his creations endowed every creature with living attributes. He illustrated his favorite doctrine of man being the creature of circumstances, by saying it was coming to live in Schuylkill County which first developed in him the latent slumbering organ of rootology.

Dust and Fog.—Beneficial Effects of Smoke.

Mr. John Aitken recently read a paper before the Royal Society of Edinburgh on the origin of fogs, mists, and clouds. From a great number of experiments with moist air at different temperatures, to determine the conditions which produce condensation of water vapor, he concludes that whenever water vapor condenses in the atmosphere, it always does so on some solid nucleus; that dust particles in the air form the nuclei on which the vapor condenses; that if there were no dust there would be no fogs, no clouds, no mists, and probably no rain; and that the supersaturated air would convert every object on the surface of the earth into a condenser on which it would deposit as dew; lastly, that our breath, when it becomes visible on a frosty morning, and every puff of steam, as it escapes into the air from an engine, show the impure and dusty state of the atmosphere.

These results have been verified at temperatures as low as 14° Fah., at which, however, there was little cloudiness produced, owing to the small amount of vapor in air so cold. The sources of this dust are many and various; for instance, finely ground stone from the surface of the earth, the ash of exploded meteorites, and living germs. Mr. Aitken showed experimentally that, by simply heating any substance, such as a piece of glass, iron, or wood, a fume of solid particles was given off, which, when carried along with pure air into a receiver, gave rise to a dense fog mixed with steam. So delicate is this test, that the hundredth of a grain of iron wire will, when heated, produce a distinct haziness in the receiver. By far the most active source of these fog-producing particles is, however, the smoke and sulphur given off by our coal fires; and as even gas grates will not prevent the emission of these particles, Mr. Aitken thinks it is hopeless to expect that London, and other large cities wherein such fuel is used, can ever be free from fogs. However, inasmuch as more perfect combustion will prevent the discharge of soot flakes, these fogs may be rendered whiter, purer, and therefore more wholesome, by the use of gas grates, such as that recommended by Dr. Siemens. Mr. Aitken also drew attention to the deodorizing and antiseptic powers of smoke and sulphur, which, he thinks, probably operate beneficially in killing the deadly germs and disinfecting the foul smells which cling about the stagnant air of fogs, and suggests caution lest, by suppressing smoke, we substitute a greater evil for a lesser one.

THE NAVIES OF EUROPE.—TEN YEARS' PROGRESS IN SHIPS OF WAR.

In recent issues of this paper considerable space has been given to the consideration of our coastwise and maritime defenselessness, and to the pressing need of attention to our naval weakness.

The past decade has been a period of remarkable activity and creative progress in all the navy yards of the world save ours. During this time the great powers of Europe have substantially reconstructed their navies on a scale previously undreamed of; and even the third and fourth rate powers of the world have so increased their war fleets as to place us in a decidedly precarious position navally should a controversy with either or any of them suddenly arise. There is happily no present indication of foreign war, but a war is always possible; and it ill-becomes the richest nation in the world to be doing nothing for the protection of the exposed wealth of its seaports, or for putting itself in position to command respect—the surest guarantee of peace.

According to the recent report of the Navy Department the strength (more correctly, weakness) of the United States Navy is summed up as follows:

In Commission—Steamers, 29, sailing ships, 4; monitors, 8; torpedo boats, 2; total, 43. In Ordinary—Steamers, 18; sailing vessels, 8; monitors, 7; steamers, 3; sailing ships, 3; monitors, 1; steamer, 1; sailing ships, 3. On Stocks—Steamers, 5, sailing ship, 1; monitors, 4; ironclad, 3. Repairing—Steamers, 9. At Naval Academy—Sailing ships, 3; monitors, 1. Public Marine School—Sailing ship, 1. Tugs of all kinds at yards and stations, 25. Total number of vessels, 139.

Of these vessels, constituting the general service fleet, six are double-turreted armor-belted monitors, only one of which is finished or near completion—the rest are rotting on the stocks; fifteen are single turreted monitors built from fifteen to eighteen years ago, and now practically worthless; five are unarmored screw steamers (frigates), the youngest, the flag ship Tennessee, being fifteen years old; twelve second-rate and twenty third-rate corvettes, all but one second-rate (the Trenton) and half a dozen third-rates being ancient and of small value; four paddle steamers, all ancient; two torpedo vessels, and a dozen small gunboats, only two of which are yet armed. Some of these vessels carry small rifled guns (altered from smoothbores), and all are slow, very few exceeding ten knots.

The navy of Great Britain presents a remarkable contrast. It now comprises, according to the careful summary of Mr. King ("War Ships and Navies of the World," by Chief Engineer J. W. King, U. S. N. Boston: A. Williams & Co. 1880), nearly four hundred vessels of all kinds, excluding those laid up or employed in permanent harbor service. These vessels are divided into three classes: ships for great naval battles, ships for coast defense, and unarmored cruising vessels. Of the first class of heavily armored sea-going fighting ships, armed with powerful guns, there are now twenty-eight, carrying 254 guns, weighing in all 4,493 tons. Eleven of the ironclads are sea-going turret ships—nine masted and two rigged—and seventeen are broadside ships, of which three are armor-belted cruisers. The coast defenders number fifteen, and the iron broadside ships of the original type number ten. In addition, two iron-plated wooden ships remain serviceable. These are all large ships; nearly all are of recent construction, the average expenditure on new armored ships, according to Mr. King, being about fifteen million dollars a year, while nearly four millions are spent on other new vessels. The first-class turret ships range between 270 and 330 feet in length; 6,200 to 11,406 tons displacement; carry guns of from 25 to 80 tons; and can steam from 12½ to 15 knots an hour. The first-class broadside ships are from 260 to 325 feet in length, and, with one exception, exceed 6,000 tons displacement, rising as high as 9,500 tons. They carry guns of from 12 to 25 tons, and all make better time than the fastest American corvettes, or between 12 and 15 knots. The armor-belted ships are but slightly smaller and less powerful. The coast defenders are improvements on our monitors in size, speed, and armament. Most of the old-type iron broadside ships are larger than our Tennessee; are armored, carry guns from 6½ to 12 tons, and can steam from 12 to 15 knots.

The lately built unarmored ships of the British Navy include three iron frigates, six iron corvettes, two steel dispatch vessels, nine steel and iron corvettes, six composite corvettes, fourteen first-class composite sloops, and six second-class, with a hundred composite gun vessels and gun boats. The frigates steam from 15 to 16 knots; the first-class corvettes from 13 to 15 knots; the second-class 11 knots; the dispatch boats, both as large or larger than the Trenton, have exceeded 18 knots.

The old-type steam cruisers of wood and iron in the general service fleet are by no means of small importance, though they do not properly fall within the scope of this article. This fleet comprises fifteen ships of the line, twelve frigates, twenty corvettes, ten sloops, thirteen troop ships, supply ships, dispatch steamers, yachts, surveying vessels, etc.

The new fighting fleet of France practically dates from 1872, when a programme was drawn up for the construction of 217 vessels of various types, costing in all upward of $121,000,000. The finished armored vessels comprise eight sea-going ships of the first class, iron or iron and steel rams, from 311 to 322 feet in length, from 8,133 to 10,332 tons displacement, and of speeds ranging from 13 to 14½ knots; seven or eight sea-going ships of the second class, about 250 feet in length, from 4,000 to 6,000 tons displacement, and speeds of from 13 to 14 knots; fifteen coast defenders, from 216 to 241 feet in length; sixteen first-class wood and iron ships of old types, and eight of second-class, the former from 252 to 284 feet in length, the latter 230 feet. All of these ships are armed with breech-loading rifled guns. When Mr. King's table was made two first-class sea-going ships were building, each to carry three 100-ton guns. All the French sea-going armored ships are rigged; the mastless vessels for coast defense include six turreted vessels; all the rest are on the broadside principle, or have the broadside and turret principles combined. The heaviest guns are mounted *en barbette*. Both the armored and unarmored modern ships have the ram bow.

Of the latter type of vessels the programme of 1872 contemplated eight first-class, eight second-class, and eighteen third-class cruisers, eighteen dispatch vessels, thirty-two gun boats, and thirty-five transports. A large portion of these are already afloat. By 1885 it is expected that the entire fleet will consist of new vessels of the most approved modern types armed with the best modern guns, all in perfect condition for service.

The list of the old-type steam cruisers, mostly of wood, given by Lieutenant Very ("Navies of the World," by Lieut. Edward W. Very, U. S. N. New York: John Wiley & Sons. 1880), includes nine ships of the line, six frigates, ten corvettes, twenty one sloops, eleven dispatch vessels, and forty-two transports.

The fleets of Germany and Italy are almost entirely the work of the past decade or so. It is only since 1860 that Germany has had any navy at all, to speak of, and since 1873 that any attempt has been made to acquire a navy commensurate with the importance of the empire on land. The armored ships afloat or building comprise six casemate ships, 213 to 280 feet in length, 7,135 to 7,560 tons displacement, speed of 14 knots, and armed with Krupp guns of from 18 to 36 tons; two armor-belted turret ships, with casemate around turret, 298 and 308 feet in length, about 6,500 tons displacement, 14 knots speed, and armed with Krupp guns, the largest being of 18 tons; three large broadside ships; one corvette, and eight or ten coast defenders, of 1,030 tons displacement and slow speed. The latter carry each a 36-ton Krupp gun, in a movable turret protected by an armor parapet. None of these will be able to match the larger ironclads of England, or the Italian Duilio or Dandolo; but will have a strength sufficient, perhaps, to meet the French under any conditions proffered.

The modern unarmored ships of Germany include seven fast iron corvettes, 2,460 to 3,833 tons displacement, carrying from 12 to 16 guns each, having covered gun decks; and six open deck corvettes of 2,169 tons displacement; three fast dispatch vessels (16 knots), and five gun boats.

The modern war fleet of Italy dates from 1877, and comprises the most powerful and heavily armed vessels ever built. The Italian ships are specially remarkable for the heavy guns they carry and their great speed. The broadside ships Italia and Lepanto, now building, are 400½ feet long, 13,480 tons displacement, are expected to steam 16 knots, and will each carry four 100-ton Armstrong guns, mounted in pairs *en barbette*, and 18 smaller guns. The mastless turret ship Duilio lacks an inch of 341 feet; its displacement is 10,401 tons; it carries four 100-ton guns, and makes 15 knots. The unfinished Dandolo is in every respect its counterpart. The four line of battle cruisers already afloat are from 250 to 265 feet long, and though lightly armored are heavily armed, two of them carrying one 23-ton and six 18-ton guns, the other two carrying six 18-ton guns and two 12-ton guns. There are besides one monitor ram, four floating batteries, and six broadside frigates, for coast defense and station service. The unarmored fleet numbers ten fast cruisers, of which three are second-class corvettes, four gun boats, and three torpedo vessels. By the decree of 1877 it was determined to have completed by 1888 sixteen ships of war of the first class; ten of second class for local defense, for cruisings, and for foreign stations; and twenty vessels of third class; twelve transports, and twelve small ships for local service, a programme which is rapidly being carried out, as already shown.

Two years ago the Russian Navy included thirty-one armored ships and a couple of hundred other vessels. The armored ships were: frigates, 6; battery ships, 3; turret ships, 5; Popoffkas, 2; double turret monitors, 3; single turret monitors, 12. The more powerful of the Russian war ships have been launched since 1874. The double turret ship, Peter the Great, is 330 feet long, is of 9,510 tons displacement, carries four 40-ton guns, and has made 13 knots. The Knatz Minin is another powerful ship, 389 feet long, 5,800 tons displacement, and carries four 28 ton guns, mounted in pairs *en barbette*. The two Popoffkas are floating citadels of circular form, designed for service in shallow water. The latest novelty is the turbot-shaped Livadia, ostensibly a yacht for the Czar, but doubtless intended, in case of need, to be heavily armored and armed for naval uses. During the past five or six years Russia has also been expending large sums on unarmored fast cruising ships, this arm of the navy having already become formidable.

The armored fleet of Austria contains but three or four vessels older than 1870. It comprises three redoubt frigates, 276 to 302 feet in length, 5,940 to 7,390 tons displacement, armed with 10 and 11 inch Krupp guns (18 to 28 tons), and able to make from 13 to 14 knots; five casemate frigates, 223 to 275 feet in length; three broadside frigates, of 197 and 253 feet length; two monitors, and one citadel ship. The smaller frigates are armed with 7 and 8 inch guns, and make from 11 to 13 knots. The last mentioned vessel carries two 17 inch Armstrong guns. The unarmored fleet contains a considerable number of recent cruisers of fair speed and efficiency.

The navy of Holland is chiefly strong for defensive purposes, and comprises but two sea-going armored ships. The armored ships of Spain are few and of small importance compared with those of other European powers. The list includes 138 vessels of all kinds, but there are no modern sea-going armor-clads and no cruisers of the rapid type. Denmark has launched two iron-clads since 1873, the frigate Odin, carrying four 18-ton guns; and the broadside, casemated, central battery ship Helgoland, launched in 1878. The half dozen other armored vessels are old. The Swedish navy is designed chiefly for coast defense. This arm comprises four armored monitors, ten armored gunboats, and about a hundred other vessels of all sorts. The navy proper comprises 38 unarmored vessels. Portugal has one armored ship, ten screw corvettes, nine gunboats, and half a dozen sailing vessels, transports, etc. Norway has four monitors, one frigate, four corvettes, and about a hundred gunboats and other small vessels. Greece has fifteen vessels, including two ironclads. Turkey has vessels enough to rank among the naval powers, but lacks money and officers to make them effective. Fifteen of her ships are large and fairly armed.

The chief lesson taught by the costly naval experiments of European powers during the past decade—a lesson which the United States can profit by—seems to be the inexpediency of buiding huge floating fortresses at enormous cost. The power of guns can be increased more rapidly than the ability of ships to withstand them; and the greater the target the greater the chance of being hit, and the greater the loss of life and property when a crushing blow has been struck.

For defense against the largest class of ironclads we need properly placed stationary coast defenders, the armor of which can be increased as the power of the guns to be resisted is increased. The superior accuracy of fire possible in a land battery will make one heavy gun, so placed and guarded, more formidable than many guns of equal weight on shipboard. For naval purposes a large number of small vessels of great speed, each carrying one heavy gun, will be more efficient than a few large armor clads of equal aggregate cost.

The Scientific American.

While the newspaper press of the day is, for the most part, inculcating more of error than of truth in the public mind in regard to medical topics, cultivating the vulgar superstitions by circulating every sensational story about madstones and blood-stones and the like, and gloating over every report of the desecration of graves for anatomical purposes, it is refreshing to turn to the pages of the periodical above named, and to observe that whenever medical topics are introduced, it is with the design of imparting the truth and inculcating correct ideas. Many years of growth have raised the SCIENTIFIC AMERICAN to the front rank, so that there is not in any country a publication superior to it in its sphere.
—*Pacific Medical and Surgical Journal.*

Photographic Emulsions.

BY H. W. VOGEL, BERLIN.

The essence of the invention consists in combining gelatine and bromide of silver with pyroxiline by the use of a new solvent, which insures the homogeneous mixture of the two. The solvent may be one of the inferior members of the fatty acids, such as formic, acetic, propionic acid, etc., or mixtures of the same alone or with alcohol, etc. Four various methods of producing the combination are described, of which the first is as follows: Ordinary gelatine is dried and dissolved warm in one of the above-mentioned acids, and one per cent of pyroxiline dissolved in a similar acid is added.

Machinery and Civilization.

Mr. Charles C. Coffin has been giving a series of lectures in the Lowell (Mass.) Institute on our manufacturing industries and the relation of invention to civilization. From the Boston *Advertiser* we make the following extracts from one of these lectures:

The first need of men in this world is for something to eat; the second is for something to wear. The earliest historical allusion to the manufacture of textile fabrics is the simile in the oldest poem extant—the Book of Job—the comparison of the swiftness of time to the weaver's shuttle. The weaver's shuttle of the East and the loom of the Orient through all the centuries have not changed. Throughout Asia, and even in some sections of Italy and Spain, the spindle of to-day is like that which Penelope deftly twirled when preparing garments for her absent lord. The use of machinery in the manufacture of clothing has been a powerful agency in modern civilization. Out of the multitudinous machines of the present century I select those for spinning and weaving to represent the progress of mechanic art. It is noteworthy that the first movement in free intellectual thought in antagonism to the dogmatism of the Middle Ages and the first mechanism to relieve woman from unceasing toil were coincident. During those years in which Martin Luther, Melanchthon, and their compeers were awaking the world to a new intellectual and religious life, a German carpenter constructed the spinning wheel, which made its appearance about 1530. The knitting machine was the second invention—the device of a young curate of Nottingham, the Rev. William Lee; and during those months when the Mayflower was crossing the Atlantic, the first stockings knit by the machine were placed on the market.

The lecturer commented upon the fact that the century following Lee's invention rolled away without any invention. Men were giving their attention to other things. The spirit of the age was against invention. The learned were lost in abstractions, were regardless of human needs, utterly ignorant of the resources of nature to alleviate human woe or to lift men to a higher plane of life. Another reason why inventions did not come earlier was that all christendom, through the Middle Ages and down to the beginning of the present century, was engaged in war. The conditions were all adverse to scientific research. In 1781, just one hundred years ago, came Watt's first working engine, with a condenser and the steam applied to propel the piston in both directions.

Aside from the very few wind and water mills, the human race at the beginning of the present century was living by its own muscular energy, digging and delving, spinning and weaving, with rude instruments and mechanisms.

The world is more enlightened now, but there are still many people who cannot see how the introduction of a machine which will do the work of many men can be promotive of the well being of the community. Imagine yourselves as standing on the bank of the Merrimac in 1821, with Nathan Appleton, William Appleton, Patrick T. Jackson, Kirk Boott, John W. Boott, Paul Moody, and Nathaniel Bowditch. No sound breaks the stillness, save the rushing of the water over the rock. It is the energy of nature running to waste, and these gentlemen determined to set it to work for their individual welfare. They purchased the surrounding farms and the old canal which other men had constructed for the passage of rafts, set themselves to enlarging it, and in building a dam, not working with their own hands, but summoning the farmers, who came with their oxen to haul rocks. Stonemasons are wanted, and the blacksmith to sharpen their tools. Young men come down from Vermont and New Hampshire to dig the canal. The gentlemen who are pushing the enterprise need bricks. Another class of laborers is called for. Lumber is needed, and sawmills are set to humming. Masons, hodcarriers, mixers of mortar, lime burners, are set to work, with still more oxen, more teamsters and cartmen, besides coopers to make the casks for the lime. An architect plans the manufactory; the carpenters frame it, and a corps of joiners finish it. A millwright calculates the power, sets another corps of men at work constructing the great wheel. The manufacturers of the spinning and carding and weaving machines have regiments hammering and filing brass, steel, and iron. They in turn have set the founders, puddlers, and smelters to work. Furnaces send up their lurid flames; vessels are sailing on the ocean to fetch and carry the materials. The miners far down in the earth, the sailor climbing the shrouds in mid-ocean, the millwright lost in thought, as he calculates the power of nature's energy, the brickmaker moulding the plastic clay, the joiner plying his plane, the teamster urging his cattle; all have been called from former vocations to aid in building the mills. Why have they come? Because these gentlemen offer them more remunerative wages than they have been receiving.

Let us follow on. The mills are erected, the machines are in place, but human hands are still needed. The gentlemen summon the farmers' sons and daughters by the inducement of better wages. Have the gentlemen thrown any one out of employment? They have changed labor; they have made the spinning wheel and loom of the household useless lumber, not throwing the old-time spinners and weavers out of employment, but transferring them to one in which they can do more for themselves and their fellowmen. You ask, perhaps, what the masons, joiners, and carpenters who built the mill are to do when the mill is completed? Are they not out of employment? The mill is only the beginning. Dwelling houses are needed, stores, shops for the grocer, butcher, baker, joiner, mason, blacksmith—the whole fraternity of trades and occupations. The first mill erected at Lowell was the beginning of a city to-day numbering between 50,000 and 60,000 inhabitants. It will be instructive in this connection to see what labor and capital together will accomplish through the use of the energy of nature, in giving value to raw materials.

The Southern farmer plows his lands, casts in the cotton seed. He sells his crop at 12 cents per pound, obtaining a livelihood by agricultural labor. The operative in Lowell, by manufacturing it into muslin, may make it worth 80 cents, by more delicate manipulation into lace worth $1. But before the process could be undertaken by the machinist, the iron manufacturers were called upon to construct the machinery. The ore which the miner dug from the ground, and which he sold for 75 cents, the iron smelter sold for $5. The machinist makes it worth $100. If, instead of putting it into spindles and wheels, it had been sold to the manufacturer of fine needles, he would have made it worth $6,800. The manufacturer of watch springs would have made it worth $200,000; or if he were to use it for pallet arbors it would be worth $2,577,595. Past earnings and present labor together give this increased value to the 75 cents' worth of ore.

Invention renders old things obsolete and so is destructive; but there is a force more destructive than invention, a force that not only drives men from occupation, but upon the instant consigns their costly machines to destruction—a force wielded almost wholly by the female sex—the force of fashion, a power stronger than the combined strength of inventors, manufacturers, and operatives. Not long ago every woman in this audience quite likely regarded a hoop-skirt as necessary to make her wardrobe complete. Probably not less than 25,000,000 were manufactured per annum, requiring an outlay of many millions of dollars for complicated machinery, furnaces, and rolling mills for the foundation of steel, manufactures for the weaving of tape, employing many thousand operatives; but suddenly the idea gained possession of the female mind that dress would be more graceful and pleasing to the eye without them, and they were upon the instant discarded, bringing about quick destruction to the manufactures and loss of occupation to the operatives.

Invention is an educator. It begins with thought. The more thought put into his machine by the inventor the higher the intelligence to operate it. Mechanics has become a distinct profession, requiring high mathematics, physics, and the power of abstract thought. Trade and commerce recognize the new profession by offering it their highest pecuniary rewards. It is the master mechanic, receiving his salary of $15,000 per annum, who is the cheapest employe of some corporations in this country. Fifty years ago, in 1830, the spindles of the world were as follows: United States, 1,000,000; Europe, 2,000,000; Great Britain, 8,000,000. To-day the United States has 11,000,000; Europe, 20,000,000; Great Britain, 40,000,000. In cotton manufacture it is estimated that one man to-day is able to do the work of 1,000 hand laborers, and that the cotton, silk, and woolen industries of to-day would require the labor of every human being if prepared by hand labor.

One hundred years ago, when thread numbered 150 by the standard set up by spinners was considered the utmost degree of fineness possible by English spinners, a pound of cotton spun to such fineness would give a thread 74 miles in length, sufficient to reach from Boston to Concord, N. H. The machinery of to-day spins for useful purposes thread numbered 600—from one pound a thread 196 miles in length. And machinery has been constructed so delicate that a pound of cotton has given a thread reaching 1,061 miles—farther than from Boston to Chicago! The weaver of my boyhood could throw the shuttle perhaps twenty-five times a minute, but not at that rate through the day. Human muscle would break down under such rapid action. In 1850 Compton's loom threw the shuttle fifty times a minute, whereas so great has been the advance of invention, that the loom of to-day is considered a slow moving mechanism if the shuttle does not fly 240 times a minute! "No man can afford to take as a gift to-day a cotton manufactory equipped with the machinery of 1860," was the remark of the late superintendent of the Amoskeag Mills. "We are breaking up the machinery of those days for old iron."

In some departments of cotton manufacture a man with the present machines will do eight times the amount of work which he could accomplish in 1860. In the manufacture of coarse cloth an operative with ten machines does twice the work which he could accomplish with thirteen machines before the war. There never was a period so fruitful in discovery, so fertile in invention as the present, and the reason is manifest. The first discoverers and inventors groped in the dark. They were ignorant of nature's laws. They did not know what force was. They had a limited comprehension of what the simple mechanical powers were. There was little accumulated wealth of research.

In contrast, the mechanic of to-day has all the discoveries, the experiments, the ascertained facts, mathematics of machinery, the laws of force at his command. He inherits the scientific wealth of all the past and makes it his capital. Instead of gazing, as it were, upon old mines worked out, he beholds mountain ranges filled with golden ore, and engages in his work with the stimulus of the needs of the human race, and the ever increasing wants of an advancing civilization.

Repairing Steamers Out of Dry Dock.

Some weeks ago the steamship Queen, of the National Line, had her bow stove in by collision on the bay. To save the heavy cost of occupying the dry dock while the plates were being made for repairing the breach, the Queen was towed to the Erie Basin, where the manager of the line, Mr. Hurst, had the work done by means of a cofferdam, which was built on the dock. The dam was about 25 feet square, and was simply a huge box without a cover. In one side of this box an aperture was cut into which the bow of the vessel exactly fitted. Then the box was sunk beneath the steamship and raised under her bow so that it fitted snugly to her hull, and the edges were calked. After the water had been pumped out the workmen descended into the box or cofferdam and rebuilt her bow. This method of repairing, which is an old but much neglected one, saved the company, Mr. Hurst is reported to say, just $26,000.

More recently the method has been applied to the iron steamship Holland, of the same line. Mr. Hurst says: "In the November gales she was all torn to pieces about the stern. She is 450 feet long and is registered at 4,000 tons burden. No dry dock in America could lift her. She is at our dock at Houston street, North River. I had a coffer dam built in Jersey City and towed to the Holland. The dam is 36 feet long, 26 feet wide, and 22 feet deep. I sent a carpenter into the hold of the Holland, and he took measurements every 2 feet from keel to deck. He then went on the dock and built a flat pattern the exact shape of the vessel about 10 feet from her stern. The shape of the pattern was cut from one side of the coffer dam. Then the coffer dam was towed to the vessel, heavy chains were thrown into her until she sank, the chains were then withdrawn, and the dam rose to the hull of the steamship. The stern fitted perfectly into the aperture, and all was made snug." The repairs will take till February 15. By that time the charge for dockage would have amounted to over $30,000, which is saved by the use of the coffer dam.

A Large Iron Steamboat.

The Fall River Steamboat Company announce that a contract has been signed with John Roach & Son for the construction for them of an iron steamboat, to be the largest ever built for the Long Island Sound trade, between New York and Fall River. Her length over all, on deck, will be 395 feet; length of hull, 380 feet; extreme breadth of beam across the guards, 87 feet; breadth of beam of hull, 50 feet, and 17 feet depth of hold. She will be built upon the cellular system, that is, with two hulls—the most recent type of shipbuilding insuring safety—the cellular spaces at the sides being two feet deep, and along the bottom three feet deep, between the hulls. The spaces between the two hulls will be divided into ninety-six watertight compartments, and, in addition, there will be six water-tight bulkheads from the inner hull to the main deck. The new boat will be provided with a steam steering apparatus, and an independent or safety-steering quadrant aft, in case of accident to the steam gear. The means for extinguishing fire, for closing one compartment from another, and other provisions for safety, will be on the latest improved methods. The engine will be on the "walking beam" principle, with 110 inches diameter of cylinder and fourteen feet stroke. There will be four main boilers, their construction being such as to warrant carrying a pressure of steam fifty pounds to the square inch, although the working pressure will be about twenty-five pounds to the square inch. The paddle shaft will be twenty-six inches in diameter, and with the piston rod, connecting rods, and rock shafts, will be made of the best wrought iron. The machinery will be inclosed in a compartment of longitudinal and athwartship bulkheads, carried up to the hurricane deck. The passenger accommodations are intended to be superior to those of any steamboat now afloat. The boat is to be completed by May, 1882.

AGRICULTURAL INVENTIONS.

Messrs. Anthony W. Byers and James C. Dorser, of Sherman, Texas, have patented a cotton planter so constructed that it can be adjusted to plant less or more seed, as required. There is an ingenious arrangement of spikes or prongs attached to the rim of the feed wheel, which take hold of the cotton seeds and draw them out between curved steel springs fixed in the slot in the bottom of the feed board or bottom of hopper, and at the sides and forward end of this slot are attached springs which are curved downward and outward in such a manner that their bends may meet, or nearly meet, within the slot, so as to prevent the seeds from passing out except when pushed out by the prongs of the feed wheel and thus prevent the seeds from being dropped in bunches. The outward curve of the ends of the springs allows the seeds to drop from them freely, and allows the prongs of the feed wheel to pass up between the springs should the said feed wheel be turned backward.

Mr. Julius Holekamp, of Comfort, Texas, has patented a seed planter whereby corn, sorghum, beans, rice, cotton, etc., may be planted in hills or drills, and so constructed that the seed may be planted in any desired quantity, and at any desired distance apart, and with the rows at any distance apart.

Mr. Christian E. Gardner, of Orangeburg, S. C., has patented a seed planter and fertilizer-distributer, which has two hoppers and dropping devices whereby different materials may be carried and distributed by the same machine and at the same time. Adjustments are provided whereby the machine may be used either as a single or double planter.

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.

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) W. R. E. inquires: Is there any process whereby we can recover the hydrochloric acid from a solution of chloride of zinc which we have as a by product in the manufacture of one of our colors? I can recover the acid from chloride of barium, by the use of sulphuric acid, but sulphate of zinc, being a soluble salt, does not precipitate in the same manner as sulphate of barium. A. We fear that there is no method short of an expensive and complex series of reactions and decompositions by which the hydrochloric acid could be recovered, and which would necessarily be too expensive to be profitable. From the fact that a solution of chloride of zinc possesses the property of rapidly decomposing sulphide of ammonium and the organic matter of miasmata which convey disease, it forms a valuable disinfectant and deodorizer, and we suggest the desirableness of the waste product alluded to being turned to account in this direction. Its value as a disinfectant has been thoroughly established.

(2) T. R. writes: In making a curve on a railroad, which rail is the highest, the inside one or the outside? Is it not the outside one that is raised, and the inside rail left level? A. Generally the outer rail is raised, but engineers differ somewhat in their practice. 2. Is it necessary to raise either where the speed is not over three miles an hour? A. No.

(3) G. E. P. asks: 1. What is the best cheap protection for rough wood work against fire (sparks and light flame inside of building)? A. Saturate the wood with a strong aqueous solution of tungstate of soda. 2. Which is the best, something applied like paint directly to the wood, or sheathing the same with sheet tin? A. The tin or sheet iron.

(4) C. D. A. asks: Is there any way to extract a portion of a glass stopper which has been broken off down in the neck of the bottle? A. Repair the broken glass by means of a little Armenian cement or stratena. (See SCIENTIFIC AMERICAN SUPPLEMENT, No. 158.) Then heat the neck of the bottle quickly but moderately, so as not to heat the stopper. The heat will expand the neck of the bottle so as to loosen the stopper, which may then be removed.

(5) J. H. P. writes: My neighbor has a medium sized hot air furnace with indirect draught, which he controls by check draught in smoke pipe, by slide in door at bottom of furnace, which when open admits air through the fire, and he also opens a space in feed door equal to four square inches, admitting air over the fire, which he claims is necessary to supply oxygen for the combustion of the coal gas. I claim that so much cold air passing over the fire is not only unnecessary, but to the expense of fuel, as in heating, cools the fire and the radiating surface of the furnace, lessens the degree of heat in the hot air chamber, and then passes through the flues into the chimney. I also claim that, as furnaces are commonly fitted, a closer approximate to the necessary amount of oxygen required for the combustion of the coal gas can be obtained through an opening to the fire from below, together with that passing to the fire through the joints to doors, than would result from opening a space to admit air directly to and above the fire. A. If the draught is good the introduction of a small amount of air over the fire may effect a saving in fuel, without decreasing the heat. With thick fires burned slowly, much carbonic oxide (CO)—a combustible gas is formed by the partial decomposition of the carbonic acid (CO_2), formed near the grate, in its passage through the body of fuel. If air is not admitted above the fire much of this gaseous fuel may escape unburned up the chimney. Your neighbor may therefore be correct.

(6) C. C. writes: The SCIENTIFIC AMERICAN SUPPLEMENT No. 253, contains a rule for estimating the horse power of a high pressure engine, by a practical engineer. But he does not give the *modus operandi* of obtaining the average pressure from expansion (except by the indicator). A. If you have no indicator, you can get the average pressure approximately by assuming that the entering steam has a pressure of 3 to 6 lb. less than the boiler pressure, and that this is the pressure in the cylinder until cut off; the terminal pressure will depend on the point of cut-off—that is, if cut off at one-half, the terminal pressure will be one-half the entering pressure—if cut off at one-third, one-third, etc. For example, suppose the boiler pressure 63 lb., then the initial cylinder pressure would be 60 lb.; and if cut off at one-half the terminal pressure, would be 30 lb.; and if cut off at one-third, 20 lb. Next add together the initial and the terminal pressures and divide by 2 the quotient is the approximate average pressure, $60+30=\frac{90}{2}=45$ lb. average and $60+20=\frac{80}{2}=40$ lb. average.

(7) C. D. N. writes: I made a copying pad after receipt in SUPPLEMENT, No. 225, using 18 ounces of glycerine and 3 ounces of gelatine, and maintaining the heat for about four hours, and in making the ink I used half an ounce aniline, half an ounce alcohol, and 3½ ounces of water, and I cannot take over 3 or 4 copies. What is the matter? A. Try an ink with less alcohol and more aniline violet. See that the latter is pure, not mixed with dextrine, as is very frequently the case.

(8) H. S. asks: 1. Why do engineers say 28 or 30 inches vacuum instead of pounds? A. 28 or 30 inches of mercury is only equal to 14 or 15 lb. Vacuum gauges are usually marked in inches. 2. Where is the most pressure in a boiler? A. The pressure at the bottom of legs is as much greater than that in the steam chamber as is due to the head of water. 3. Why are all gauges tapped into the drum? A. Gauges are usually located where most convenient for engineers.

(9) J. S. M. asks how to proceed to wear the inside of a steam cylinder smooth after it has become cut by running dry or from other cause. A. You can restore the surface by grinding out the cylinder with a true segment of lead and sand or emery, but great care must be taken that it is so done as to leave the cylinder true.

(10) E. F. R. writes: 1. I am building the hand power electric machine described in SUPPLEMENT, No. 161. Please tell me about how much No. 16 cotton covered wire it will take to wind the electromagnets. A. It will take about 1 lb. to each arm of the magnet. 2. What is meant by a resistance of two or three ohms? A. An ohm is the unit of electrical resistance, and is about equal to that of a pure copper wire one-twentieth of an inch in diameter and 250 feet long. 3. How are wires connected to the binding posts, etc., under the base? A. A screw provided with a copper washer passes upward through the base into the binding post, and clamps the wire between the washer and the underside of the base. 4. In making the induction coil in SUPPLEMENT, No. 160, shall I need 40 square feet of tin foil or 20 ditto; or, in other words, in counting the surface do you count both sides of a sheet? A. One side only is counted. Use 40 square feet.

(11) J. M. H. writes: 1. I wish to construct a telephone line of about one mile in length. Will the telephone as illustrated in Figs. 2 and 3, SUPPLEMENT, No. 142, work successfully on a line of that length? A. Yes. 2. What kind of wire will be the best to use for the line; will No. 14 galvanized telephone wire do? A. No. 14 will answer, but No. 12 would be better. 3. How is the silk covered wire fastened to the binding screws? A. The end is stripped and soldered to the heavy wire which is clamped between the shoulder of the binding post and the wood of the telephone handle. 4. Will the plate such as is used by artists for tin types do for the diaphragm. A. Yes. 5. Should the wire as used for the line be attached direct to the telephone? A. Yes. 6. Is the coil in the connecting wire, as shown in the engraving, necessary? A. No. 7. Must the spool be of the same size and dimensions as in the engraving? A. The size is correct, but may be varied somewhat without seriously affecting the working of the instrument. 8. Will it answer to attach the ground wire to an iron pipe that runs into a well, and how should it be attached? A. It would probably answer. Solder the wire to the pipe. 9. Would a bar magnet 9 inches long and weighing 15 oz., threaded at one end, answer any better in place of the horseshoe magnets and the iron core? A. No; the telephone with the three-eighths bar magnet is the best of the two forms shown.

(12) H. W. L. asks how to burn crude petroleum. Is it burnt in the same manner as kerosene, if not, how? A. Petroleum is a mixture of a large number of hydrocarbons, some very light, some heavy, all combustible. It is neither safe nor economical to burn the crude oil in a lamp or with a wick. For heating purposes the best results are obtained by the use of some form of injector which delivers the oil in a spray mixed with a large volume of atmospheric oxygen. Under such circumstances the combustion is nearly perfect, and the heat is intense.

(13) A. F. S. asks: What coloring matter is best for making transfer paper that will show plainly on black walnut? A. Try chrome yellow, or a yellow lake, made up with a sufficient quantity of melted lard and a little wax.

(14) A. T. G. asks how to make printer's rollers. A. 1. Glue, 8 lb.; molasses, 7 lb.; soften the glue by soaking it in cold rain water for 24 hours; then melt over the water bath and stir in the molasses previously heated, moderately. Heat gently for half an hour, with occasional stirring, let stand to cool somewhat and pour into oiled moulds. Requires from 8 to 10 hours in winter, and longer in summer, to harden. 2. Best white glue and glycerine, equal weights; soften the glue in cold water over night, then melt it over the water bath and gradually stir in the hot glycerine; continue the heat for seven hours, with occasional stirring, to drive off all the water absorbed by the glue. Let cool somewhat, skim and pour into well oiled brass moulds in the center of which the spindle is properly adjusted. Let it stand ten hours to harden before attempting to remove it. Large rollers require longer to harden than small ones.

(15) S. M. asks (1) for the name of a work treating on air pumps. A. There is a good article on the subject in Knight's "Mechanical Dictionary." 2. I desire to make bicarbonate of soda, and would like to get acid from my boiler fire, and think I might draw it by connecting a tight cylinder by a pipe with the fire and allow the carbonic acid to enter at top of cylinder and go to bottom of, say, four feet of water, and by pumping the air out of top of cylinder creating a vacuum, and thus causing the carbonic acid to flow in and wash it in passing through the water. A. The carbonic acid from the combustion of coal under an ordinary boiler contains much sulphurous acid and various hydrocarbons, beside this difficulty, the solution of soda must be kept cool to admit of the absorption of the gas to form the hydro (bi) carbonate.

(16) G. H. A. asks: 1. Would an ordinary oil stove furnish enough heat for a boiler large enough to supply with steam an engine large enough to run a steam carriage that would carry two persons on good roads? A. No. 5. How large an engine would be necessary? A. Probably 3 inch cylinder and 6 inch to 12 inch stroke, depending upon whether geared or not. 3. Would not a boiler built in the sectional plan be better (make more steam with less heat, and be safer) than an ordinary tubular boiler? A. Yes.

(17) W. H. C. asks for a recipe for an invisible ink so that it will only show when heated. A. Dilute a strong aqueous solution of pure chloride of cobalt with water, until, when written with, the characters are invisible after drying at ordinary temperatures. Heat develops a dark blue or purple color. Use a clean pen and sheet of blotting paper.

(18) C. G. asks: 1. Is it possible for feed water to enter a boiler too hot? A. No. 2. Since using a new system of heating feed water, we have been troubled with constant foaming of the boilers, and a gauge cock which is located in the side of mud drum shows at all times half water and half steam. We use river water, and clean out regularly, and until inauguration of heating water by this new system never had any trouble. The water is quite at 200° on entering the force pump. We enter at mud drum. What would be the effect of putting feed water in at water line or above? Give us your views, and tell us the cause of our trouble. A. We think that if you enter the feed water into the body of the boiler nearer the surface of the water you would be relieved of your trouble.

(19) C. D. R. asks: Will a boiler made from galvanized iron be strong enough to run an engine one inch bore by 3 inch stroke, for experiment? A. Yes, if the iron is of proper thickness; but galvanized iron is very poor stuff for the purpose, and should be thicker than if vulcanized.

(20) J. L. asks: What is the simplest way to find out the distance the tail piece on a lathe should be removed from its central position to turn a given taper? Supposing I have a piece of steel one foot long, taper required one-tenth of one inch to every inch, how far would I have to remove the center from its central position? A. Set over the tail center one-half the total taper in the whole length; if it is one-sixteenth of an inch difference of diameter in a piece twelve inches in length, set over the tail center half of twelve-sixteenths or three-eighths of an inch.

(21) C. J. H. writes: In making quantitative blowpipe assay of gold and silver ores, charcoal is

recommended for a support in the first fusion of the assay. It is often quite difficult to procure good coals for the purpose, especially when on a prospecting trip. Is there not some kind of material from which small capsules can be made for the purpose, which can be used an indefinite number of times, and which would be equally as good as charcoal? A. We know of no support that will serve as a good substitute for the coal. A small bone ash cupel will answer in some cases.

(22) R. G. asks: 1. What is the weight of a foot of water in pipes from one-sixteenth of an inch to one inch in diameter? A. The weight of one cubic foot of fresh water is 62½ lb. and from this you can estimate the weight of water of any diameter and length of pipe. 2. What is smallest water meter under a 20 foot head that it would be possible to drive a sewing machine with at the usual rate of speed? A. You should apply to a maker of turbine wheels. The size depends upon the construction of the wheel and the manner in which the water is applied.

(23) A. W. C. writes: I have a coil of half inch steam pipe (iron) to be used for a boiler which opened in two places in the weld in coiling. Can you tell me how to repair it? A. Either braze up the opening in the pipe, or close it up as close as possible with a hammer and bolt a sleeve around it, with cement for a joint.

(24) L. K. S. asks: When were ships first copper bottomed? A. Fincham's history states that it was in the year 1553 that metal sheathing was first applied.

(25) C. D. W. asks in what cities on this tontinent other than horse power is used on street railways, also what power is used in cities you may name, whether steam, electrical, or compressed air? A. Compressed air engines have been tried in this city, but we believe they are not now in practical operation. At New Orleans, steam produced from highly heated wat r tarried in tanks or fireless boilers is used. In San Fra cisco cars are drawn by endless ropes drawn by stationary engines, and we understand that Cincinnati is about to apply the same principle. In Philadelphia and in Brooklyn on many of the streets of the outskirts cars are drawn by steam locomotives of peculiar construction.

(26) E. H. A. asks: What is the weight of a blow given on a pile from a hammer weighing 1,700 lb. and falling 24 feet? A. 29·8 tons.

(27) "Cameo" asks whether a cameo is any kind of stone, cut in relief, or whether it is necessarily a precious stone. A. "A precious stone carved in relief."—Webster. "A precious stone or shell having an imitative design engraved upon it in bass relief, or figures raised above the surface."—Worcester.

(28) C. G. A. writes: I am about to construct some wooden trays with perforated bottoms, to hold fish eggs. They are to be placed in a tall pile, one over the other in the air, and be supplied with water in small quantity, which shall dip down through the whole series. I want a varnish or other preparation which shall be proof against the action of the water, and shall protect the wood from it and also prevent the wood exuding any hurtful juices. Is there any better mode than to varnish well with asphaltum? A. Give several flowing coats of good asphaltum varnish thinned with oil of tupentine somewhat and let them dry thoroughly before wetting.

(29) W. H. P. asks: 1. Can the electric light and other phenomena produced by a current from a Gramme machine be produced by the current of one or more induction coils? A. No. 2. If not, why not? A. Because the secondary current is of necessity intermittent and of very high tension. The machine referred to produces a quantity current which is requisite for the electric light.

(30) B. R. D. asks (1) how to proceed in the manufacture of aluminum. A. Alum is dissolved in hot water, a certain proportion of carbonate of soda is added, and the whole evaporated to dryness. In the manufacture of aluminum alloys this preparation is simply added to the metals—copper, tin, zinc, nickel, etc., fused in a covered crucible, and vigorously stirred in while the heat is continued, with care to exclude the air as much as possible. For gold colored aluminum bronze: 2 lb. copper is melted, and to it is added 1 lb. of the soda alum mixture and 6 oz. oxide of zinc. Cover, stir, and heat for about 15 minutes. 2. A foreign journal says: "1 oz. of charcoal, 3 oz. of salt, and 1 lb. of the oxide of aluminum put in a covered crucible and kept in the fire from 15 to 25 minutes at about 700° Fah." I wanted some to-day for an experiment, and failed. I inclose a sample of what I got. A. Too large a quantity of charcoal powder or too small a quantity of aluminum oxide (calcined) was used in your experiment. Reduce the materials to a powder that will all pass through a 90-mesh sieve, first having dried all thoroughly. Mix thoroughly, cover well in the crucible, and give a better heat. 3. Have I the right to make for an experiment? A. Yes. 4. What is the lifting power of the magnets in the best electric machines per horse power? A. Probably 200 lb. There is no fixed limit.

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

S. H. H.—Chrome iron ore, worth assaying.—A. F. B.—Nickeliferous pyrites—of some value.—T. P. C.—1. Lead sulphide (galena), argentiferous, in quartz and limestone. 2. Galena in limestone. 3. Pectolite—a lime potash soda silicate with a little galena. 4. Magnetic iron oxide—magnetite or loadstone. 5. Trap rock. 6. Clay. 7. Quartzite.—F. B. M.—Sandstone—no value.—T. S. B.—Ferruginous sandstone—contains nothing of value.—G. M. W. and G. M. D.—An impure ocher. If ground and calcined would make a cheap pigment.—W. K.—1. Quartz carrying a small quantity of argentiferous sulphurets. 2. Gold quartz. 3 Quartz, gypsum, and iron sulphuret. 4. Micaceous and garnetiferous quartz. It carries a small quantity of copper and iron sulphurets, and some of it may be argentiferous. 5. Quartz, fluorite, and zinc oxide.

NEW BOOKS AND PUBLICATIONS.

AYER'S ALMANAC FOR 1881. IN ENGLISH, GERMAN, DUTCH, NORWEGIAN, SWEDISH, FRENCH, SPANISH, PORTUGUESE, AND BOHEMIAN. Published by Dr. J. C. Ayer & Co. Lowell, Mass.

We are in receipt of a neatly bound set of the various editions of Ayer's Almanac, as above, containing not only specimens of the languages above named, but also some pages of Turkish, Armenian, Greek, Bulgarian, and Chinese. The collection before us is a literary curiosity, and a remarkable example of enterprise and liberality. The annual edition is from ten to eleven millions, for free circulation.

SEWING MACHINERY. By J. W. Urquhart. London: Crosby, Lockwood & Co.

Gives a brief history of the principal sewing machine inventions, with details of construction and directions for adjusting the leading machines of the several types.

THE STATELY HOMES OF ENGLAND. By Llewellynn Jewitt and S. C. Hall. Two series in one volume. 8vo, pp. 399 and 360. New York: R. Worthington.

Thirty-one of the more notable of the historic castles, halls, and other "stately homes" of England are here pleasantly described and pictured by means of three hundred and eighty engravings on wood. The text is uncommonly good for a work of this class. The homes portrayed are rich in historic interest, many being ancient and all the seats of history-making families. The sketches were originally prepared for the pages of the *Art Journal*, but have since been considerably enlarged.

TOMLINSON'S HANDY BOOK FOR THE OFFICE AND HOME. Chicago: John H. Tomlinson. 8vo, paper.

The author has compiled from various sources a considerable amount of information and practical advice touching business affairs, social conduct, and so on.

MODERN ARCHITECTURAL DESIGNS AND DETAILS. New York: Bicknell & Comstock. Price $3.

Embraces plates 17–24. Low priced Queen Anne cottages, summer houses, and sea shore houses, with elevations, framing plans, exterior and interior details, and window sash.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

January 11, 1881,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, 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. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Aerial navigation, machine for, E. A. Pearse 236,619
Air compressor, J. H. Quinn 236,455
Animal matter, process of and apparatus for treating, A. & E. Lister 236,070
Animal trap, G. W. Reagan 236,456
Anvil and vise, combined, A. L. Adams 236,526
Apple corer and cutter, E. D. Baldwin 236,477
Areas, vaults, etc., covering, lighting, and ventilating, T. Hyatt (r) 9,534
Auger lip, detachable, Adams & Robertson 236,401
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Bale ejector for presses, L. Miller 236,609
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Blind, rolling and flexible, J. G. Wilson 236,651
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Boneblack furnace, discharging apparatus for, E. K. Richards 236,458
Book, account, W. C. Lovell 236,602
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Boot and shoe nailing machine, H. P. Fairfield 236,568
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Carding machine, G. Bernhart 236,408
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Carpet stretcher, F. M. Draper 236,421
Carriage seat, extra, C. Hall 236,428
Cartridge shells, apparatus for resizing, uncapping, and capping, R. Morris 236,611
Cartridge shells, tool for extracting, A. Paul 236,617
Centrifugal ventilator or pump, E. D. Farcot 236,423
Chain conveyer, P. Keene 236,438
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Check row lines, anchor for, G. D. & L. L. Haworth 236,581
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Churn, rotary, Kinyon & Brown 236,500
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Cider press, H. S. Tompkins 236,467
Cigarettes, tobacco form for, M. Pacholder 236,510
Cock, stop, J. & J. Broughton, Jr 236,543
Collars, machine for pressing unstarched, I. P. Turner 236,653
Collars, shaper for horse, W. H. Bustin 236,547
Convertible chair and hammock, S. R. Robinson 236,630
Corset, J. H. Foy 236,571
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Cotton gin, E. C. Horne 236,591
Cotton gin, M. E. Pratt 236,623
Cradle, oscillating, F. H. Brown 236,545
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Cultivator and horse hoe, J. Forbes (r) 9,530
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Gems, method of and device for connecting, A. Schaffer 236,513
Glasses, mechanism for grinding bands upon the surfaces of wine, J. B. Higbee 236,432
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Spark arrester, J. J. Kean 236,477
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Velocipede, J. Pullen 236,454
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Vise, saw, S. O. Parker 236,451
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Washing machine, A. R. Steelsmith 236,647
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Coffin handle socket, W. M. Smith 12,122
Oil cloth, C. T. & V. E. Meyer ..... 12,114 to 12,119
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Stove, Bascom & Heister 12,108
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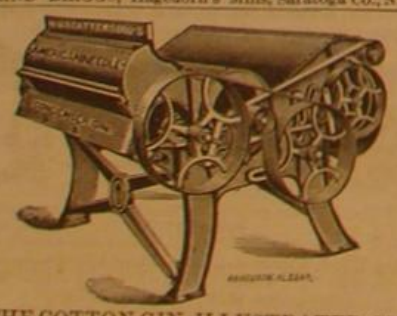
CHARLES R. BUCKLAND,
Acting Secretary.

SYDNEY, 24th November, 1880.

WANTED.—A situation in a Machine Shop, or to set up Steam Engines; can give references. Address HOWLAND BRIGGS, Hagedorn's Mills, Saratoga Co., N. Y.



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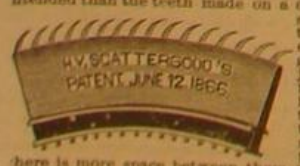

Fig. 1, the complete machine, gins, cleans, and passes the cotton through the condenser in a continuous sheet or bat, which may be handled from the gin to the press without loss. As a flue gin it is superior to the saw gin—gins faster and gives a greater yield of cotton.

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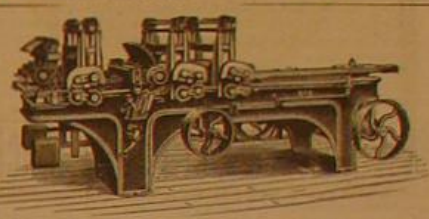

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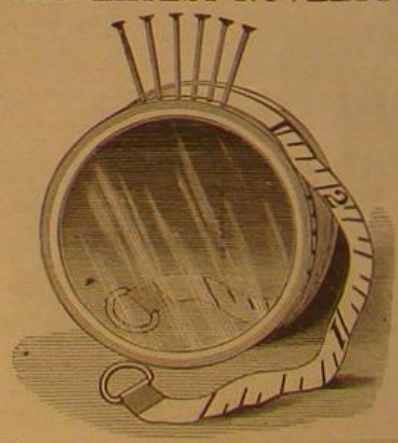

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Vol. XLIV.—No. 8. [NEW SERIES.]] NEW YORK, FEBRUARY 19, 1881. [$3.20 per Annum. [POSTAGE PREPAID.

AMERICAN INDUSTRIES.—No. 66.

BARREL MACHINERY.

Our commodities are handled and stored to a great extent in packages which may be classed under the general head of barrels; these packages are cheaper, stronger, and easier handled than other forms, and in many instances they are the only practicable package. Oil, liquor, pork, flour, sirup, sugar, and many other articles that could be named are almost without exception packed in barrels. The enormous demand for packages of this class have rendered their manufacture one of the leading industries of the day.

Not many years ago barrels were made almost exclusively by hand, but in this, as in all other manufactures of any magnitude, machinery has been demanded and is now furnished for the majority of operations in barrel making, and as a consequence the article has been both improved and cheapened.

In the manufacture of machinery for making staves, heading, hogsheads, barrels, and kegs, Messrs. E. & B. Holmes, of Buffalo, N. Y., undoubtedly take the lead, their machines being in use the world over.

Our engravings represent several of these machines of the most recent and approved styles. We understand that this firm make some forty different machines for the manufacture of barrels.

Fig. 1 shows a machine for dressing staves on both sides for beer kegs, barrels, and heavy casks. It takes the stave out of wind, and does heavy work that has heretofore been done by hand. This has been greatly needed, and is of great value to makers of casks. It receives the stave in the rough rived state, and while dressing both sides of the stave simultaneously, brings it to an even thickness, and takes all of the wind and crook out of it. It is contrived so as to save all of the timber that can possibly be saved, and will dress the staves as rapidly as the attendant can put them into the machine. After being dressed in this machine the staves are passed through the inside stave dresser, shown in Fig. 2, which hollows out or thins from the inner side of the central part of the stave, leaving it of the original thickness at the ends. This machine is more especially designed for preparing staves for beer kegs, barrels, and other large and heavy casks, the idea being to leave the ends of the cask full thickness to receive the heads, while the central portion of the cask is made thinner to increase the capacity of the cask and to allow the staves to be drawn into the barrel form with the application of less power and with less breakage than with staves of the usual form. This machine is very rapid in its operation, finishing with ease 6,000 staves a day.

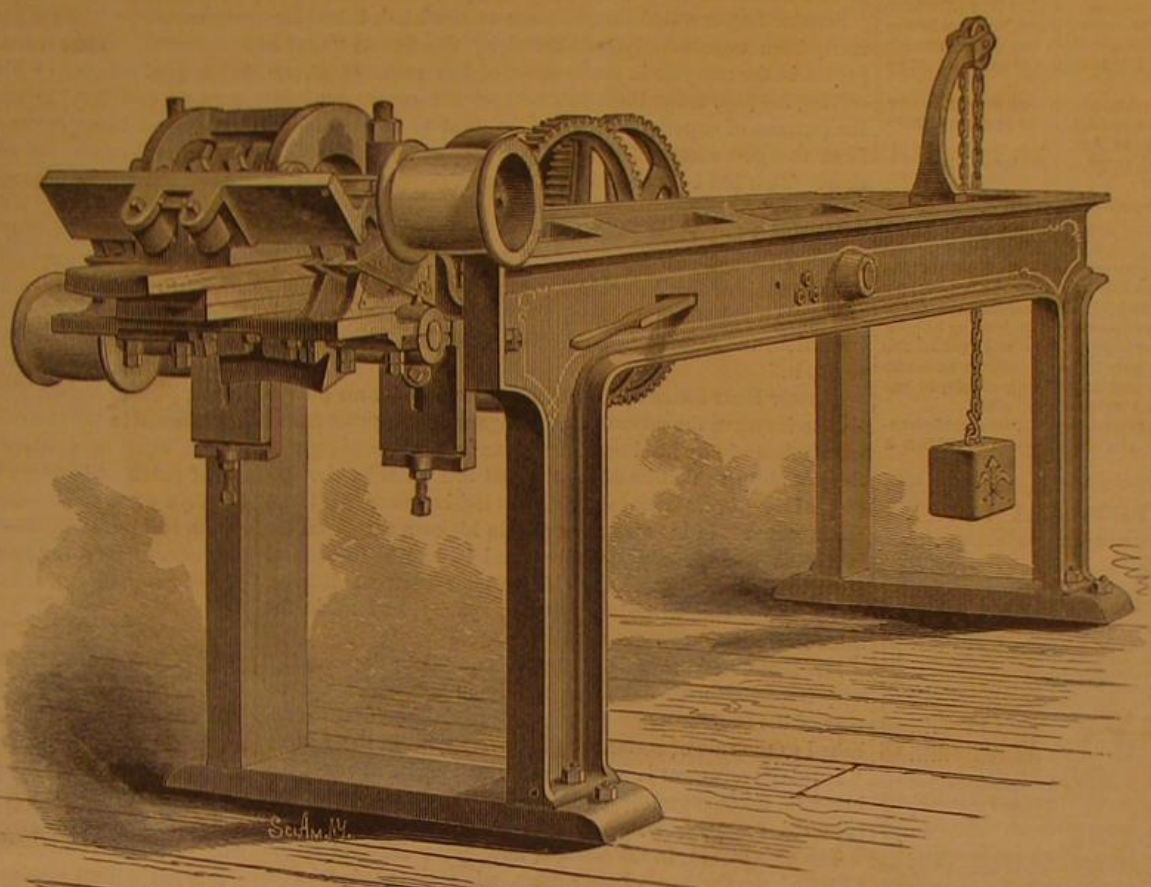

Fig. 1.—MACHINE FOR DRESSING STAVES FOR BEER KEGS BARRELS AND CASKS.

The next machine in the order of sequence is the combined fan and stave jointer, shown in Fig. 3. It is capable of jointing staves of different lengths and thicknesses, and will work equally well on rived and sawed staves, taking out all winds and crooks by means of the powerful clamps attached. The capacity of this machine is 8,000 staves per diem.

The casing inclosing the jointer wheels is constructed so that it makes an exhaust fan of the machine, which carries the savings through suitable conductors to any desired distance. This machine joints staves for all kinds of casks for oil, spirits, sirups, etc., also for beer kegs and barrels, and finishes the stave ready to set up.

The machine shown in Fig. 4 is for drawing the staves together at one end of the cask after the other ends of the staves have been set up in the head truss hoop. This machine is operated by screw power, and will draw together the most stubborn casks, and is adapted to various sizes. An expert operator can windlass from 1,200 to 1,500 barrels per day on this machine. The wire rope being placed around the cask and the power applied, the staves are very quickly brought together, when the remaining truss hoop may be put on, when, by depressing a foot lever, the cask is instantly relieved, and the machine is ready for another.

Messrs. E. & B. Holmes make a truss hoop driving machine (not shown) which drives the truss hoops with such power as to compress the wood of the staves and make perfectly tight joints.

[*Continued on page* 114.]

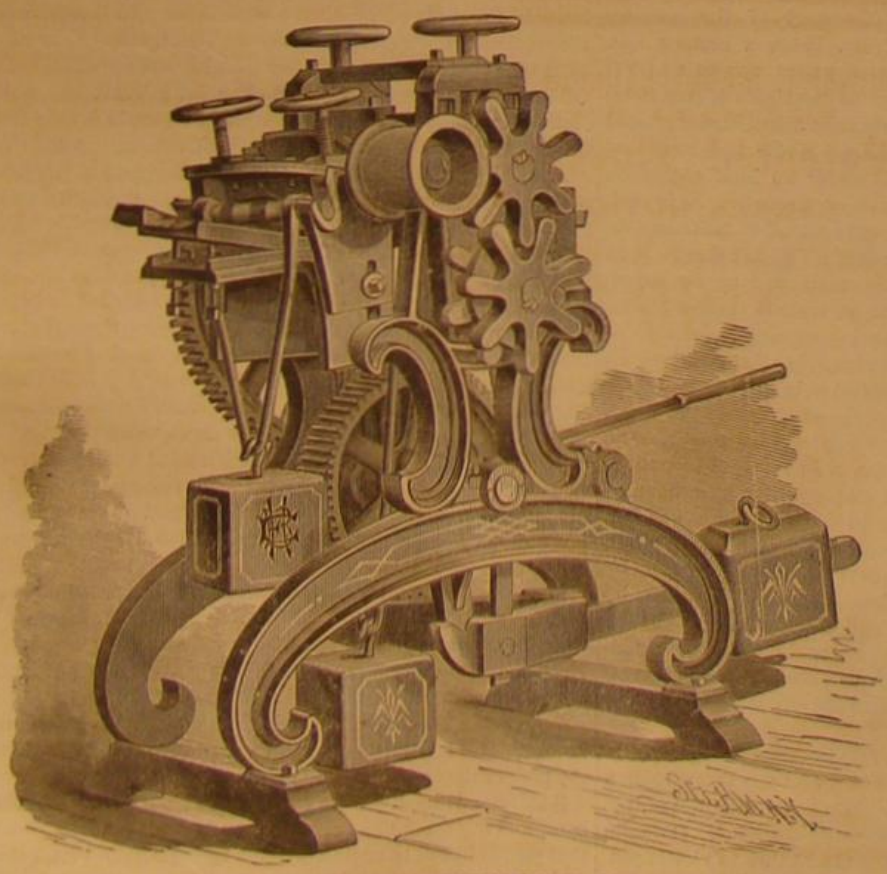

Fig. 2.—MACHINE FOR HOLLOWING STAVES FOR BEER KEGS, BARRELS, AND CASKS.

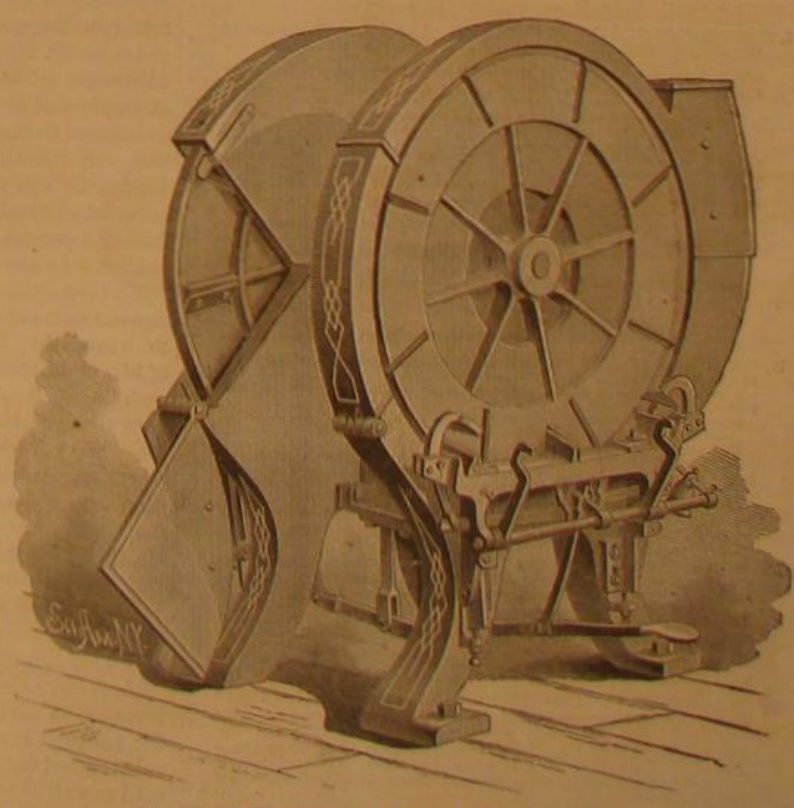

Fig. 3.—COMBINED FAN AND STAVE JOINTER.

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Scientific American.

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NEW YORK, SATURDAY, FEBRUARY 19, 1881.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 268,

For the Week ending February 19, 1881.

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RIGHTS OF PATENTEES WHILE IN THE EMPLOY OF THE GOVERNMENT.

This subject has been brought before Congress, through the introduction of a bill (S. No. 730) for the relief of Mrs. S. A. Wright, widow of the late George Wright, who (as it appears from the report of the Committee on Patents), while he was employed as master machinist in one of the government shops, invented and patented an improved linch-pin for field artillery carriages. The invention was adopted by the Ordnance Department, in September, 1863, and has since been used by that department.

The invention consists in forming the top of the linch-pin with a hook which turns down over the end of the axletree and prevents the linch-pin from coming out, affording security against the accident of wheels coming off from field artillery in traveling rapidly or over rough ground. As no compensation was ever received by Mr. Wright or his heirs from the government for the use of this invention, the committee recommended the passage of the bill. A lively and somewhat protracted debate ensued, in which many senators took part.

Senator Logan stated that, in cases of this kind, it had formerly been unanimously considered by the Senate "that a person in the army or in the employ of the government, receiving his pay, using the machinery of the government for the purpose of experimenting, had no right to compensation from the government for any invention made during that time. That has been the rule for years in the Senate and in Congress."

Senator Platt considered the rule well established "that where an employe of a private individual, using the time and the tools of that individual, a manufacturer for instance, has made a valuable invention, while the patentee owns his invention, the manufacturer has a kind of equitable license to use it."

Senator Hoar assumed that Wright "was under no obligation to improve the government's wagons or the government mechanism of any kind any more than any other citizen of this country; so that he did not invent this while in the employ of the government in any correct legal sense of that term. He invented it in his own right and in his own time, and the invention was his own property, and is just as foreign, as alien to that employment as if the Senator from Illinois, twenty years ago, when in a private capacity, had made the same invention."

Mr. Hoar, in further discussing this question, deemed it a very important matter that the principle upon which the report of the Committee on Patents was made should be established as the rule of action for the government in the future. "If this government is to excel other nations in war as it has in peace, it cannot afford to do without the resource of the inventive faculty of its people."

The case would, in his opinion, have been different if the Chief of the Ordnance Department, whose duty it is "to recommend, to direct, to improve the construction of ordnance for the use of the government, had made the invention patented by Wright. In the exercise of his mind upon a question like that, that officer would be in the employ of the government, because it would be exactly in the line of duty which he is paid by the government to perform.

Senator Conkling's opinion was, that if any person in government employ made an invention not within the hours of his employment—*i. e.*, out of hours—in that case he ought to have the benefit of his invention.

Mr. Conkling opposed the bill, chiefly because he thought it questionable whether Wright was the original inventor of the linch-pin in question.

This discussion betrays, on the part of the senators named, with the exception of Mr. Hoar, a curious misapprehension of the spirit of our patent system and the ruling of the courts with regard to the rights of patentees; and even Mr. Hoar might properly have taken higher ground with respect to the duty of inventors. While it is true that an employe of the government is under no legal obligation to improve the means and materials of the service, he is still, like every other good citizen, morally bound to make any invention he can for the public good. The fact that he is in government employ, however, or is employed by an individual or a corporation, is no bar to his right to control his invention if he chooses to take out a patent for it.

Mr. Conkling errs in assuming or implying that an inventor's right to take out a patent and control it is limited to inventions made "by the application of time not within the hours of his employment" by another. The patent law prescribes no such limit. It asks no question beyond the fact of invention. How the inventor was otherwise employed, or by whom, or for what purpose, has nothing to do with the case. The patent is issued to the inventor on his complying with certain conditions which make no reference to his employment by the government or anybody else. The position taken by Mr. Platt is, therefore, widely and mischievously incorrect. Unless the inventor has agreed to assign the patent of any invention he may make to his employer, the latter has no legal claim upon it, no matter what were the circumstances under which the invention was made.

If, as Mr. Logan states, it is a rule in Congress to deny to inventors in the employ of the government any compensation for patented inventions it may choose to make use of, the rule is a bad one and should be speedily amended. It is absurd as well as unjust for the government thus to violate contracts entered into with it in good faith by its citizens. We are of the opinion that the Senator must be entirely wrong in the assertion he makes; for how could one branch of a legislative body pursue the policy of overriding laws made by both houses and sustained by the highest judiciary of the land? That Congress as a whole would have as little right to infringe the property rights of an inventor, whether in government service or not, or to authorize an officer of the government to use without compensation a patented invention, is equally clear.

The clause of the Constitution (section 8), which provides for the issuance of letters patent for new and useful inventions, expressly provides that the inventor shall have the exclusive control of his invention. The letters patent, bearing the seal of the United States, explicitly describe the exclusive ownership of the patentee. The grant reserves nothing for the government. The property right covered by the patent is exclusive and absolute throughout the United States, and can no more be invaded without compensation by the government than any other property. This has been the ruling of the courts, and the rule was recently reaffirmed by the U. S. Circuit Court, Southern District of New York, in the case of Campbell *vs.* James *et al.*

In this case a patent had been infringed by an officer of the government. The defendant claimed that there was no infringement; that he had acted as an officer of the government in the performance of his duties for the benefit of the government, and that the monopoly granted in the patent did not extend to or cover any use by the government. The court ruled otherwise, and held that a patented invention, like all other private property recognized by law, is exempt from being taken for public use without just compensation by the supreme law of the land, and that such property cannot be taken by any officer in time of peace, leaving the owner to seek compensation. Accordingly the defendant was declared an infringer and ordered to pay damages and costs to the amount of $63,000.

It is obvious that any policy like that said to be pursued by the Senate would simply encourage the officers of the government in the performance of unlawful acts; and (except in cases of military urgency) any arbitrary seizure or use of patented inventions, whether owned by a government employe or not, lays the infringing officer liable to prosecution and punishment—the exception made in cases of military necessity raising no bar, any more than with other species of property, to a lawful claim for compensation.

VACCINATION AND REVACCINATION.

The immunity from epidemic small-pox enjoyed by civilized communities, thanks to general vaccination, is to be preserved only by constant vigilance. With the flood of immigration pouring in upon us, largely from countries in which vaccination is not general among the poorer classes, our American towns and cities need to be particularly vigilant.

It is but a little while since an attempt was made to conceal the prevalence of small pox among a ship load of Italian emigrants on their arrival at this port; and our city barely escaped having the contagion thus dispersed in many quarters, and among a class indifferent to sanitary precautions. The frequent occurrence of the disease among the same people and others of a like social grade, at this season, is proof enough that the efforts of the sanitary police to quarantine infected incomers are not always so successful.

With our rapid railway communication it is easily possible for infected parties to travel long distances between the time of their exposure and the breaking out of the malady enough to betray its presence. In this way a neighboring city was lately infected by a party of Canadian operatives, who brought the seeds of the disease with them. In like manner the epidemic now raging in Southern Dakota appears to have been imported by newly arrived emigrants, and widely distributed among the French Canadian settlements by public funerals and other practices common to people ignorant of or indifferent to the proper treatment of contagious diseases.

A striking illustration of this wanton disregard of personal and public safety among people of this sort is given in the recent report of the New York State Board of Health. For some months small-pox has been very prevalent in and about Troy, particularly among the factory people of the adjacent towns. Eighty persons of this class attended an evening party masked. On unmasking for supper it was discovered that one of the dancers had varioloid eruption upon her face. The party was not to be broken up by any little thing like that, however, and the dancing continued until morning. Within a fortnight twenty-two of the eighty were down with the disease, and eleven others had contracted small-pox from them, only one case occurring outside the twenty-two families first exposed. Compulsory vaccination and other sanitary precautions were promptly enforced, and the epidemic was stamped out.

Similar cases of criminal indifference to the spread of contagion, though involving perhaps a smaller number at a time, have come to the knowledge of our City Board of Health, and the result is, as many as sixty cases of small-pox are now under treatment at Riverside Hospital. Sixty out of twelve hundred thousand is by no means an alarming number; still it is large enough to warrant especial care on the part of the community to guard against contagion.

Small-pox is relatively so rare among native born Americans, and anything like epidemic small-pox is so infrequent, that people not only neglect to have their children vaccinated early, but still more to have vaccination repeated when it has once been apparently well done. Not a few people have also been kept from having their children vaccinated by the absurd and often untruthful reports of anti-vaccinationists,

A vast amount of mischief has been done in this way by people who think they have the good of the community at heart. Against their extravagant and often baseless assertions our Boards of Health set overwhelming evidence that the frequency and virulence of small-pox have been greatly mitigated by vaccination wherever it has been systematically practiced. The records of Riverside Hospital, where the small-pox patients of this city are sent, show that the mortality among the unvaccinated is from two to three times as great as among those who claim to have been vaccinated; and it is well known that with a considerable portion of those who have been vaccinated the work has not been well done, or the protection has become diminished by time.

During the epidemic in Philadelphia ten years ago less than a quarter of the deaths among those who had been vaccinated were of those who showed a good typical scar.

Where re-vaccination had been carefully practiced the immunity from the disease seemed almost perfect, and in the few cases in which small pox was taken by such persons none died. The statistics on this head are instructive. The report of the physician in charge of the hospital for small-pox patients (Dr. Gunn) says:

"Among 2,377 cases of small-pox admitted during the epidemic, only 36 are said to have been re-vaccinated, of which four died. But by subjecting these cases to a careful analysis, we find as follows: Seventeen were re-vaccinated at a distant period, some as far back as thirty-one years; five had not been re-vaccinated until after exposure; seven were said to have been successfully re-vaccinated, but were unable to exhibit any cicatrices as the result; sixteen bore upon their arms very poor and uncharacteristic scars, some of which, indeed, were scarcely visible; five presented fair cicatrices; and only three cases were able to show good cicatrices. Of the four cases which died, two occurred among those without cicatrices, one among those re-vaccinated after exposure, and one among those showing poor and uncharacteristic scars. All the cases which bore upon their arms unmistakable evidence of successful re vaccination suffered from the mildest form possible of the disease. Indeed, three of these cases exhibited an eruption of doubtful character, and have therefore been recorded as cases of varioloid (?). The eruption on three others did not advance beyond the papular stage; and on seven it was barely vesicular. From the foregoing facts, we are fully prepared to earnestly and cordially recommend re-vaccination as a most necessary supplemental measure to the primary vaccination."

Evidence of this nature is abundant. And the surest way to prevent small-pox epidemics, or the popular alarm which attends threatened epidemics, is to vaccinate and re-vaccinate from time to time until no further "taking" is possible.

THE PETROLEUM BASINS OF WYOMING.

Prof. Samuel Aughey, who has recently examined the Shoshone and Beaver oil basins in the Territory of Wyoming, has just made a report to the owners, and from this we glean the following particulars in regard to these important deposits of petroleum. The Shoshone springs are 78 miles from the Union Pacific Railroad, and immediately north of Point of Rocks station. The extent of the basin is about forty acres. In past ages a lake of petroleum covered the entire basin, a fact which is now evidenced by a remaining covering of hardened oil. Within the basin there are now hundreds of points from which gas and oil are continually issuing. The land, claimed and held by a stock company, aggregates 400 acres, embracing all the old oil basin, and title has been secured under the United States mining laws. This company has sunk a number of shafts, which are now used only for the storing of oil. Prof. Aughey computes the amount at present collected and held ready for shipment to be about 1,500 barrels, but there are as yet no facilities for transportation to the railroad. He believes that the ultimate capacity and extension for production of this oil basin is very great, and that the quantity of oil stored away in these Wyoming reservoirs is greater than in more eastern localities. The oil is intensely black, the coloring matter being inseparable by any method or process as yet tried. Distillation of a small quantity gave 0.63 naphtha. There was 47 per cent of a kerosene, having 150° flash test. It then produced 32 per cent of a neutral and lighter colored lubricating oil, with 12 per cent of dry coke. The oil as it flows has a gravity of 20°. Its flash test is 294° and fire test 322°. Cold test 16° below zero. The Beaver oil basin is situated 25 miles directly east from the Shoshone, and in every respect seems separate and distinct from the latter. The oil which issues here is of a much lighter color than at the Shoshone deposits, varying from a pale yellow to a light mahogany. It has a gravity of less than 20°, and, as far as tried, has proved an extraordinary lubricant, with an excellent cold and fire test. Its odor is no more unpleasant than that of lard oil. Included and connected with these oil basins there exists a magazine of fuel, which for extent and value is extremely important. A very slight alteration in furnaces will admit of this hardened hydrocarbon as a fuel for general use. Even now, and surrounded by such vast deposits of lignites, it does not seem to be any too soon to call attention to a combustible of ten times the potency of coal for generating steam. It has, moreover, in its favor a saving of labor and expense in mining, and an advantage of 90 per cent of weight. There are millions of tons of this hardened oil near the surface in these two basins. Russia is already utilizing *her* hardened oils of the Caspian Sea in operating her railroads, and it is safe to say that the railway which crosses Wyoming Territory will not remain long unmindful of the rich and cheap deposit of fuel which lies so close at hand.

EXPERIMENTS WITH UNDERGROUND WIRES.

After a three months' test of their system of insulating telegraph and telephone wires underground, the national Subterranean Electric Company have applied for permission to introduce their system in Philadelphia. The company claim that when once introduced on their plan, telegraph, telephone, or other wires can be used in separate chambers, and that no disturbance of the pavement will be required for repairs or for additional wires. In the experiment referred to, in Camden, the telephone wires were, after three months' use apparently in as perfect condition as when first laid down. The plan embraces a system of terra-cotta cylindrical blocks, perforated lengthwise with several small holes, vitrified and lined with rubber. These blocks are laid end to end, cemented together, and form groups of pipes through which wires or cables are run. These pipes are laid in sections, at the end of each a sunken chamber affording workmen access to the pipes and wires for purposes of repairs or laying additional wires, which can be strung through the sections from chamber to chamber. The chambers are covered when not in use, and afford no obstruction to travel. The cost of the system is not given.

What is claimed as a cheap and durable system is under trial in Prospect Park, Brooklyn. The wires are strung in a trough of pine wood, into which is poured a mixture of pulverized glass, resin, and other ingredients made semi fluid by heat. In this compound, which becomes hard on cooling, the wires are hermetically sealed. It is claimed that the mixture has a very high insulating power, is durable, and sufficiently elastic to maintain its integrity under varying pressure. A bundle of wires of any length can thus be laid in sections without a break, and operated with a relatively small battery power, owing to the perfection of the insulation. The cost of the system is given at $1,500 a mile. The number of wires and the space between them are not given.

A more expensive and not altogether satisfactory system is used in London, where something like a hundred miles of underground lines have been laid. In this system the iron or earthen piping is in sections of 200 yards, separated by test and joint boxes. The cables are composed of 60 No. 18 copper wires insulated with gutta percha. The cost is given at about $7,000 a mile. The maintenance of perfect insulation is difficult, and when a fault occurs the whole cable has to be withdrawn and repaired.

A TELEPHONIC CONTROVERSY SETTLED.

An interesting controversy as to priority of invention has been going on before the Patent Office for the past two years between Alexander Graham Bell, the telephone inventor, and David Brooks, of Philadelphia, the well-known electrician. The invention in dispute was the use of a return wire on a telephone circuit, to prevent the noises of induction. On some of the city telephone lines the noise produced by induction from electrical currents is so great as to form a serious obstacle to the use of telephone instruments. If one attempts to listen there is such a loud bubbling noise heard, and such a mixture of clicks and other voices, which come in from the neighboring wires, that the principal satisfaction of conversing with one's correspondent is taken away. If the telephone wire passes in the vicinity of Western Union wires, on which Gray's harmonic telegraph instruments happen to be at work, then there is added to the general confusion of tongues a series of tootings or cat calls that are quite distressing to the ears of sensitive telephoners. Professor Bell and Professor Brooks discovered the remedy; it consists in using two wires on the telephone circuit instead of a single wire. If an extra wire, insulated, is stretched close alongside of the usual single wire, the extra being employed as a return circuit wire, instead of the earth, then all noise from induction disappears, and telephoning becomes a pleasure.

The Commissioner of Patents decides that the priority of invention belongs to Prof. Brooks, he having made the invention in July, 1877, whereas Bell did not make it until the end of August, 1877. But, more than this, Bell's date of invention must, by law, be carried forward to the date of the final enrollment of his English patent, May 18, 1878; as it is not allowable, in this country, so far as proofs of invention are concerned, for any applicant, if he takes a foreign patent before he applies for an American patent, to go back of the date of his foreign patent. Bell did not apply for his American patent until December 20, 1878. The Commissioner of Patents, therefore, reversed the decision of the Board of Examiners in Chief, and awards the discovery to Professor Brooks, to whom it clearly belongs.

Gilding Steel.

Polished steel may be beautifully gilded by means of the ethereal solution of gold. Dissolve pure gold in aqua regia, evaporate gently to dryness, so as to drive off the superfluous acid, re-dissolve in water, and add three times its bulk of sulphuric ether. Allow to stand for twenty-four hours in a stoppered bottle, and the ethereal solution of gold will float at top. Polished steel dipped in this is at once beautifully gilded, and by tracing patterns on the surface of the metal with any kind of varnish, beautiful devices in plain metal and gilt will be produced. For other metals the electro process is best.

Effect of a Galvanic Current upon the Absolute Strength of Iron Wire.

Some experiments made by G. Hoffmann to determine this point have recently been made public, and will perhaps surprise many of our readers, some of whom will expect to find that electricity has no effect upon strength, while others will be disappointed to find this influence so slight. The wires employed were very small, ranging from one-fifth to two-fifths of a millimeter in diameter. (One line is about equal to two millimeters.) A piece of each wire, one meter long, was clamped at both ends between steel plates, and thus suspended at one end while a scale pan hung from the other end, and in it were placed, at first, weights, then fine sand was poured in until the wire broke under the strain. The experiments were conducted between 68° and 77° Fah., and mostly after the passage of a current, a few, however, during its passage. Feeble currents were employed, and those as constant as possible, and with every practicable precaution. The duration of the separate experiments was almost always the same.

In every case there was an increase of strength, and when the passage of the current lasted three hours the weight requisite to break the wire was increased from twelve to ninety-two grains.

With increased time there was an increase of strength up to a certain maximum, which was attained in some wires sooner than in others. Thus wires which gained in three hours 12 to 28 grms., gained in twelve hours 23 to 44 grms., and in 25 hours 24 to 50.

With feeble currents the increase of strength for equal times was nearly proportional to the strength of the current. If the current was somewhat stronger this law did not hold any longer, owing to its heating the wire. The strength seemed to be greater while the current was passing than after it was broken.

Hoffmann thinks that while this increase of cohesive power was partially due to the heat generated by the current, the galvanic current itself played its own essential part therein. A. P.

Constipation.

Hall's Journal of Health thinks it is doubtful if consumption numbers as many victims as are stricken down by the various diseases that result from habitual constipation. True consumption is an inherited disease. It may remain always dormant, but when aroused to action, decay commences at a point circumscribed, and gradually extends—unless arrested—until so much of the lungs becomes involved that vital action ceases. The evils of constipation result from inattention to the calls of nature, and usually commence with children whose habits are not closely looked to by their parents.

The processes of nature are always active while life lasts. When effete matter is retained a moment beyond the time its expulsion is demanded, the system commences its efforts to get rid of it. When the natural egress is checked, the absorbents carry the more fluid portions of the poisonous mass into the circulation, and it becomes diffused throughout the body. The more solid or clay-like portions is forced into the lower rectum, where it becomes firmly impacted, thus cutting off the circulation in the small blood vessels, causing painful engorgements known as piles and hemorrhoids. A continuance of these troubles often results in fissure, fistula, or cancer. The trouble is seldom confined here. As a result of the blood poisoning we almost invariably find more or less dyspepsia, with decided derangement of the functions of the heart, liver, and kidneys, accompanied by headache and nervous debility, often verging on paralysis.

Coal Ashes for Fertilizing.

The use of coal ashes mixed into clayey soils has been found of great benefit, and its value is vouched for by many agriculturists. The *Husbandman* reports an experiment made with coal ashes, applied at the rate of 200 bushels to twenty square rods, or ten bushels to the square rod. The soil was compact and heavy. The ashes were drawn on late in the autumn and spread on the ground, which had been recently plowed. In the spring the plowing was repeated, thoroughly mixing the ashes with the soil. The ground was planted with garden vegetables. The beneficial result was in the correction of the heavy character of the soil, the ashes acting mechanically and not as a manure, and producing a satisfactory improvement.

Newspaper Telegraphs.

The desirability of having immediate and absolute control of telegraphic facilities in certain emergencies has led to the leasing of telegraph wires by newspapers. The London *Times* has some short ones; the New York *Tribune* has a wire between New York and Washington; the leading papers of Cincinnati are similarly connected with Washington; and recently the Chicago *Inter-Ocean* has taken what is probably the longest wire leased by any newspaper, connecting its editorial rooms with its news bureau in Washington. All messages are sent direct, the paper having exclusive use of the wire and employing its own operators.

TO MAKE ICE CREAM.—Scald a gallon of good sweet milk, and add to it with constant stirring eight eggs well beaten with one pound white sugar, and four spoonfuls of cornstarch, first mixed into a thick cream with cold milk. Cool, flavor to suit, and freeze.

BARREL MACHINERY.

[*Continued from first page.*]

Following this machine is the machine, Fig. 5, for chamfering, howeling, and crozing, which prepares the cask to receive the heads. It cuts the chamfer, bowel, and croze at one operation, making a perfect groove of uniform width and depth to receive the head. This machine has a capacity of 1,500 casks per day, and will finish casks of any size from one-eighth beer kegs to large casks, and is made for this range of work when so ordered. All of these machines are well made and are of great practical value.

Dynamo-Electric Motor.

The London *Mining Journal* states that at the Mannheim Industrial Exhibition over 8,000 persons have been conveyed at the rate of nearly three miles an hour by the electric lift of Dr. Werner Siemens, of Berlin.

The lift is quite safe, the cage being suspended by two wire ropes, which pass over drums, and carry counterweights to balance the ordinary average load. To raise or lower the lift, therefore, only a slight additional power is required. This is supplied in the form of an electric current from a dynamo-electric generator on the ground, and is conducted to a second dynamo machine attached to the carriage. The propulsion is effected by means of a metal ladder or rack, which runs up the middle of the shaft or passage of the lift, and into this rack work two toothed wheels carried by the lower part of the framework of the carriage. These wheels are driven by the revolving armatures of the dynamo machine on the car by means of an endless screw. The current is led from the stationary generator to the moving one by conductors running up the sides of the ladder and two metal rollers which make contact with them, and are connected to the armature of the machine. The return part of the circuit is formed of the metal wires by which the carriage is suspended.

The New South Wales Museum.

It should have been mentioned in our notice of the Technological, Industrial, and Sanitary Museum of Sydney, last week, that Messrs. Trübner & Co., 57 and 59 Ludgate Hill, London, England, will receive and forward to the museum any contributions that our merchants and manufacturers may choose to make.

RECENT INVENTIONS.

Mr. Joseph Sirnguey, of New Orleans, La., has patented an improved lock, so constructed that its keyhole may be adjusted to any desired position, thus adapting the lock to be attached to doors having key holes from former locks. The casing of the lock is provided with sliding plates in which are the keyholes, and which may be fastened permanently with screws when adjusted to the desired position. By employing two sets of plates, one of which has a barrel for a spindle-key and the other a spindle for a barrel-key, the lock may be fitted for use with any kind of key.

Mr. George F. Letellier, of Tye River Depot, Va., has invented an improved millstone dressing machine of that class which employs a pick, and may be adjusted to act from the eye to the skirt of the stone. The invention consists in improved means for tripping the pick lever for regulating the force of the blow, and for adjusting the pick over the face of the stone to any required position.

Mr. George W. Dudley, of Waynesborough, Va., has patented a rotary engine which dispenses with valves, sliding abutments, etc., operated from the driving shaft by means of cams, eccentrics, etc. Segmental pistons are employed and a novel reversing valve is provided.

A stump puller, patented by Mr. William O. Youngblood, of Cedar Springs, Mich., consists of a frame, two levers pivoted to the frame, and having eye-bolts to receive the pulling chains to apply the power to the hitch chain, two ropes and their guide pulleys for connecting the levers with the power, the shaft having the connecting ropes wound around it in different directions, and two rope wheels, the two draw ropes being wound in different directions around the rope wheels.

Mr. William R. Fearn, of Savannah, Ga., has patented a railroad switch which places the control of switches in the hands of the engineers or train men. The switch levers are connected to a rod extending in both directions from the

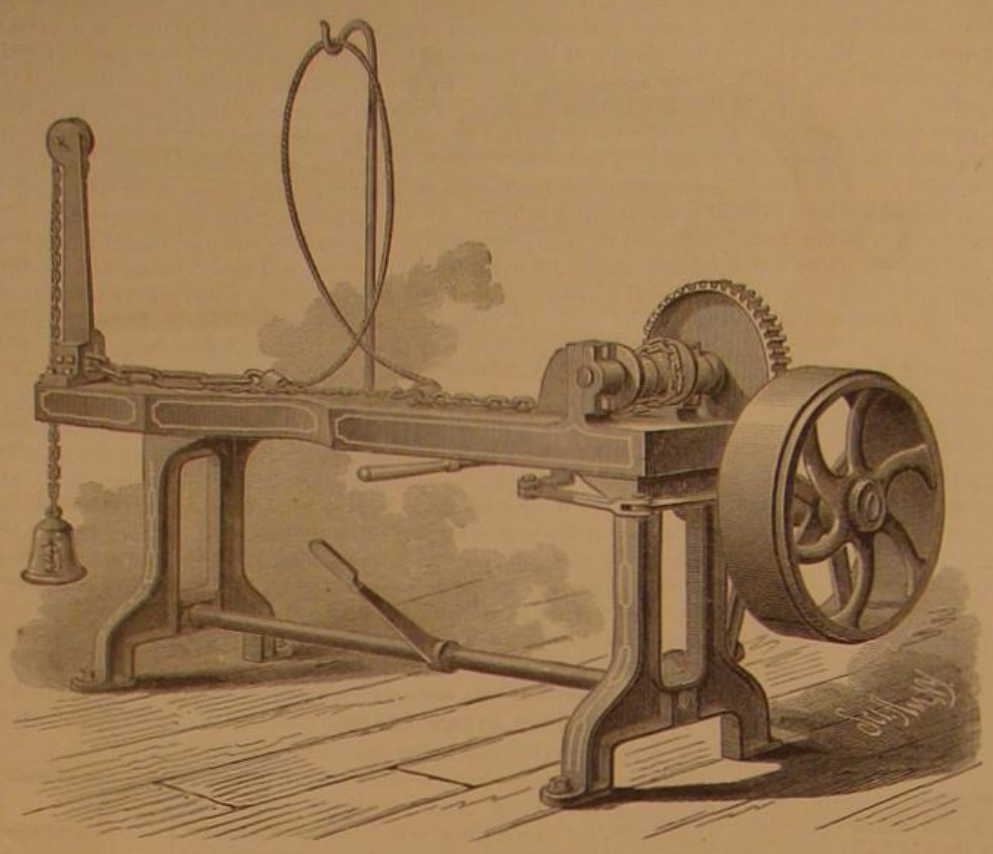


Fig. 4.—POWER WINDLASS FOR TIGHT AND SLACK BARRELS.

switch, and fitted with crank levers extending between the tracks. These levers are operated by a swinging block or key hinged to the lower end of a hanger that depends from the car or locomotive platform, and which is actuated by a lever and rod to switch the cars from one track to another as required.

Mr. John Gearon, of Beloit, Ia., has invented an improvement in scythe snaths, which consists in a scythe snath formed in three parts, halved to each other, secured at their junctions by bolts, and provided with handles. By this construction the parts are rendered adjustable to suit the convenience of the operator, and the proper position of the scythe relative to the handles is secured without the usual bending in the manufacture of the snath when formed in a single piece.

Mr. J. B. King, of St. Paul, Minn., has patented a calendar inkstand, which is simple in construction, and serves as a perpetual calendar. The inkstand has the numerals of the days of the month arranged in a table at the front, whereas the names of the days of the week and of the months are arranged on the outer surfaces of two cylindrical ink-wells fitted into corresponding chambers of the stand, each chamber being provided with a vertical slot in front, through which these names may be read

Mr. Albert G. Forster, of New York city, has patented a child's swing so constructed that the child cannot slide out of the swing while being swung and can be put into the swing quickly and easily

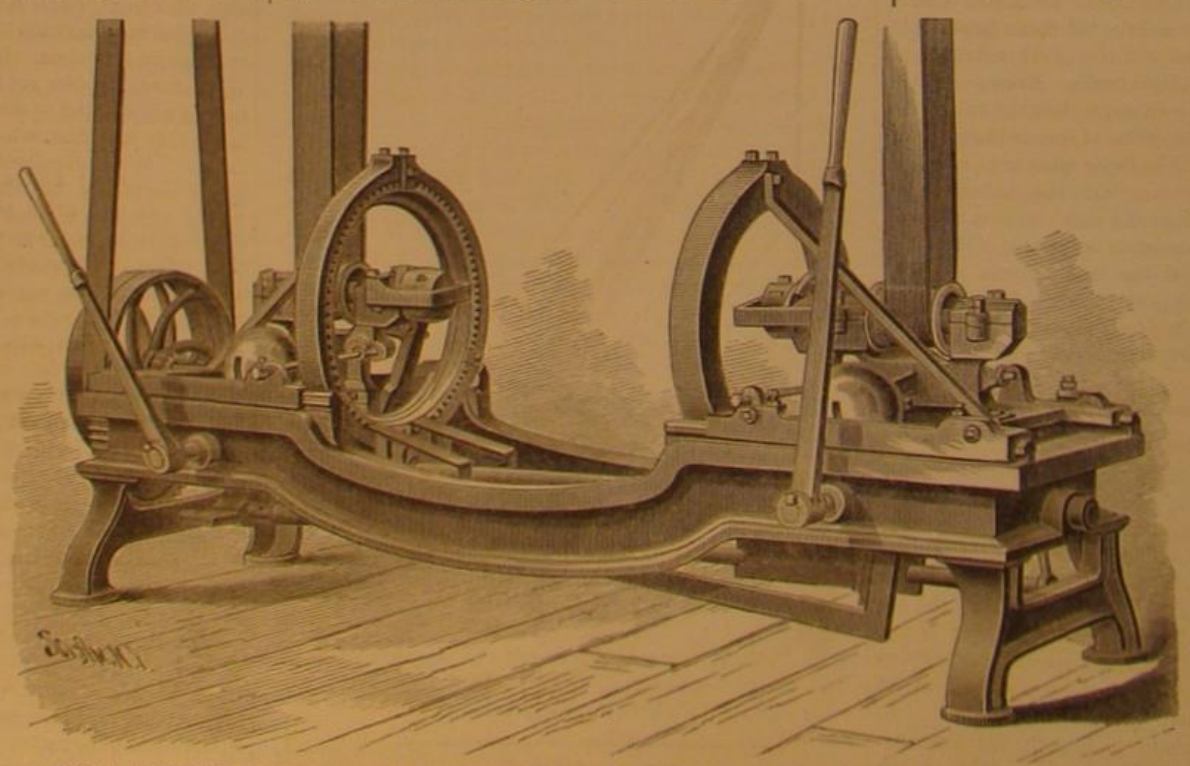


FIG. 5.—MACHINE FOR CHAMFERING HOWELING AND CROZING TIGHT AND SLACK KEGS BARRELS, AND CASKS.

Mr. William H. Peyton, of Iuka, Miss., has patented a combined shovel, tongs, and pot-hook. The extremities of the legs of the tongs are made with hooks for lifting pots, etc., and when closed they form the handle for a detachable shovel, which may readily be attached or detached.

Mr. John Casey, of Jersey City, N. J., has patented a check receiver for use in restaurants, bar-rooms, and other places to receive checks handed in by customers. It *not only* exposes to view all the checks inserted, but also exposes, in a series, a certain number of checks last received, before they finally enter the receiver, whereby if a wrong check be inserted the error or fraud may be detected.

Mr. Andrew Climie, of Ann Arbor, Mich., has patented an improved bolt for the locks of cases and drawers in museums, etc., where a number of doors or drawers are required to be locked at the same time. He employs a series of bolts with sockets upon the sides of their bases, a series of bearings, one or more *sliding rods carrying* the bolts, one or more bent levers, and one or more connecting rods, by which mechanism one or more series of bolts can be simultaneously operated.

Mr. Horatio Ely, Jr., of Red Bank, N. J., has patented a railroad signaling apparatus, which consists of series of self-adjusting rocking bars secured below the rails parallel to the cross-ties, provided with arms projecting upward on the outside of the rails in position to be struck by advancing trains. Motion is communicated by wires or rods connected with the rocking bars to signals or guards in advance of the trains.

Messrs. Anthony W. Byers and James C. Dorser, of Sherman, Texas, have patented an improved cotton planter so constructed that more or less seed can be planted as desired. A slotted hopper having a slotted feed-board controlled by springs, and a spiked feed-wheel supplied with prongs and curved plates, are the principal devices employed to accomplish the end sought, these devices being adjustable.

Mr. Jasper N. Blair, of Slippery Rock, Pa., has patented a car coupling consisting of a drawbar containing two longitudinally hinged spring-actuated dogs set a little apart, with their sloping faces presented toward each other, thereby forming a central wedge shaped opening into which the coupling link can be entered, caught, and held by the shoulders at the rear of the dogs. A segmental lever is employed for throwing the dogs apart in uncoupling the cars.

Mr. Eli C. Horne, of Jasper, Florida, has patented a cotton gin, which consists in a combination with a roller of a stationary superposed blade, yieldingly held to the face of the roll, and a subjacent reciprocating blade, having its upper edge arranged obliquely to the lower edge of the stationary blade. The cotton to be ginned is pressed by the reciprocating blade between the stationary blade and the roll, being fed thereto from a suitable feed-board.

Mr. Luther Homes, of New Orleans, La., has patented a grass-cutter so constructed as to cut the grass without any vibration or rotation of the knives as the machine is drawn forward, and which permits the knives to be readily detached and sharpened. The knives are constructed to yield to any undue obstruction. Short knives are arranged in oblique angular relation with two long knives, and the grass to be cut being drawn into the angles formed by the edges of the blades, is cut by the forward movement of the machine.

Mr. Robert J. Bowman, of Alexandria, Va., has patented an improved gang plow, planter, and cultivator, so constructed that it can readily be adjusted for either of the uses specified, and can be made equally effective and convenient in either capacity. A number of novel arrangements of detachable and adjustable devices accomplish the ends sought.

Mr. W. H. Hickok, of East Troy, Pa., has invented a ditching machine for opening blind and tile ditches. A long axle is mounted on two wheels and provided with a pole having a long double-tree. This enables the wheels and team to straddle the ditch. The mechanism is carried by the axle, and is

very ingenious, a shovel being caused to penetrate the earth, which it raises and delivers upon either side of the ditch at will of the operator.

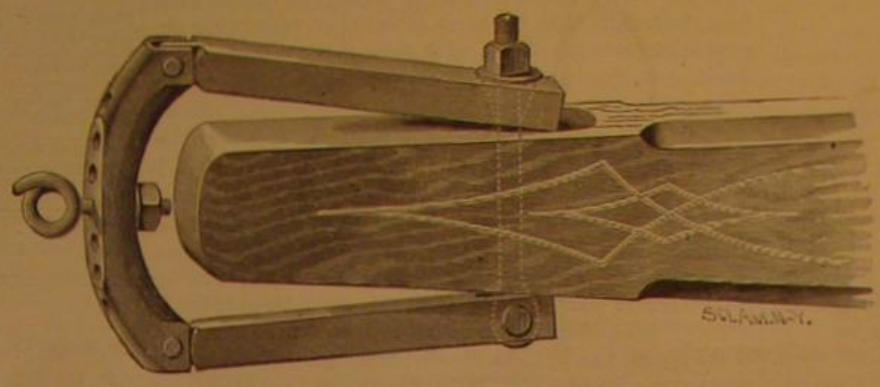
IMPROVED CLEVIS.

The clevis represented in the engraving is to be used on plows, harrows, and other agricultural implements. It may be readily adjusted to fit drawbeams of various dimensions, and may therefore be applied to any of the implements on a farm requiring a clevis. It consists of two bars hinged to opposite ends of a link, and connected with each other by a bolt which is pivoted to one of them and passes through the beam and through the other bar, and is provided with a nut which may be screwed down more or less to adapt the clevis to drawbeams of different sizes.

The curved link has several holes through it for receiving the hook to which the single tree or double-tree is attached.

This clevis may be applied to the beam horizontally, perpendicularly, or at any desired angle, either in front or at top or under the beam, as may be found most convenient.

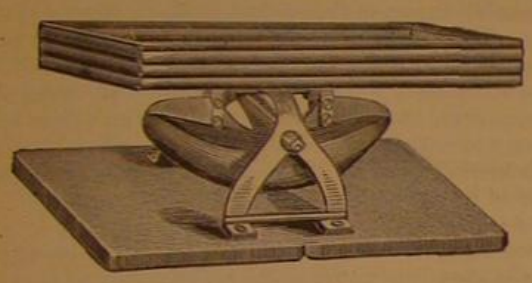
Further information in regard to this useful invention may be obtained by addressing Mr. S. K. Latta Dyersburg, Tenn.



JENNINGS' PLOW CLEVIS.

THE HUSTON SELF-LEVELING BERTH.

It is no new idea to suspend ship berths so that they will retain an even position at whatever angle the ship may be forced by the waves, and several steamship companies have tried and abandoned such devices In the SCIENTIFIC AMERICAN of May 29, 1880, notice was made of a highly promising exhibition of the Huston ship's berth on the City of Alexandria, plying between this city and Havana. It is gratifying to know that the opinion which we then formed, with regard to the ability of the invention to overcome the causes of sea-sickness, has been justified by the behavior of the berth under a great variety of conditions at sea.



THE HUSTON SELF-LEVELING BERTH.

It will be observed from our illustration that the berth (with its occupant) is counterbalanced by a crescent-shaped weight rigidly attached to the underside of the berth, while the whole is so swung on a universal joint as to maintain a level surface no matter how the vessel may pitch and roll. The motion of the berth is also regulated by rubber bands, so that sudden or jerky movements are made impossible. As will be seen in the subjoined cut the berth takes up no more room than the ordinary ship's berth. Even those who never suffer from sea-sickness will appreciate the value of a contrivance which enables them to lie at ease in the roughest weather; while to invalids, and to those who are certain to be martyrs to the distressing *mal de mer*, the advantage of being substantially independent of the ship's motion while on board ship is beyond one's power to estimate. Obviously the plan here described can, at the best, prevent sea-sickness only while the patient is lying down. It is very desirable that some one should devise a means of preventing sea-sickness absolutely. A fortune would surely be his reward.

Launching a Ship.

Not one-half the people who witness the launching of a vessel can tell how it is done. They hear a great sound of pounding and driving of wedges for half an hour or so, then a loud shout is raised, and the ship starts slowly at first, but, gradually increasing her speed, slides with a steady, stately motion from off the pile of timber and blocks where she has been standing for months; and where but a moment before the huge creature towered aloft, nothing remains but a *débris* of timber and planks, while out on the water floats one of the most graceful works of man.

When the ship is about ready to launch, her immense weight rest principally upon blocks some eight or ten inches square on the ends, and perhaps some fifteen or eighteen inches in length. These blocks are placed directly under the keel, and in order to launch the vessel it is necessary to transfer the weight of the vessel to the way—two long lines of heavy timber reaching about two-thirds the length of the vessel on either side, and about midway the bilge or bottom. These ways are simply two lengths of timber with a thick layer of grease between them, so that as soon as the ship acquires any momentum they will slip one along the other. To transfer the weight of the vessel on to these ways, so that gravity—the stern or heaviest part of the vessel being much lower than the bow—will cause her to move, is the whole secret of launching. To do this, between the top of the ways and the vessel are driven pine wedges, which, of course, raise her somewhat, and so relieve the blocks under the keel of part of the weight resting upon them. This done, workmen take their places under the vessel, and with iron wedges cut and knock away the blocks. When these are removed, the entire weight of the vessel settles at once upon the greased ways, and the result is exactly the same as would be if a person should seat himself upon a sled pointing downhill upon an icy slope—away she goes!

There seems to be a strange sort of fascination for most people in the launching of a large vessel, and in our shipbuilding ports it is not uncommon for a thousand persons to be present to enjoy the spectacle.—*George Bancroft Griffith, in Potter's American Monthly.*

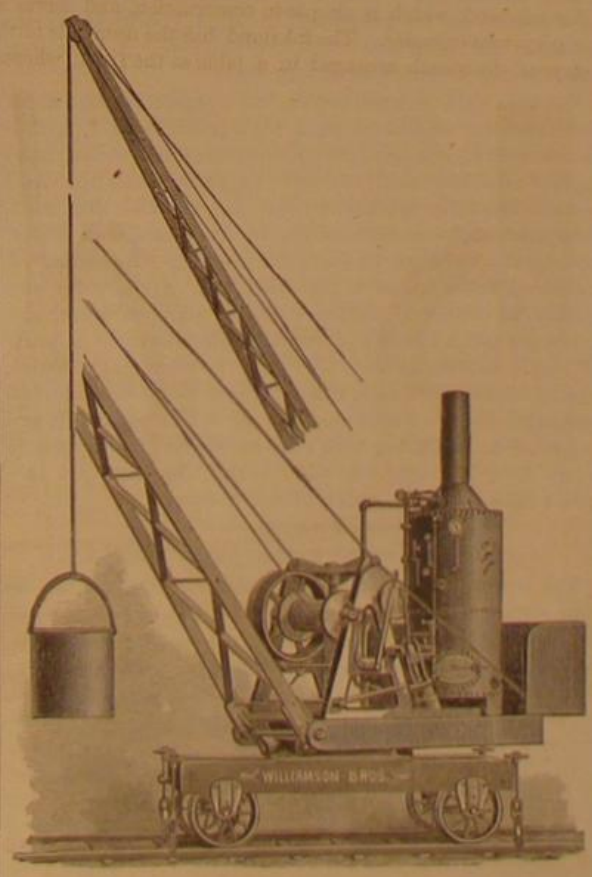
IMPROVED STEAM CRANE.

Handling heavy or bulky articles by sheer muscular force is becoming almost as rare where a great deal of lifting is required as it once was to handle unwieldy objects by steam, and in almost every place where any considerable amount of hoisting, loading, and unloading is required to be done, there steam is employed.

Our engraving shows a steam crane designed and built by Williamson Brothers, Richmond and York streets, Philadelphia, Pa., for the Edgar Thomson Steel Works. It is suited to unloading cargo, and has a double engine, which communicates motion to the winding drum through friction gearing. This gearing, which is very simple, has been successfully applied to a large number of cargo hoisting engines for ship use by this firm. One lever controls the hoisting, stopping, and lowering of the load.

The crane is revolved on its base by a double cone friction clutch, which admits of turning the crane in either direction without reversing the engine.

The carriage and the base on which the engine and boiler rest are both made of wrought iron. The jib, which is of wrought iron, is made longer than usual to meet the particular work for which the crane is designed.



WILLIAMSON BROTHERS' STEAM CRANE.

The engines of this crane are 6 bore, 8 stroke, and develop 12 horse power. The machine complete weighs about 7 tons.

Messrs. Williamson Bros. make similar locomotive cranes suitable for light or heavy work, with spur gear for hoisting, revolving, traveling, and altering the radius of the jib, and their large experience in this class of machines enables them to construct hoists adapted to any purpose for which they may be required.

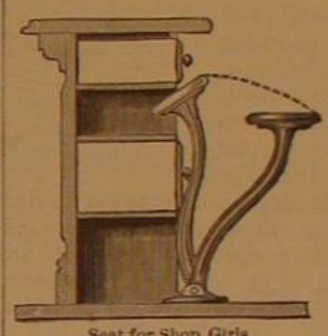
A SEAT FOR SHOP GIRLS.

Scarcely a season passes without a general protest against the common rule in our retail shops requiring saleswomen to stand at all times, even when not serving customers. Physicians have denounced the custom as health-destroying and cruel; ladies have combined to secure its abolition by withholding their patronage from shops in which the girls are not allowed to sit; and our daily newspapers have repeatedly inveighed against the practice and called for its abolition. Still it prevails; not because of any hard-heartedness on the part of shopkeepers, but for purely practical considerations. In the limited space between counters and shelves there is no room for fixed seats of the usual construction, and movable stools would be still more in the way. To widen the space so as to make room for stools would only increase the labor of those who have to handle the goods.

As in most cases of inconvenience and suffering, so in this, it is not the philanthropist or the sentimentalist who must be looked to for a remedy, but the inventor.

What is required is a seat which shall be simple, inexpensive, always at hand when wanted, and able to take itself out of the way when it is not wanted. A step in this direction has been made by an English inventor, who has patented the seat shown in the illustration herewith. The curved iron support carries a plain round seat of wood, and is hinged in the foot plate so as to be easily brought forward to be used or shut back against the counter when the attendant has to stand. It takes up but little room, and is evidently handy and serviceable.

It would be easy to make a stool for the same purpose that would take up still less room and be entirely automatic. The standard should be set in a narrow slot or recess in the counter, and the seat pivoted off the center so as to drop edgewise and enable it to fit into the slot for the standard. The foot-plate would thus be entirely out of the passage, and the seat top nearly so, when not in use. A bit of rubber under the forward part of the hinge of the base to be compressed when the seat is in use would suffice to swing the seat into its recess the moment the attendant rises. By this arrangement the seat top would not be in the way of drawers or shelves, as in the English plan; and the much desired relief would be afforded to the saleswomen with the least cost of counter space and no obstruction of the passage way.



Seat for Shop Girls.

We look to our enterprising makers of counters and other shop fittings to introduce some improvement of this sort.

Fatal Discipline.

Archibald Gibson, Second Lieutenant Seventh U. S. Cavalry, died in St. Paul, Minn., January 26. The cause of his death was inflammation of the brain, said to have had the following curious origin. One day, while he was on parade at West Point, a spider got into one of his ears. By the rules, he was not allowed to raise his hand, and stood in the ranks more than an hour, while the spider worked his way into the ear. When dismissed his ear was full of blood, and the insect could not be removed for two days. The injury caused him much trouble, but did not prevent his assignment to his regiment in Northern Dakota. After some service, Lieutenant Gibson returned to his home in St. Paul, intending to resign, but, really, to die. His death is charged to inflammation of the brain, caused by necrosis of the inner wall of the skull adjoining the ear, the result of the spider's invasion.

A Great Drainage Project.

It is reported from Florida that an agreement has been entered into between the State authorities and certain Northern and Western capitalists to drain Lake Okeechobee and the great swamp region southward known as the Everglades. The lake is about thirty miles by forty, and the entire area to be reclaimed is nearly twice as large as the State of New Jersey. The projectors claim that the drained land will make the best sugar country in the world. How they propose to accomplish the work is not stated. So long as the South has so much waste land suitable for sugar growing, without drainage, an undertaking of the sort described would seem to be rather speculative than practical.

How to Use Oil Stones.

Instead of oil, which thickens and makes the stones dirty, a mixture of glycerine and alcohol is used by many. The proportions of the mixture vary according to the instrument operated upon. An article with a large surface, a razor, for instance, sharpens best with a limpid liquid, as three parts of glycerine to one of alcohol. For a graving tool, the cutting surface of which is very small, as is also the pressure exercised on the stone in sharpening, it is necessary to employ glycerine almost pure, with but two or three drops of alcohol.

ELECTRO-METALLURGY.

GOLD DEPOSITS.

In the practice of electroplating with gold the bath employed is usually heated, as the deposits obtained in such a bath are more homogeneous, tenacious, and durable, and of a better color, besides which recommendation a greater quantity of the metal may be deposited satisfactorily from it in a given time than from a cold bath.

Owing to the cost of the metal to be deposited very large surfaces are rarely required to be electroplated, and as these baths become worn out and must be replaced by fresh solutions after a short time, they are usually, as a matter of economy and convenience, used in as small a vessel as the circumstances will admit of. These vessels may be of glass, porcelain, or porcelain-enameled iron. The latter serve the purpose admirably (if the enamel is good). They should be heated over the water bath or by means of steam.

The same bath does not answer very well for all metals—either the bath must be modified to suit the metal or the latter must be previously coated with another metal to suit the conditions. Gold deposits are obtained with the greatest facility upon silver or copper, their rich alloys, or other metals coated with them. With these a hot bath (at about 170° F.) and a moderately strong current give good results. With alloys, such as German silver, the best results are obtained with a weak bath, barely warm. Steel and iron, when not coated with copper, require an intense current and a very hot bath. Lead, zinc, tin, antimony, and bismuth alloys of, or containing much of these, are preferably coated with copper before electro gilding.

HOT BATHS.

For silver, copper, or alloys rich in these:

Distilled water	1 gallon.
Phosphate of soda, cryst	9½ ounces.
Bisulphite of soda	1½ "
Cyanide of potassium, pure	½ "
Gold chloride	160 grains.

Dissolve in a portion of the water, heated, the phosphate of soda. Dissolve in another portion of the water the bisulphite of soda and cyanide of potassium.

Dissolve the gold chloride in the remaining water, stir the solution slowly into the cold phosphate of soda solution, and finally add the solution of cyanide and bisulphite. The bath, now ready for use, should be colorless.

The cost of this bath is about $5 a gallon, and the metal can be deposited from it profitably at $2 per dwt. Used at a temperature of from 120° to 175° Fah.

BATH FOR IRON AND STEEL—UNCOATED.

Distilled water	1 gallon.
Phosphate of soda, cryst	7⅞ ounces.
Bisulphite of soda	2 "
Cyanide of potassium, pure	½ drachm.
Gold chloride	160 grains.

Dissolve as before. Heat to 175° or 180° Fah. Pass the second metal through the hot potash, then through dilute muriatic acid (acid 1, water 15), brush, and connect at once. Requires a very intense current at first.

The following baths work well with bronze and brass, but are not suited for direct gilding on iron or steel:

Distilled water	1 gallon.
Phosphate of soda, cryst	6½ ounces.
Bisulphite of soda	1½ "
Bicarbonate of potash	½ "
Caustic soda	½ "
Cyanide of potassium pure	½ "
Gold chloride	½ "

Dissolve all together, except the gold chloride, in the hot water; filter, cool, and gradually stir in the gold chloride dissolved in a little water. Heat from 120° to 140° Fah. for use. It requires an intense current.

Distilled water	1 gallon.
Ferrocyanide of potassium	5½ ounces.
Carbonate of potash, pure	1½ "
Sal ammoniac	½ "
Gold chloride	½ "

Dissolve as in the last, boil for half an hour, replace the evaporated water, and the bath is ready for use.

Distilled water	1 gallon.
Cyanide of potassium	2½ ounces.
Gold chloride	1 "

Dissolve the gold chloride in the water, then add the cyanide, and stir until solution is complete.

Baths of this kind are commonly used, and with little regard to temperature. They are simple in preparation, but are, unfortunately, not very uniform in their working, ungilding one part while another is gilding, and producing a variety of colors, especially when freshly prepared. They improve by use, however.

COLD ELECTRO GILDING BATH.

Water, distilled	1 gallon.
Potassium cyanide, pure	3½ ounces.
Gold chloride	3/5 "

Dissolve the cyanide in a part of the water, then gradually add the gold chloride dissolved in the remainder. Boil for half an hour before using. (Use cold.)

The cold bath is kept in a gutta percha lined, wooden, or (if small) porcelain tank arranged as for brass plating. The anodes are thin plates of laminated gold, wholly suspended in the liquid (while in use) by means of platinum wires, from clean brass rods joined to the copper or carbon pole of the battery, the rods supporting the work being in connection with the zinc. When in proper working order the color of the deposit is yellow. If the deposit becomes black or dark-red, add more cyanide (dissolved in water) to the bath, or use a weaker current.

If the cyanide is in excess the plating will proceed very slowly or not at all; or, as sometimes happens, articles already gilded will lose their gold. In such cases add a little more gold chloride or increase the intensity of the current.

Cold electro-gilding must be done slowly, and requires a good deal of attention to secure good work. The articles must be frequently examined to detect irregular deposits or dark spots (which must be scratch-brushed and returned). It is also frequently necessary to add to or remove an element from the battery, especially when adding or taking work from the bath. With too much intensity of current the deposit is black or red; if too weak those portions opposite the anode only get covered. In coating German silver it is necessary to use a weak bath and a small exposure of anode. The best results with this alloy are obtained when the bath is slightly warmed.

MANAGEMENT OF THE HOT BATH.

The articles should be kept in agitation while in the bath. They should be placed in connection with the battery before or immediately upon entering the bath. A foil or wire of platinum is in many cases preferable to a soluble gold anode when electro-gilding by aid of heat. It suffers no alteration in the liquid, and by its manipulation the color of the deposit may be materially altered. When it is removed so as to expose only a small surface in the bath a pale yellowish deposit may be obtained; when the immersion is greater, a clear yellow; with a still greater exposure, a red gold color. The strength of the hot baths may be maintained by successive additions of gold chloride with a proper proportion of the other salts and water; but it is preferable to wear out the bath entirely and prepare a new one, as it soon becomes contaminated with copper or silver if much of these metals have been gilt in it. In a nearly exhausted bath containing dissolved copper the electro deposit will be what is called "red gold;" if it contains an excess of silver a "green gold" deposit will result. The gold and copper or gold and silver are deposited together as an alloy, the color of which depends upon the relative proportion of the metals, battery strength, etc.

Dead luster gilding is produced by the slow deposition of a considerable quantity of gold, by giving the metallic surface a dead luster before gilding (by means of acids), by first preparing a coating of frosted silver or by depositing the gold upon a heavy copper deposit produced with a weak current in a bath of copper sulphate.

In order to secure a good deposit of gold it is absolutely necessary that the work should be perfectly freed from any trace of oxide, grease, oil, or other impurity. Articles of copper and brass may be cleansed by first immersing them in a strong boiling solution of caustic potash or soda, and, after rinsing, dipping momentarily in nitric acid and immediately rinsing, or scouring with pumice stone moistened with a strong solution of cyanide of potassium in water.

Other metals require a somewhat different treatment, which we will have occasion to refer to in a subsequent article.

The bichromate battery is commonly used in connection with hot electro-gilding baths. See article on nickel-plating, p. 153, No. 10, vol. xliii.

As gold chloride procured in the market cannot always be depended on for purity and strength, it is preferable to purchase the gold and make the chloride. A pure gold chloride may be prepared as follows:

Put coin gold, in small pieces, into a glass flask with about five times its weight of aqua regia (nitric acid 1, hydrochloric acid 3), and heat gently, with small additions of aqua regia if necessary, until the gold is dissolved and the silver remains behind as white chloride. Let it settle, decant the clear solution, wash the residue several times with water, adding the washings to the gold solution. Evaporate off excess of the acids in a porcelain dish over a water bath (nearly to dryness). Dilute with ten parts of water, and gradually add a strong aqueous solution (filtered) of sulphate of iron. Let stand until the dark powder (gold) settles; gently decant the liquid, wash the gold with hot water, and redissolve it in a small quantity of warm aqua regia and evaporate the solution, with constant stirring, to dryness in a porcelain dish over the water bath. One ounce of pure gold equals about 1 5/8 ounce of this chloride.

The Work of the Patent Office in 1880.

The annual report of the Commissioner of Patents for the year ending December 31, 1880, gives the business of the year as follows: Applications for patents for inventions, 21,761; applications for patents for designs, 634; applications for reissues of patents, 617; total, 23,012. Patents issued, 13,441; patents reissued, 506; patents expired, 3,781; trade-marks and labels registered, 533.

Of the 13,441 patents issued during the year, 12,655 were to citizens of the United States, and 786 to foreigners.

There was received during the year for patents, copies of records or drawings, and from other sources, an aggregate of $749,685.32. The total amount expended was $538,865.17, leaving a balance of $210,820.15. On January 1, 1880, there remained $1,420,806.56 to the credit of the Patent Fund, which, added to the surplus of 1880, makes the amount to the credit of the Patent Fund on January 1, 1881, $1,631,626.71.

Our Export of Breadstuffs.

The official report of the exports of breadstuffs in 1880 shows the largest movement ever recorded, both as to quantity and as to value, except during the fiscal year which embraced the first six months of 1880. Reducing flour and meal to wheat and corn, at the approximate rate of five bushels to the barrel, the quantities exported for the last two years may be stated thus:

	Quantity.		Average Price.	
	1880.	1879.	1880.	1879.
Flour, barrels	6,545,920	5,885,831	$5.82	$5.53
Meal, barrels	384,177	340,969	2.93	2.60
Wheat, bushels	134,701,146	137,975,715	1.20	1.16
Corn, bushels	105,717,215	83,144,845	55	49
Rye, bushels	2,546,995	4,445,030	92	69
Barley, bushels	1,246,640	1,163,514	65	61
Oats, bushels	544,294	1,048,934	45	34
Wheat and flour, bush'ls	167,430,746	167,404,870		
Corn and meal, bushels	107,638,100	84,849,690		
All grain, bushels	279,206,775	258,852,038		

Correspondence.

The Sun Dogs of Colorado.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN, dated January 22, appears a letter from Jerseyville, Ill., written by F. S. Davenport, in which, after describing the remarkable sun dog phenomena of December 30, 1880, he inquires if any one had ever seen the like before. Colorado was almost wild over such a phenomena, December 23, 1876. In this case it began at sunrise. The thermometer indicated all the way from ten to twenty-two degrees below zero. The atmosphere was suffused with a myriad of crystalline particles. The horizontal rays of which Mr. Davenport speaks encircled the entire horizon, and had in it four additional sun dogs the greater part of the day, and at times eight. Instead of being one circle around the sun, we had two, the inner one bright, the outer one fainter. The upper arc of the outer one touched the arc of the brilliant prismatic crescent in the zenith. This crescent was brighter at that time than the sun, and could be looked at only a short time on account of its extreme brilliancy. The sky within the circle which the crescent would have formed, if complete, was a deep blue and very beautiful. Full descriptions were given in all of the Colorado papers, while the Denver *Tribune* gave a cut representing it partially.

The spectacle lasted until three o'clock, though it was brightest at about eleven. An additional halo, somewhat like a rainbow, was visible in the western heavens at about sunset.

A similar phenomenon, though not near so bright, was witnessed some time last December.

Boulder, Col. OTTO H. WANGELIN.

Corundum Localities of Georgia.

The corundum outcrops of Georgia are widely separate. In the northwest part of the State, in Towns County, and southwest of the corundum locality in Clay County, North Carolina, is an outcropping of corundum, a portion of which is of reddish color. Here a good amount of work has been done, with what success I am unable to say. The matrix of this corundum is smaragdite, called by some distinguished mineralogists kokscharoffite. The composition of the two are similar, except that smaragdite contains the oxide of chromium, which is probably the coloring matter of the corundum. The matrix of corundum is usually some one of the varieties of chlorite; that of the precious gems, the ruby, sapphire, etc., is ripidolite. I doubt whether the colored varieties can be found only in connection with chrome. Southwest of this are several outcrops of corundum extending nearly to the line of Alabama; also one or two in the eastern part of the State, none of which are at present mined.

The only outcrops of corundum in Alabama are found lying between the waters of the Coosa and Tallapoosa rivers in Tallapoosa County. These mines are worked by the Hampden Emery Company, of Chester, Mass. The annual yield is small.

Throughout the United States, as yet, no localities have been discovered with the corundum disseminated through the spinel, making emery like that of Naxos and Turkey.

Geologically considered the corundum seems to occur in belts associated with the magnesian minerals, and is usually found in the outcrops of serpentine and crysolite. From Dudleyville, in Alabama, it extends northeast through the northwest part of Georgia into the mountains of North Carolina, where the largest development occurs. Passing through the Blue Ridge it continues in a northeastern course through the State, similar to the gold and other metalliferous and mineral belts. There is another belt passing through the eastern part of Georgia into South Carolina.

Judging from the present development of corundum, no sufficient quantity can be had to take the place of emery.

(MRS.) H. A. BURDICK.

THE *Victorian Review*, the leading monthly of Australia, published at Melbourne, and one that compares favorably with our best home magazines, after mentioning a number of illustrated industrial subjects which had attracted the editor's special attention, concludes as follows:

"In fact, nothing rare, or curious, or useful, in the worlds of nature or of industry, seems to escape the conductors of the SCIENTIFIC AMERICAN."

The Machinery of the Future and the Well-being of Society.

Mr. C. C. Coffin has completed his course of six lectures before the Lowell Institute, and to the Boston *Advertiser* we are indebted for the following extract from the closing lecture of the interesting series:

The topic under consideration was: "The Machinery of the Future and the Well-being of Society." In his opening remarks the lecturer alluded to the value of the patent law, and showed how it had stimulated invention to a high degree, and claimed that invention is an educator, and the American mechanic is a thinker. His superior intelligence is acknowledged abroad. Gladstone fells his trees with an ax of American manufacture, not because its edge is any keener than those of English make, but because of the adaptability of the implement in lightness and effectiveness. In the opinion of Mr. Coffin China will not cease to be a market for our manufactures, although the Chinese may establish manufactories. Continuing, he said: Great as has been the advance of the last fifty years, it is within the bounds of probability and reason to expect greater progress during the years immediately before us. As yet we know very little of the energy of nature—what it is—its convertibility, gravitation into chemical affinity, magnetism, electricity into light and heat, and all into motion. It is thirty-eight years only since Joule made the discovery that they are one and the same. How great the progress! Yet we may confidently expect that discovery and invention will be quite as marvelous in coming years.

Five years ago the *telephone*—now the photophone, sending oral messages along a ray of light, with clear and distinct enunciation! The next application of the energy of nature for the promotion of our comfort, happiness, and general well-being promises to be the utilization of the electric light. The lecturer traced the history of its development, and said the cheapness of the machinery will allow of its adoption in a great number of country villages—requiring only a small steam engine, a generator, and the extension of the wires. Especially will this be the case in our New England manufacturing villages, where the power is derived from the streams, the erection of a water wheel and a generator being all the machinery required. It is one of the marvels of science that Lowell, Lawrence, and Manchester may be lighted by the water of the Merrimac—by gravitation—with no consumption of any material, no loss of energy! Think of a wire extending from this hall to Niagara, and ourselves sitting here in the radiance generated by the energy of that torrent! It is not fancy, but altogether practicable. In the future sewing machines will be worked by turning a button or pressing a spring, taking the power from the same mill which is to furnish light, and we shall use magnetic elevators. It is quite probable that the introduction of the electric light will be followed by the use of gas for heating and cooking.

Referring to science, in its application to war, the lecturer said: I am not sanguine in any expectation that there is to be any immediate disbanding of great standing armies in Europe; but rifled cannon, repeating small arms of long range, effective a mile away, the multiple gun, have revolutionized warfare. What is beyond we do not foresee, but on land as well as the ocean we may confidently expect that science and invention will in time bring about a new order of things, and men, instead of shouldering the musket during the best years of their life, as in France and Germany they are now compelled to do, will give their strength and energy to the arts of peaceful life. The lecturer next alluded to the growth of population and wealth during the last fifty years, and proved that the poor man of to-day has vastly more than it was possible for the poor man of 1830 to obtain. He may not be in possession of any riches when he reaches the end of life, but his burden through life is not so weighty as it was a half century ago. We cannot foresee what discovery may yet develop of nature's energy in other directions, but at the present, and probably for many years, the human race will use the forces imprisoned in coal as the most available. The coal area of the world is thus divided: Europe aggregates about 3,500 square miles, Great Britain 5,400, while North America has an area exceeding 300,000 square miles! That of England is less than the area of Massachusetts. It is estimated that at the present rate of consumption there is coal enough in England to last 1,000 years. If with 5,000 square miles of coal lands Great Britain has such an extended lease of life, what shall we say of this continent, with between three and four hundred thousand square miles of coal? We gauge the future by what we know of the past and present. Five thousand square miles of potential energy in the coal fields of Great Britain; one thousand years her lease of life! Three hundred thousand square miles of potential energy on this continent, and our expectation of life—who can tell us what it is? We are fifty millions to day; ten years hence we shall number seventy, and at the close of the century ninety millions. What shall we be one hundred years hence? what one thousand years?

Cement for Leather.

One who has tried everything, says that after an experience of fifteen years he has found nothing to equal the following as a cement for leather belting. Common glue and isinglass, equal parts, soaked for ten hours in just enough water to cover them. Bring gradually to a boiling heat and add pure tannin until the whole becomes ropy or appears like the white of eggs. Buff off the surfaces to be joined, apply this cement, and clamp firmly.

The Improvement of Erie Canal.

After speaking at length of the successful operation of the Erie Canal during the past year, and the importance of the canal to the prosperity of our State, the State Engineer recommends the following means for improving that water way and saving the trade we now owe to it. He says:

The British are so confident that they will wrest the trade of the West from us that they have nearly completed works that will cost more than $30,000,000. This is in addition to about $20,000,000 spent in early improvements, making about $50,000,000 paid out to gain the great prize they seek—the control of the carrying trade from the heart of our country to the markets of the world. They do not fear our railroads. While we are neglecting our water routes they spare no cost to perfect theirs. This is the greatest danger that threatens our commerce. It concerns all classes of citizens and all methods of transportation.

In view of this great danger it is our duty to consider how we can save the commerce New York has so long held. We should see first how we can cheapen transportation by the American water route, consisting of the great lakes, the Erie and Oswego Canals, and Hudson River. The larger the vessel the less the cost of carrying. If our waters admit of vessels drawing even a single foot more than can pass the Welland Canal we shall have a great advantage over the British route. By removing the obstructions in the natural channels between the great lakes, and by deepening Buffalo Harbor, twenty feet of water can be gained, while the locks on the Welland Canal will only admit of vessels drawing thirteen and one-half feet. The United States Government is engaged in deepening these channels, and our representatives in Congress should see to it that this work is accomplished in time to offset the advantages which the British will gain from the enlarged Welland and St. Lawrence Canals. The State of New York does not ask of the United States Government any assistance in maintaining or enlarging its canals. It only asks that the tide waters of the Hudson River and the natural channels between the great lakes shall have the consideration which is due to them as the great channels of commerce of our country. That large vessels can carry their cargoes cheaper than small ones is seen by the fact that vessels carry grain from Chicago to Buffalo for one-half the cost of carrying it from Buffalo to New York, although the former distance is twice the latter. It is four times as expensive to transport grain upon the Erie Canal as it is upon great bodies of water.

In order to cheapen transportation upon the Erie Canal the boats must be able to carry larger cargoes, and to bring this about we should make the canal deeper. If one foot of water is added to the depth of the canal by raising its banks, the present boats can carry fifty tons additional load, and the relation between the size of the boat and the size of the canal will not be disturbed. This increase in depth would enable the boats to carry one-fifth more cargo. At the present rate of carrying it would cheapen transportation one cent a bushel, which would be equivalent to removing tolls. This plan of deepening the canal recommends itself to the boatmen, because it requires no outlay on their part, the boats now in use having a capacity for fifty tons more than the present depth allows them to carry. If no additional load was carried this increase of depth, with the application of power to the locks for operating the gates and drawing the boats in and out, such as is in use in New Jersey on the Delaware and Raritan Canal, would enable boats to make thirty-seven hours better time in a round trip from Buffalo to New York. This gain in many instances would allow boatmen to make another trip a season. There is no sentiment in trade. Business goes where it can be done the cheapest, and the route that can carry for a few mills less per bushel than any other will command it. The average freight (not including tolls) a bushel of wheat from Buffalo to New York during the past season has been five and a half cents. If this charge could be reduced to four and a half cents the Erie Canal could offer such economical transportation that there would be very little danger from its northern rival. I have had careful surveys made for the raising of the banks of the canal one foot and for furnishing the necessary water; these show that the work can be done for about $1,000,000. The gain that this improvement would have made in transportation during the past season would be equal to the cost of the work.

Walls and Beams.

One precaution that is very seldom taken with high buildings is so supporting the timbers of the floor that, in case they break or fall, they shall not pry the wall over inward, and that in case they expand they will not push it over outward. As ordinarily constructed, holes are left in the walls, into which the ends of the joists are set, the holes being about the size of the ends of the joists, so that in case the floor falls the timbers are apt to tumble the walls inward on the contents of the building. The *Paper Trade Journal* suggests two ways of getting around this. One is to set the end of the joist upon a corbel or projection from the face of the wall, so that the joist clears the face of the wall entirely, and in case it falls it exerts no influence upon the wall. The other method has the same object in view, and accomplishes it in a simpler way. The holes made to receive the joists are made about twice as high as the joists, so that in falling the joist has no prying effect upon the wall. These remarks apply to iron as well as wooden beams; but for iron beams there should be observed the additional precaution to leave a greater space between the end of the beam and the wall, so that the inevitable expansion of the beam from fire shall cause no thrust outward, tending to overthrow the walls. It would perhaps be as well if all external walls were held together by anchor bolts with external plates, which, although not very sightly, yet often tend to hold the wall up when otherwise it would topple and fall outwards. Of course, if the beams are properly cased below with some fireproof material or by some heatproof method, their expansion will be very much less than if they are left naked to the action of the heat.

The "Jumpers" of Maine.

Dr. George M. Beard, in a paper read before the American Neurological Association, records some curious facts in regard to a singular class of persons whom he met in the region of the Moosehead Lake, Maine, and who are known in the language of that region as "Jumpers," or "Jumping Frenchmen." These individuals are afflicted with a peculiar nervous affection which manifests itself by sudden and explosive movements of the body under the influence of external excitation, by a passive submission to orders authoritatively given them, and by an irresistible desire to imitate the action of others. The person thus afflicted jumps at the slightest sudden touch, and when an order is given him in a loud, quick tone he repeats the order and at once obeys. If, for instance, on the shore of a river he be ordered to jump into the water, he exclaims "Jump in," and at once executes the order. If he is told to strike one of his companions he exclaims, "Strike him," and the act follows the words.

Dr. Beard made the following experiments with one of these persons, who was twenty-seven years of age: While sitting in a chair with a knife in his hand, about to cut some tobacco, this man was struck sharply on the shoulder and told to "throw it." Almost as quick as the explosion of a pistol the knife was thrown and stuck in a beam opposite; and at the same time he repeated the order, "Throw it," with a certain cry as of terror or alarm. A moment after, while filling his pipe, he was again slapped on the shoulder and told to "throw it." Immediately he threw the pipe and tobacco on the grass, at least a rod away, and with the same suddenness and explosiveness of movement as before. Whenever this man was struck quietly and easily, and in such a way that he could see that he was to be struck, he made only a slight jump or movement; but when the strike was unexpected he could not restrain the jumping or jerking motion, although the cry did not always appear. Like experiments were made on other individuals of different ages with the exhibition of the same peculiar phenomena.

Dr. Beard classes this "jumping" as a psychical or mental form of nervous disease, of a functional character, its best analogue being psychical or mental hysteria—the so-called "servant-girl hysteria," as known to us in modern days, and as very widely known during the epidemics of the Middle Ages. Like mental or psychical hysteria, the jumping occurs not in the weak, or nervous, or anæmic, but in those in firm and unusual health; there are no stronger men in the woods, or anywhere, than some of these very "jumpers." Dr. Beard regards the disease as probably an evolution of *tickling*. Some, if not all, of the "jumpers" are ticklish—exceedingly so—and are easily irritated when touched in sensitive parts of the body. It would seem that in the evenings, in the woods, after the day's toil, in lieu of most other sources of amusement, the lumbermen have teased each other by tickling and playing and startling timid ones, until there has developed this jumping, which, by mental contagion, and by this practice, and by inheritance, has ripened into the full stage of the malady as it appears at the present hour. The malady is fully as hereditary as insanity, or epilepsy, or hay fever. Dr. Beard in four families found fourteen cases, and by the study of these it was possible to trace the disease back at least half a century. The malady seems to be endemic, confined mainly to the north woods of Maine and to persons of French descent, and it is psycho-contagious, that is, can be caught by personal contact, like chorea and hysteria.

A Large Order for Locomotives.

Recently the Baldwin Locomotive Works received from the Denver and Rio Grande Railroad Company an order for 144 locomotives, an increase of equipment made necessary by the southern extension of the road. This is said to be the largest order for locomotives in one block ever placed. The cost of the locomotives will be over $1,000,000. The work will be done during next summer and fall.

New Explosive Compound.

This compound, by J. M. Lewin, Paris, said to possess more explosive force than all other explosive materials, and which will not explode when a flame is applied to it, or in consequence of an ordinary blow, but only by means of a cartridge or capsule, consists of the ingredients given below in or about the proportions specified; *i. e.*, nitro-glycerine, 60 parts; nitrate of potassium, sodium or ammonia, 16 parts; palmitic acidulated oxide of cetyl (cetoceum), 1 part; carbonate of lime, 1 part; lignine, 1 part; and wood or animal charcoal or peat moss (sphagnum), 16 parts.

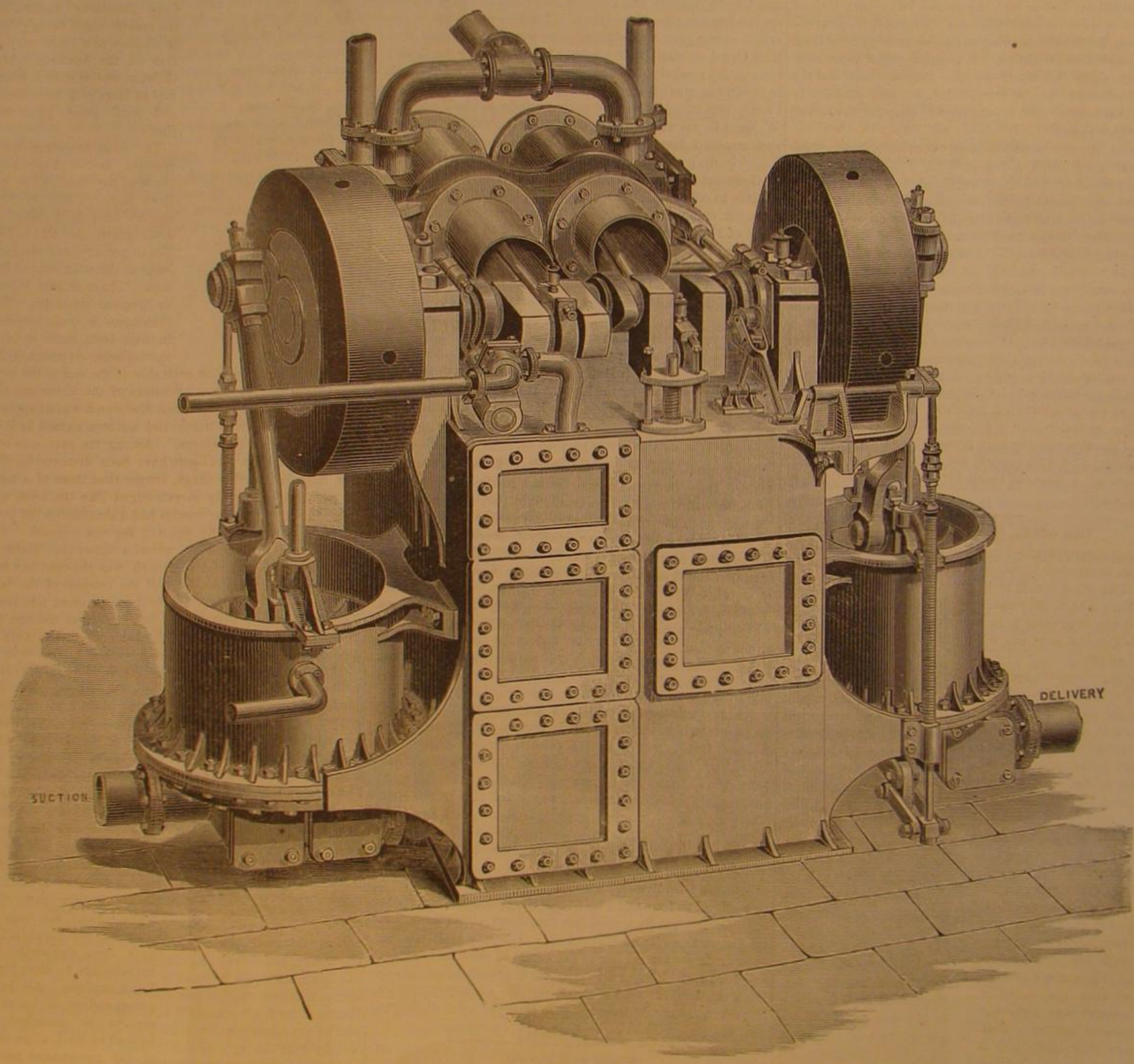
The Growth of New York City.

As shown in the statistics of the Department of Buildings the growth of New York was more rapid last year than in any twelvemonth since 1872, when the speculative building mania reached its height. That year the expenditure on buildings was not less than $27,000,000. In 1877 it was less than half as much. It increased to sixteen and a half millions in 1878. The figures for 1880 show an expenditure of $24,000,000 for new buildings.

IMPROVED AIR REFRIGERATING MACHINE.

We illustrate a machine constructed by Messrs. Hall, of Dartford, for use in the Australian meat trade. The engraving is very nearly self-explanatory.

The machine consists of a pair of horizontal trunk engines, mounted on the top of a condenser. To one side is bolted a compressing cylinder, 27 inches diameter and 18 inches stroke. To the other side is bolted the expansion cylinder, 22 inches in diameter and 18 inches stroke; both these cylinders are open-topped. The valves are placed in the bottoms of the cylinders, and are worked by cams on the crank shaft and levers. Air is drawn into the compressing cylinder on the up stroke, and delivered on the down stroke, into the surface condenser at a pressure of about 50 lb. to 55 lb. on the square inch. The air here parts with its heat in the condenser, and it is then delivered into the expansion cylinder, the valve of which cuts off at about one-fourth stroke. The expanded air is then delivered through a pipe into the room to be cooled. About fifty per cent of the work expended in the compressing cylinder is returned in the expansion cylinder, the difference being made up by the engine. The machine is but one of several Messrs. Hall have in hand of different patterns. The outline diagrams show the form which they recommend for ordinary use, the height being kept down to render it specially suitable for use between decks, but the machine can be made to take any form almost, and can be made of any dimensions to suit particular requirements. The condenser, or refrigerator, consists of nests of brass tubes, through which the water circulates. The tubes are of brass, half an inch in diameter outside. The ends of the tubes are accessible through the man lids shown.—*The Engineer.*



IMPROVED AIR REFRIGERATING MACHINE.

The Utilization of Waste Ivory.

A curious and valuable contrivance has been explained to our Sheffield correspondent for the utilization of waste ivory—a subject of very great importance to other classes besides cutlery manufacturers, in consequence of the rapidly increasing value of the article. The firm who have made the discovery—Messrs. Kilner Brothers, Albion Works, Holley street, Sheffield—have patented their plan, and applied it in the first instance to table cutlery. Their object is obtained by using odd ends of ivory, or ivory that is not sufficiently long for the ordinary length of handles, by cementing the pieces together, and by "tapping" the "tang." In this way each piece of ivory is screwed close to its fellow. The handle is then carved or fluted, by which means all joints are concealed. The tang passes through from end to end, and being riveted, the handle is prevented from leaving the blade, either by being placed in hot water, or by any other means which misdirected domestic ingenuity can contrive. Every housekeeper will appreciate this boon, as in the ordinary method of hafting table cutlery the handles come off with irritating frequency. By their patent, which is also applied to knives with bone, horn, and other handles, the firm can produce a really good article at about one-half the cost of ordinary knives. The ivory waste used in this way costs 2s. 6d. per pound—cut out of the solid piece it would be 20s. Among other specimens exhibited to our correspondent was a carving knife, the ivory handle of which, if the ivory was of one piece, would be worth 3s. 6d. The firm can supply the complete knife and fork for 4s. 3d., with the handle treated according to their patent.—*The Engineer.*

Omaha Waterworks.

The *Fireman's Journal* is informed that a suit has been begun by the Holly Manufacturing Company, of Lockport, N. Y., against the Omaha City Waterworks Company for infringement of Holly's patent of direct pressure. This suit, says the *Journal*, grows out of the fact that the Holly Company, after a long and bitter fight, was underbid by an Omaha company for the construction of the city waterworks. The Omaha company is building the works on the combined system of reservoir and direct pressure. It has distributed its pipe, partly built its reservoirs, and received part of the pumping machinery, and is under contract to complete the works by September next. This litigation may seriously complicate matters, and may postpone the completion of the works for some time, and possibly the plan of construction may have to be changed.

An Electric Storm.

A severe snow storm, accompanied by electrical disturbance and high wind, prevailed, January 6, over a space eight hundred miles wide, along the line of the Union Pacific Railroad between Omaha and Ogden. For twenty-four hours the telegraph wires were useless, the intensity of the electric storm being shown by the fact that when the telegraph key was opened by the operator a steady electric light burned at the connecting points. L. H. Korty, Chief Operator of the Union Pacific Telegraph lines, has kept a record for years, and with but one exception in twelve years, this storm occurred on the 5th, 6th, or 7th of January. It is believed that the entire Rocky Mountain region is visited by them.

To Fasten Cloth on Wooden Surfaces.

The following is said to be an excellent method of fastening cloth to the top of tables, desks, etc.: Make a mixture of 2¼ pounds of wheat flour, 2 tablespoonfuls of powdered rosin, and 2 tablespoonfuls of powdered alum; rub the mixture in a suitable vessel, with water, to a uniform, smooth paste; transfer this to a small kettle over a fire, and stir until the paste is perfectly homogeneous without lumps. As soon as the mass has become so stiff that the stirrer remains upright in it transfer it to another vessel and cover it up so that no skin may form on its surface. This paste is applied in a very thin layer to the surface of the table; the cloth, or leather, is then laid and pressed upon it, and smoothed with a roller. The ends are cut off after drying. If leather is to be fastened on, this must first be moistened with water. The paste is then applied, and the leather rubbed smooth with a cloth.

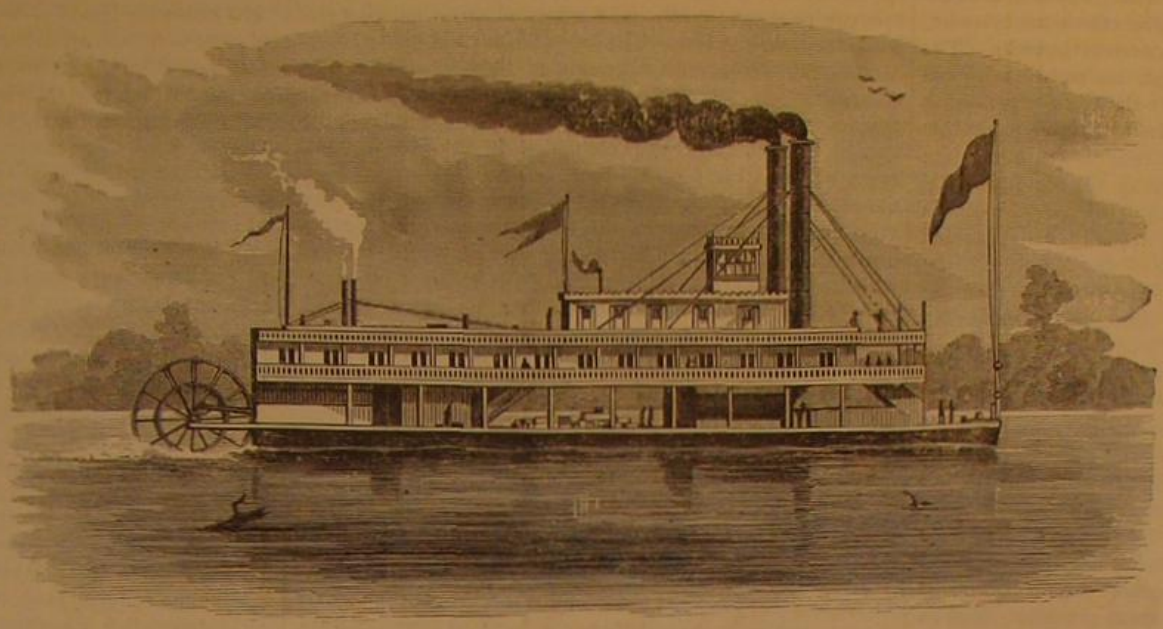
STRENGTH OF INSECTS.—At a meeting of the Maryland Academy of Sciences recently Dr. Theobald showed a species of a beetle and gave the following figures: Weight of beetle, two grains; weight moved by it, 5½ ounces—2,640 grains, or 1,320 times the weight of the beetle. A man weighing 150 pounds, endowed with the strength of this insect, should therefore be able to move 198,000 pounds, or nearly 100 tons.

AMERICAN BUILT STEEL STEAMER FOR THE RIVER MAGDALENA.

BY H. L. BRIDWELL.

We recently published an illustrated description of a light draught steel steamer built in England for the Government of the United States of Colombia, to ply on the River Magdalena. American mechanics have also been engaged in constructing light draught vessels for the Magdalena, and we herewith present a view of the last one built in this country, the Victoria, belonging to the Magdalena River Navigation Company. The Victoria was built at Pittsburg, Pa., by James Rees, Esq., of the Duquesne Engine Works, who also built the Francis Montoya for the same stream, and, like the English steamer, was shipped in pieces after being temporarily set up.

The Victoria differs materially from the boat of the Yarrows, which has practically no upper structure, and is shorn of cabins and other accessories, in order to attain extreme lightness of draught. The Rees steamer was intended for a regular freight and passenger traffic, to accommodate which she is provided with a full length cabin on the upper deck and an officers' cabin above on the hurricane deck. The upper works are complete with all the appointments and fixtures of a regular North American river vessel. The hull is 155 feet in length, 32½ feet beam, and 4½ feet depth hold, constructed of steel, in eight watertight compartments. The boiler, also of steel, is of the locomotive type, 18 feet long, 45 inches in diameter, and has forty-one 3½ inch tubes, furnishing steam at a working pressure of 150 lb. per square inch. The cylinders are 16 inches diameter, with 6 feet stroke, of the direct-acting high pressure type. The steamer has a capacity of 400 tons cargo, and yet draws but 22 inches with steam up, a splendid result for a vessel so complete in all particulars.



STEEL PASSENGER STEAMER VICTORIA FOR RIVER MAGDALENA, S. A.

THE GECKO, OR WALL LIZARD.

Gecko is a name applied to a family of nocturnal lizards, numerous in species, found in all the warm regions of the globe. The name is said to be given them from the slight guttural cry which they make when pursuing their prey. In broad day they seem to be blinded by the rays of the sun, and repose half asleep, but when evening comes they regain all their agility.

Their appearance is quite repulsive; their bodies are flat, covered with a flabby skin, head large and flattened, a huge mouth armed with fine sharp teeth, their tongues short and fleshy, large eyes at the sides of the head, which are covered with transparent eyelids, the pupils narrow and vertical, like the cat and owl.

Considered as an impure animal by the Hebrews, the gecko is, in the extreme East, the object of great terror, and it is looked upon as impregnated with the most subtle poison. The ancient authors believed that the saliva of these animals was made use of to poison arrows. Bontius says that their bite is deadly, and another author relates that he saw at Cairo three ladies in great danger of death from having eaten some food upon which a gecko had stepped.

Although this animal is an object of repulsion and fear to the common people it appears to be absolutely inoffensive. M. Sauvage says, in *La Nature*, that he has often handled, without precaution, the different species of geckos, even the gecko of Egypt, so feared that it is named Abou-burz, or "father of leprosy," from the belief that it communicates that terrible disease to persons who partake of food with which it comes in contact.

Geckos are useful to man, as they feed upon insects, caterpillars, and flies, which they entrap by placing themselves in ambush. They are often found in considerable numbers within doors, concealing themselves upon the roofs or crawling about upon the walls and ceilings. Their toes have, for the most part, a leaf-like expansion which enables them to walk even upon polished perpendicular surfaces, and they run noiselessly and with great rapidity in all directions. Their hooked claws, sometimes retractible like those of the cat, assist them to climb nimbly along the walls, where they hunt their prey from stone to stone, or by entering small crevices in the rocks into which their flat flexible bodies are able to penetrate.

Some geckos, as the platydactylus, have their toes widened the whole length, while the hemidactylus are expanded only at the base, and the phyllodactylus at the extremity of the toes.

These last, formerly supposed to inhabit only New Guinea, Australia, and Chili, have been found in Europe and are known as the European phyllodactylus. They were believed to be peculiar to Sardinia, but have lately been found by M. Lataste in the Island of Pendus in the Gulf of Marseilles.

The common platydactylus, which is found in Southern France, Italy, and Spain, was known to the ancients, who probably called it a lizard, and thought that its venom neutralized the poison of the scorpion. The bite of this animal, which was dangerous or even deadly in Greece, was, according to Pliny, almost inoffensive in Sicily. The same author says that the skin macerated in vinegar or reduced to ashes was a sovereign remedy in some diseases. In this species the body is often of a gray color, while the lower parts are whitish, but sometimes it is of a bronzed brown, with gray bands across the back and tail; the head, although flat, is thickened at the back, the neck being distinct from the body; the skin which envelops it is transversely folded. The upper part of the skull is covered with small convex plates, the oval tubercles are strongly defined and are surrounded by other smaller tubercles, and with fine granulated scales, protecting the back. The upper part of the tail is provided with spines.

The geographical distribution of the hemidactylus is the same as that of the species just described. The head is short, the nose very blunt, the surface of the skull slightly convex. The toes are all provided with claws, and are not united by a membrane. From the nape of the neck to the beginning of the tail the tubercles, like small nails, are arranged in longitudinal rows nearly approaching one another. The general color of the head is gray, sometimes reddish with brown marbling.

THE GECKO OR WALL LIZARD.

The Miocene Beds of Oregon and their Fossils.

A writer in the *Kansas City Review*, who has for some time been making collections of fossil remains for Professor Cope, says that although the miocene beds of the John Day River, Oregon, have been explored for nine or ten years, each year an equally rich harvest has been gathered. In none of his explorations in the fossil beds of the Northwest had he ever found such perfect specimens as those that he gathered in this region. One of his finds proved to be the type of a new genus, and was named by Professor Cope *Boocherus humerosus*, the specific name being given in allusion to a huge projection on the humerus. The skeleton was that of a mammal as large as a rhinoceros, and with great pillar-like limbs.

The most abundant fossil remains found have been those of the *Oreodon*, or extinct hog. Three or four species have been detected, some about the size of the Texan peccary and others as large as the wild boar of Europe. These animals belong to tropical countries. The rhinoceros is quite common in these beds, three or more species being represented, one of them having a horn on each side of the end of the nose. The *Hipparion* and other ancestors of the horse are also found here. One peculiar genus discovered was an ancestor of the South American llama, and has been named by Prof. Cope *Protheriun Sternbergii*. Among the carnivora over ten species of dogs and tigers have been discovered. One large dog had terrible fangs, longer than those of a tiger, and which were sharply serrate-edged like the teeth of a shark. Another peculiar species had a shoulder on the lower canine, against which the point of the upper struck. This large number of carnivorous animals shows that herbivora were also abundant; and that such was the case has been proved, too, by the abundance of the remains of the latter that has been found. Of the rodents, a great number of species have been discovered, ranging from the size of a mouse to that of a beaver. Hard-shelled turtles were the only reptiles obtained; and these varied in size from six inches to two feet in diameter. One of the great difficulties in the way of working these beds lies in the dazzling color of the surface, which soon causes the eye to tire, and gives the explorer a sensation like that of snow-blindness. Hence, five hours' constant search has to be counted a good day's work. The miocene beds of Oregon extend over the greater part of the eastern part of the State. Thus far only the John Day and Crooked River have been explored. Rich harvests are in store for the future explorer. All the new genera and species found here are to be described and figured by Prof. Cope in one of the government publications.

The Composition of Serpents' Venom.

What a wonderful thing the venom of a serpent is! Chemical analysis fails to detect anything in it to account for its action. Water, a little albumen, some mineral salts, and traces of mucus, epithelial cells, etc., lumped together as "extractive." Nothing more—nothing specific about it, at all. Tasteless, colorless, and inodorous, it may be rubbed on the sound skin, or applied to the eye, or taken into the mouth without any result whatever. The bites of different kinds of snakes produce different effects; some act as a depressant to the vascular system, some as a powerful narcotic, some cause inflammation of the spine, while others seem to give rise to disorganization of the structural constituents of the blood. All are attended more or less with

rigors, delirium syncope, convulsions, paralysis, and coma. Whether the poisons of any two or more species are identical I do not know—it seems probable; but in the five species with which I have experimented on myself, so far I have found five distinct and separate venoms. I imagine, for instance, that the rattlesnake and copperhead will prove to possess the same, and perhaps several of the viperine snakes. I hope so. Some of these fluids are very unstable, and decompose if kept only a short time or if their specific gravity is disturbed, while others retain their deadly properties even when dried. That of the common French viper (*Vipera aspis*) may be diluted down till it forms a mere local irritant. No *true* antidote has ever been discovered for the bite of any snake, and the search for something which shall be an antidote against the bite of all, appears to me to be irrational in the extreme, seeing that there are so many different poisons, producing in many cases opposite effects. One might as well expect to find a general antidote for opium, belladonna, strychnine, arsenic, and mercury poisoning. The action of ammonia, upon which so much stress has been laid, is probably nothing more than that of a strong stimulant; certainly its action in maintaining the fluidity of the blood is quite hypothetical, seeing that premature coagulation of the fibrine has never been actually demonstrated. Indeed, it is said that at the autopsy of the keeper Girling, bitten many years ago by a cobra de capello at the Gardens, the blood formed no clot at all, but was found permanently fluid in all the great vessels.—*Land and Water.*

Sanitary Inventions in House Building.

The modern residence illustrates, in innumerable ways, the activity of inventors in recent years, and although so much has already been done the future seems to present a still wider field, with even more and more complex problems, whose successful solution will yield deserved award to inventive genius. To faults in our present system of building, principally in regard to the plumbing arrangements, the prevalence and generally dangerous character of diphtheria is now largely attributed. Whether or not it is true that the community is at present suffering from a greater prevalence of this disease than ever before, or whether the general conviction that this is so comes from the fact that the medical fraternity are now making a closer definition of its causes and nature, it is certain that defective methods of disposing of sewage cannot fail to contribute largely to its propagation. Leaving out of view entirely the question of sewage ventilation or disinfection, the advantages or disadvantages of different kinds of traps, the arrangement of house pipes, or the flooding of sewers, it is evident that, in closely populated sections, it needs only one break in the precautionary efforts to start a disease which may prove na epidemic. Of course the more perfect the system the smaller the number of such chances, and the easier it is to successfully combat the disease, but the common sewer forms a connecting link between the costly brown stone and the humble tenement. The latter, however, has the close supervision of the health authorities, which is too often omitted in the former case. It is not surprising to find, therefore, as recently stated by the President of the New York Board of Health, that some of the lately built tenement houses of the metropolis are actually safer residences, from a sanitary point of view, than many pretentious mansions. The latter had, perhaps, fairly good plumbing work at the start, but age and use have in many cases caused a gradual deterioration, possibly not noticed by continuous occupants, and improvements have since been introduced which make the contrast yet stronger, so that it is not uncommon now to find that the hidden and diffusive power of some infectious disease has its original source in abodes where such danger had been least looked for.

In a large proportion of the residences now erected in our principal cities, the question of cost is a minor consideration, so that the owner can obtain the maximum of comfort, convenience, and elegance, with the assurance that every possible condition necessary to making a healthful residence has been complied with. So we have the various methods of heating by steam, hot water, and hot air, either from appliances within the house, or, as now proposed, with the heat furnished from some central source of supply; it is, also, quite within the scope of the possibilities of the near future that we shall have a system of cooling houses and places of public entertainment in the summer season by artificially generated currents of cold air, quite as effectually as we can warm them at present. In the making of a light more economical and better than gas, inventors everywhere are now showing a marvelous degree of activity, and the employment of electricity for this purpose, and in the telephone and other ways, has, within a very recent period, opened up many new channels of improvement. In the mason, carpenter, joiner, and decorative work, money is expended unsparingly, and in many ways which were unknown a few years ago, to add either to the attractiveness or the durability of the residence. But, with all these efforts to attain an ideal perfection, there have been many conspicuous instances of failure to make a healthful dwelling place where it had been supposed that all the required conditions had been most rigidly complied with.

In city buildings, where the houses so adjoin each other that party walls are in common on both sides, it is not to be supposed that much attention need be paid to having a damp course to cut off soil emanations, a matter which is of great importance in all country houses; but with whole blocks of residences or tenement houses erected on made ground, where the filling-in material has been mixed with garbage, or where the natural drainage has been improperly provided for, an even worse condition will be likely to result than can come from building on a wet soil in the country without a suitable damp course. The exhalations from made ground of this character are certain to make themselves manifest sooner or later, and to permeate or be taken up, to greater or less degree, by the buildings erected thereon, and in such way that the sun and wind can have but little power to carry them off.

The one question, however, which stands out beyond all others in the matter of sanitary house building, is that of plumbing. The gas and water pipes are generally hid away, so that it is not easy to examine them, and the condition and adequacy of the sewer connections are almost always taken on trust. The effectual covering of water pipes so that they will not be liable to freeze in cold weather is one of the reasons for disposing of them in this way, but this only makes the work of repairing the greater when an accident does happen, and putting the pipes where they cannot be seen and readily examined, is often the frequent cause of a small leak making a great deal of damage. More than this, however, a defect in the sewer connecting pipes, whether from accident or the inadequacy of the service, means much more than the simple cost of remedying this evil, for upon the perfect working of the drainage pipes and their connections depends, more than on any other one cause, the healthfulness of a house or a neighborhood. With the pipes all in plain sight, or where they could easily be examined, there are few householders who would not make it their business to look into such matters, and be sure that there was no room in this way for the escape of foul sewer gases into their kitchens, and sleeping and living rooms. Many ingenious theories have been put forward of late in regard to proper systems of sewage for large cities, and "sanitary plumbing" has come to be an accepted term in the building trades, but the disastrous results which have in many cases followed the adoption of the most approved plans, point only too plainly to the fact that the specialists, as well as the public in general, have yet much to learn in this direction.

Oil of Coffee.

From a paper upon the oil of roasted coffee, contributed to a chemical journal by Dr. C. O. Cech, of St. Petersburg, we extract the following:

Although the coffee bean belongs to our daily food, we are still uncertain of the chemical nature and composition of the products of roasting coffee, and of oil of coffee, one of the important characteristic constituents of the bean.

The existence of a coffee oil makes itself known in a striking manner by its roasting, for this oil, driven out of the beans by the heat, is partially volatilized, and, together with other products of the roasting, produces the characteristic aroma of roasted coffee, an odor possessed by no other substance. In very strong black coffee, too, we can see this oil like little drops of grease floating on it. The amount of oil in coffee varies from 8 to 13 per cent, and at least half of this is lost in roasting, so that it would be a paying experiment to attempt to collect this oil, especially in large establishments where much coffee is burned and several pounds of oil are dissipated daily. In 1878 not less than five hundred thousand tons of coffee were consumed, so that the amount of oil that might have been collected was very considerable. Dr. Cech tried the experiment, in one of the large roasting establishments of Berlin, of connecting the roasting drum with a cooling apparatus and a receiver so as to condense and collect the volatile and oily products of the roasting. At first there is scarcely any gas generated in the drums, but after the beans are browned and the whole mass has been heated to the temperature where the oil evaporates, such a quantity of the volatile aromatic oil is generated that it trickles down the walls of the chamber in which the beans are shoveled and cooled after coming from the drums. Unfortunately the manipulations of roasting are at present such, that this very cooling and reshoveling of hot beans must be done in the open air, and is the reason that it is not possible to catch and condense the vapors so abundantly liberated. Practice has proven that at the very moment when the beans turn brown and the first vapors begin to be given off it is absolutely necessary to pull the drum out of the roasting furnace and rapidly cool the coffee by shoveling and reshoveling in the air, or there is danger of its taking fire in the furnace and burning to a coal. Nevertheless it might be feasible to connect the drums with an exhauster so as to condense the gases in a receiver, and at the same time cool the bean enough to prevent its taking fire. Cech has no doubt that the oil obtained in this manner would find use, at a profit, in making liqueurs.

To study the properties of oil of coffee, Dr. Cech pounded up 50 lb. of different kinds of coffee in a mortar, and then extracted it with alcohol and ether, obtaining about 1,200 grammes (2½ lb.) of oil of coffee. The beans extracted by him were not of equal value as regards the yield of oil, for while some contained as high as 13 per cent, other kinds fell below 8 per cent.

The oil of coffee is a green, thick, transparent oil, and after some time a few long needles were deposited from it. These proved to be caffeine. Since caffeine is not extracted from the exhausted beans by ether, and very little of it is taken up by the alcohol employed, the coffee from which the oil has been extracted could be employed for the manufacture of caffeine.

The coffee oil became turbid in half a year, although it was kept in hermetically closed bottles. Small groups of crystals were formed in the middle of the liquid, and slowly settled to the bottom, and at the end of three years the bottle was two-thirds full of a dirty mass of crystals consisting of the solid fatty acids, but the upper layer of the liquid remained for years transparent, clear, and of a beautiful green color, proving that a portion of coffee oil consists of liquid oleic acid.

Although Dr. Cech has had the oil in his possession for three years he has not determined its percentage composition.—*J. pr. Ch.*

An Easy Test for Olive Oil.

One of the rarest articles of daily use is *pure* olive oil, and many think themselves fortunate to obtain oil which is in part made from the olives. Add to this fact the difficulty of distinguishing one vegetable oil from another by chemical test, especially of recognizing them when mixed, and no wonder the importers of olive oil soon accumulate a competency.

A German soap journal tells its readers how to detect adulterations in oils, without, however, enlightening them as to the sort of oil used for adulteration.

The test is exceedingly simple, and can be performed by any one possessing a good chemical thermometer. About a teaspoonful of oil is put in a test tube, and a thermometer suspended in the oil, which is now to be heated to 250° C. (472° Fahr.). For a comparison a second test tube of pure oil may be treated in like manner. Pure olive oil, when heated, grows rather lighter in color, but most other oils, like cotton seed, peanut oil, etc., grow darker. The latter, also, evolve a penetrating and disagreeable odor, but olive oil has a pleasant smell not unlike strawberries. This test, devised by Merz, is at least worthy of a trial.

Salicylic Acid for Bee Stings.

Although salicylic acid, from having been too highly extolled, has fallen somewhat into disfavor, there can be no doubt that it is useful in the case of bee stings. An Austrian paper recommends the following treatment: First, to remove the sting as quickly as possible with a forceps or by scratching with a finger, but never between the thumb and forefinger, because this squeezes more of the poison into the wound. Next squeeze the wound until a drop of blood comes out, and rub the place as large as a dollar with an aqueous or dilute alcoholic solution of salicylic acid. The effect is still better by injecting the salicylic acid into the wound with the hypodermic syringe. After this the spot is painted with collodion to keep out the air. A sting treated thus causes little or no pain, slight inflammation and swelling, and is not followed by nettle-fever or lameness in the most sensitive and nervous individuals. P. N.

Testing Drain Pipes.

A writer in the *Ironmonger*, from long practical experience in testing drain pipes, confidently recommends for that purpose what he terms a "smoke test," and which gives evidence as to leaks both to the sight and smell. The materials that he employs are soiled cotton waste and sulphur, the smoke from which, after ignition, is blown into the drain or pipes. If leakages exist in the latter inside of the house, the smoke and smell both issue forth and show that something is wrong, and generally tell also just where the fault or faults are. Sulphur, as well known, is one of the best of disinfectants, and a dose of the fumes from this to the drains, after disease has been in a house, would effect much good.

Ripening Melons Underground.

As well known, there are many plants which thrust their seed vessels into the ground, where the seeds are subsequently matured. The peanut is a good example of a plant which constantly exhibits this phenomenon. Others again develop flowers and seeds entirely underground, while many aquatic plants ripen their seeds under water. According to the *Gardener's Chronicle* the Persians, who are extensive cultivators of melons, have the curious practice of covering this fruit with earth at a certain stage. Such a method is in vogue among Persians who live in the neighborhood of Tiflis, in the Caucasus. Only the choicest and best keeping variety, the true Dutma, is grown. It is a long, smooth kind, which attains a weight of fifteen to twenty pounds, and will keep till Christmas. The deeply tilled ground is thrown up into beds a foot wide in spring, and the seeds sown in a drill along the center. Finally, the plants are left at a great distance apart, and irrigation is effected through the channels between the beds, so that no water touches the plants. The fruit sets in June, and only one or two are left on each shoot. When the fruit has attained the size of a man's fist the earth is hollowed out, and the shoot (with the exception of the tip), together with its fruit, is buried therein to a depth of one to one and a half inches, where it remains until the fruit is almost ripe. Considerable practical experience is necessary in order to be able to determine the exact moment when the melons should be unearthed. When the cultivator thinks that the time has arrived, he withdraws the shoot and its fruit from the ground. This is done toward evening, and the fruit is left on the surface of the ground, attached to the shoot, and exposed to the dew of one night, but care is taken to cut the fruit the next morning before the sun can reach it. It is then hung in a cool, dark, dry place, until ready for eating.

Detection of the Trichina.

Another death from *trichiniasis*, under exceptionally severe circumstances, having recently occurred, public attention is again being directed to the ravages of that terrible parasite, the *Trichina spiralis*.

A young German butcher, Franz A. Axler, apparently suffering from a severe attack of rheumatism, was lately admitted into Bellevue Hospital. For several days the physicians who visited the ward to which Axler was assigned were unable to make a diagnosis of his case; but eventually, and as a result of close watching, the conviction grew that he was suffering not from rheumatism, but from trichiniasis. This disease not yet having been relegated to that class about which it may be said "we know all about it," it is not to be wondered at that the greatest interest in this case was immediately manifested by many distinguished medical men. Upon due inquiry having been made, the fact was elicited that Axler had a short time previous to the first indications of disease been freely partaking of raw pork, a practice to which he, in common with some others of his countrymen, appears to have been somewhat addicted. To make "assurance doubly sure," Professor Janeway one day with his lance removed from the patient a small piece of muscular tissue, which, having been placed under the microscope, revealed the presence of numerous living active trichinæ. Axler eventually died; although, as we shall show, the disease, while formidable, is not necessarily *fatal* in all cases. A *post mortem* examination with the microscope, of course, showed that the active parasite had increased and multiplied to such an extent that every muscle in his body (which was teeming with parasitic life) had been attacked and destroyed by this apparently insignificant creature of nature.

In the case now recorded, and for obvious reasons, death ends all; but indications are not wanting that much trouble may yet arise and much legal skill and acumen be imported into the settlement of other cases of trichiniasis, and that the pork butcher or even middleman may be liable to be proceeded against at law by the relatives of those who have succumbed to disease contracted through eating diseased meat. When Mrs. Eliza Greifelt sued Figge Bros., in Brooklyn, for $5,000 as *solatium* for the death of her husband, who died from trichiniasis claimed to have been produced through eating of a ham supplied by this firm, a significant fact in the rendering of the verdict (which was against the plaintiff) lay in the allegation that it had not been proved that the disease had been contracted from eating that ham in particular, but, on the contrary, that death had ensued before the time when disease from such a source could have run its course; while, more directly, the evidence was such as would lead to the belief that the disease from which Mr. Greifelt died had been contracted by indulging, at a previous date, in certain pork sausages imported from Cincinnati. The verdict leaves for the butchers or dealers the slight unpleasantness that it might have been otherwise rendered had it been clearly shown that the trichiniasis from which the man died had been caused by the Brooklyn ham instead of by the Cincinnati sausage. The inference from this is too palpable to escape due notice or to require special attention being directed to it. But another portion of the charge of the judge in this case is still more significant, and to the public at large more important. In trade, he observed, persons were only bound to use "ordinary care and skill," and not the most scientific processes. This opens up the question as to what constitutes the "ordinary care and skill" standard on the part of dealers, and whether it be not possible to raise this standard a good deal higher than it appears now to be without entailing upon the butchers or sellers the necessity of incurring undue pecuniary expenditure or the acquiring of any special degree of scientific skill.

Previous to indicating simple means to both the butchers and the housewife by which diseased pork can be discovered, and showing the latter by what means the parasitic life forming the disease can be stamped out with certainty, a glance at the life history of that parasite is necessary.

In nearly every case of trichiniasis the disease has been contracted, as already observed, by the eating of raw or underdone pork. But it must also be observed that the pig is not the only animal eaten by man the flesh of which forms an abiding place for trichinæ. It has been said that the flesh of fowls is sometimes not exempt from them; that they are to be met with in rabbits we know, having seen several well developed examples in the flesh of that animal. Having partaken of a meal of raw, or even "rare," or underdone meat containing trichinæ, the recipient has in his stomach probably many thousands of the animal, if not in the full grown, at any rate in the condition of larvæ, which are not affected by contact with the gastric juice. In forty-eight hours they will have passed from the larval into the adult condition, arrived at which they immediately commence their destructive march through every tissue of the body. The life cycle of these creatures appears to be completed in about three weeks, although there is much yet to be learnt of their history. Two days suffice for their passing from the capsuled to the adult condition; the eggs from the adult take about six days to be developed into embryos. Death does not necessarily ensue when one's flesh is trichinized, for in many instances the disease comes to a termination by the animals perishing by the process of calcareous degeneration.

Both the butcher and dealer, as well as the lay portion of the public are interested in the best and easiest methods by which the presence of trichinæ in pork may become known. Every scientific man, of course, knows that the microscope is the revealer of this parasite; but it is not so generally known that a simple hand magnifier shows their presence with a degree of certainty and perfection that puts beyond the realm of doubt the fact of any sample of flesh being trichinized or not.

To examine pork, cut off in the longitudinal direction of the fiber and by means of a sharp razor a *thin* slice of the flesh about half the size of the nail of the little finger, and having placed it *in situ* on an ordinary microscopic slide or any other suitable piece of glass put on it a drop of liquor potassæ, cover it with another thin slip of glass, and keep the two firmly pressed together by means of spring clips—the ordinary spring clothes pegs being very convenient for this purpose. Upon examination by the microscope the thin and almost transparent layer of muscle will show the worms coiled up in their cysts, or moving about freely, according to the stage at which their development has arrived. This, of course, is on the assumption that the specimen undergoing examination is infected.

The microscopic power best suited for such examination is a low one, ranging from one to three inches; an objective of two inches being the most convenient, provided its defining quality is such as to enable it to be used with a tolerably high-power eye piece, which in the early stage of examination—the search—is not advisable, the lowest eyepiece being best.

We have said that the presence of trichinæ may be readily seen by a hand magnifier. By this must be understood one possessing a short focus and so constructed as to define very sharply. Those we have found most satisfactory are formed on the principle first enunciated by Dr. Wollaston, and named after him "the Wollaston doublet." It consists of two plano-convex lenses, their respective foci being as one to three, their convex surfaces being next to the eye, and the stronger of the two placed next to the object that is to be examined. By placing a diaphragm between the two the definition is improved. But even by a simple bi-convex lens, such as are used in the lowest type of microscopes as object glasses, may the trichinæ be seen, provided the focus be short and the peripheral rays cut off by means of a small diaphragm. Let it not be forgotten that by a "magnifier" of this simple form were made all those brilliant discoveries by Leeuwenhoek which astonished the scientific world at that time (A.D. 1678), and introduced a new system of philosophy and reasoning. If the lens used in the examination of trichinæ be one of plano-convex form it is important that its flat side be toward the object, for if this condition be reversed there will arise such a degree of spherical aberration as will render futile the hope of seeing distinctly. The amount of the aberration under the latter condition may be assumed as 4·5 times the thickness; whereas if reversed the aberration is only 1·17 of its thickness. The best form of simple or hand microscope is the Wollaston doublet, and the degree of magnifying most suitable for the purpose in question is one which need not exceed the ability to show the markings on the scales of the well known *Lepisma saccharina*.

From the facility with which the presence of the parasite in pork may be discovered, and the trivial nature of the expenditure to be incurred in securing the proper optical means for doing so, it is not unreasonable for the public to demand that the standard of the "ordinary care and skill" referred to by the Brooklyn judge be raised, and that such standard shall embrace the possession of a microscope, either simple or compound, and the ability to make use of it to such an extent at any rate as will enable the butcher or dealer to examine any suspected sample of meat.

One consolation remains. Man has been defined as "an animal that cooks his food;" and so long as he acts in accordance with this distinctive characteristic, so long will he be free from all harm arising out of the presence of parasitic life in his pork. Experiments prove that *partial* cooking does not destroy trichinæ, and it is probably owing to this fact that there are so many thousands in Germany who are trichinized, for in that country undercooked pork is freely partaken of. At a heat of 160° Fah., sufficiently prolonged to enable it to penetrate the capsules in which they may be inclosed, the germs of life are totally destroyed. But when the heat is raised to the boiling point, 212° Fah., then may it be assumed a matter involving no doubt whatever that the power of the trichinæ for good or evil has been suspended by death.

The Diffusibility of Carbolic Acid.

One day last December the people of Newark, New Jersey, were greatly annoyed by a taste of carbolic acid in the city water, supplied from the Passaic River. The matter was investigated, and the contamination was traced to a paper mill ten or twelve miles up the river, where an incredibly small amount of carbolic acid had been allowed to get into the water. If the report of Mr. Geo. Shepard Page is correct, the occurrence will furnish a new illustration of the wonderful divisibility of matter, and the extreme delicacy of the sense of taste. Mr. Page says, in a letter to the *Tribune:*

"The paper mill of the Messrs. Kingsland is located on the Third River, a stream of considerable magnitude, two miles from where it empties into the Passaic. From the latter point to the pumping station of the Newark Water Works is also two miles. The volume of water in the Third River is not less than 2,000,000 gallons per day, and in the Passaic 150,000,000 gallons per day. The Messrs. Kingsland, among other specialties, carbolize paper by immersion in a bath of the best liquid carbolic acid of a quality such as is used in medicinal preparations. In the process of manufacture there is a small percentage of waste paper. No paper has been carbolized since last June, when not over a hundred pounds of waste or torn paper were placed in the loft of the mill, where it remained until the last of December. It is well known to chemists and many intelligent persons that carbolic acid (really an alcohol and not an acid) evaporates rapidly when exposed to the air. To the sense of smell there was no evidence of carbolic acid in this waste paper when the Messrs. Kingsland decided, in December, to work it up again. Dust having accumulated on it, washing in the mill pond was necessary.

"A few days after this a perceptible taste of carbolic acid was noticed by the people of Newark, not only in the drinking water, but also in tea and coffee made with boiling water. As an absolute fact, not over ten pounds (a gallon) of carbolic acid had been used in this paper when treated. Certainly 30 per cent had evaporated, leaving not over seven pounds to permeate 200,000,000 gallons of water, a portion of which was aerated by passing over rapids and dams, through four miles of river, seven miles of pipe, and countless taps. It would seem incredible had we not the evidence of chemists and medical men in Newark perfectly familiar with the peculiar taste of carbolic acid. Pardon me the space occupied by this narrative, but so remarkable a scientific fact deserves to be recorded. Of course no injurious effects would be experienced, as a single carbolic troche would contain more acid than a thousand gallons of Passaic water. Indeed, a beneficial effect should be felt (of course, to a limited extent), in neutralizing Paterson and Passaic sewage, below which cities Newark and Jersey City obtain most of their water supply."

Lead Pipes Destroyed by Mortar and Cement.

In German cities, where the streets are not decorated by festoons of telegraph wires strung upon towering masts like a dismantled forest, but securely buried in leaden pipes, the telegraphic cables are out of sight and protected from ice and fire, some interesting experience has been gained. On taking up these cables it has been found that in some places the lead pipe had become brittle and porous, and a chemical examination showed that the lead had been converted into a basic carbonate (white lead). It was found that this change had taken place only where the pipe had come in contact with mortar or cement.

Dr. Rossel, who has experimented with lead, finds that in contact with lime mortar it always loses perceptibly in weight, and in contact with cement the loss is nearly as great. Lead buried in moist earth that contains chlorides, saltpeter, and sal ammoniac, lost weight, but to a much less degree than in mortar. The sulphates, like plaster of Paris and Glauber salts, had no action upon lead; neither did the carbonates, like chalk, soda, and potash, nor the silicates, sand, and clay. He calculates that a pipe one millimeter thick, or one twenty-fifth of an inch, might be eaten through in fifteen or sixteen months.

[We have ourselves seen lead pipe destroyed by holes and indentations on the outside as if bored by an insect, but were unable to ascertain the nature of the soil where it had lain.—ED.]

From his own observations Dr. Rossel makes the following statement:

1. Lead pipes should never be brought in contact with any sort of mortar or cement.

2. Clay does not attack lead pipe if free from sal ammoniac and saltpeter, the latter resulting from the decay of organic matter.

3. Plaster of Paris offers the best protection for lead pipes. Wherever lead pipes pass through a wall they should be laid in gypsum, over which mortar or cement can then be safely laid.

P. N.

Separating Apparatus for Cesspools, etc.

BY J. LESUEUR, PARIS.

To separate the liquid from the solid matters they are caused to pass from the pan to a perforated cylinder closed at bottom by a pivoted perforated plate. The liquid matters escape through the holes in the cylinder and bottom to a suitable pipe. The solid matters are retained on the bottom plate until they are sufficiently heavy to overcome a counterweight attached thereto, when the bottom plate turns on its axis and deposits the matters into a pipe leading to the cesspool.

Phosphor Tin.

An alloy of tin with phosphorus has been in use in Germany for some time for making phosphorus bronze. A practical man gives it as the result of his experience that such a compound must contain at least 9 per cent of phosphorus, else part of the tin will remain uncombined. If more than 9 per cent of phosphorus is introduced the excess will be oxidized and volatilized, because the tin is unable to take up and hold more than a certain quantity of phosphorus. A compound containing 9½ per cent of phosphorus corresponds to the formula P_2Sn_4, corresponding to the higher oxide P_2O_5.

To Fix Pencil Marks.

To fix pencil marks so they will not rub out, take well skimmed milk and dilute with an equal bulk of water. Wash the pencil marks (whether writing or drawing) with this liquid, using a soft flat camel hair brush, and avoiding all rubbing. Place upon a flat board to dry.

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.

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) B. R. asks: What is the best method of spreading a thin layer of selenium on glass surfaces and other smooth surfaces of that description? A. This is a subject of which there is but little known at present, for, as *Nature* says, "the investigation is one that requires to be carried on with the aid of a fully equipped laboratory, and is beyond the power of an ordinary experimentalist." It is, in the meantime, uncertain as to whether a transparent sheet of selenium can be more easily obtained by a method of precipitation than by mere mechanical treatment. It dissolves fuel in chloride of selenium and precipitates slowly in a botryoidal mass of black selenium. It also separates in the crystalline form from solutions of selenide of potassium or sodium. In its vitreous condition selenium melts at a temperature of about 220° Fah., and can be drawn out between mica plates to a thin red film.

(2) C. V. S. asks: 1. How many mercury flasks, as described in SUPPLEMENT, No. 182, would I need for a boiler for a boat 30 feet long, 6 or 6½ feet beam, and 3 feet deep? A. At least 60 for water and 30 for steam. 2. In laying the keel, should it be of one piece of oak, 32 or 34 feet long, steamed and bent to form the bow; or should it be a piece of oak, 33 or 34 feet long, with the bow and stern post rabbeted to the keel? A. It may be steamed and bent, or the stem and stern posts may be scarped to the keel and fastened by rivets. 3. What size should the engine be for a boat 30 feet long, of the style described in SUPPLEMENT, No. 81, of the Flirt, built by H. S. Maxim? A. 5 inch to 6 inch cylinder and 6 inch stroke. 4. Could I with a boat of this size go from New York city to United States of Colombia, say to Aspinwall, and if so, what would I need besides compass, charts, and lamps? Would I have to get any papers permitting me to go on said voyage, as the owners of vessels have to have? A. It must be inspected and licensed if over 5 tons measurement.

(3) D. A. asks: 1. Which is the better device to keep steam on a self-propelling fire engine: to keep a banked fire in the furnace, or to use a heater similar to those employed with the ordinary fire engine? In fact, is the first method a safe one? A. We consider the heater the safest. 2. In connection with a heater for keeping water hot in an engine, which pipe should be the largest: the one leading to or from the engine? A. It is quite as well to have both pipes of the same size; but if a difference is made, the return pipe should be the larger.

(4) F. W. F. asks: 1. How can I polish a small plano convex lens which is slightly scratched on the surface? A. See article on lens making, vol. xliii., page 51, SCIENTIFIC AMERICAN. 2. What preparation shall I apply to paper or other substance to take pictures with a camera, and cost of same? A. This information to be of any practical value would require too much of our space. Consult some good work on photography. 3. Why is a meniscus lens better for the object glass of a refracting telescope than a double convex lens, so stated in SCIENTIFIC AMERICAN SUPPLEMENT, No. 252? Does it give less prismatic colors? A. With the meniscus there is less spherical and chromatic aberration. 4. I have a private acoustic telephone line; line wire very small size copper wire. At each end I have a wire also of copper two or three times as large as line wire, running down into moist earth and twisted around the line wire. Will these wires convey to the ground any charge which the line may receive during a thunder shower, preventing all danger to the inmates of the houses? A. Yes, providing the ground ends are terminated in a coil buried in a bushel or so of coke which is always enveloped in moist earth. It would be better to solder your ground wire to a gas or water pipe if possible.

(5) E. W. C. asks: 1. Can a rotary engine such as the "La France Fire Engine," be run backward by bringing the steam in through the exhaust pipe? A. Yes. 2. Could such engine be run by gas, by having the explosion at regular intervals? A. It might be run in that way. 3. Which would be the most economical, the above or a cylinder engine using gas, the power being 2,000 foot pounds? A. The cylinder engine.

(6) J. B. H. asks: What will restore on silks and silk laces luster lost in dyeing? A. Grate half a dozen large potatoes into a gallon of soft water, agitate briskly for a few minutes, and let stand 24 hours to settle. Carefully draw off the clear liquid, and with this sponge the fabric thoroughly. Press very strongly with hot irons—in one direction—between fine cloths; kept moist.

(7) E. B. asks: What are the dimensions and tonnage of the yacht America, whether she is keel or center board, and the lengths of her spars? A. Yacht America's original dimensions were: Length on load, water line, 90 feet 8 inches; breadth, extreme, 22 feet 6 inches; carpenter's tonnage, 210 tons. Her present masts are: mainmast, 78 feet long; foremast, 76 feet 6 inches; mainboom, 70 feet long; foreboom, 26 feet long.

(8) F. L. P. writes: In your issue of January 22, in reply to L. D. G., you say the pressure on the feed pipe is a trifle more than on the boiler. Will you be so kind as to explain how you get the extra pressure? A. The difference in pressure is due, first, to the greater area, the upper, than the underside of the delivery valves; second, to the friction of the valves; and third, the friction of the water in the pipes and passages.

(9) U. D. M. asks: 1. What is the rule for running a belt from one pulley on to another on a bevel so as to run the shafts on an angle? A. You will find the rule with a diagram on page 27 (5), Vol. 40, SCIENTIFIC AMERICAN. 2. How much power can we use on the end of a 1½ inch shaft 250 feet long, without twisting it? A. It depends upon the speed of the shaft. 3. How large a steel wire rope do we need to 5 horse power, 250 feet from first pulley? A. It depends upon the speed of the rope. You can get tables of sizes and speeds from manufacturers of wire rope. 4. Which is the cheapest and best to use for 5 horse power, 250 feet from driving pulley, steel wire rope or iron shaft? A. Wire rope.

(10) J. S. H. writes: I have an office hand lithograph press for printing letters on stone. I get a splendid impression of transfer on the stone, but after dampening the stone with a sponge it seems to take the ink almost as readily as the transfer, thus smutting up the print. I use a buckskin roller and printer's news ink. Can you tell me how to proceed so that the stone will not take the printer's ink except where the transfer ink strikes, and how to get a clear and clean print? A. Let the stone dry and wash it with a 2 per cent aqueous solution of nitric acid; rinse in water and then in weak gum water preparatory to inking. Add a little stale beer or vinegar to the water used for dampening. Use good lithographic ink.

(11) B. I. B. asks: What kind of varnish or oil will be best for preserving eggs, and how can it be applied so as to have a thin, even coating? I want something in which eggs can be dipped. A. You may try ordinary linseed oil (used for this purpose in Germany), or thin alcoholic shellac varnish. See SUPPLEMENTS, Nos. 53 and 65; also SCIENTIFIC AMERICAN, Vol. 39, p. 375.

(12) J. S. H. writes: I see many inquiries in your columns asking how to clean the aniline ink from printing pads after through printing. I can answer. Saturate a sponge in water as hot as possible to bear the hand in, pass the wet sponge across the face of the pad and the ink will disappear. Then rinse off the face with the sponge dipped in cold water. Experience has also taught me that when the print begins to get dim, if you will dampen the face of the pad with a sponge dipped in cold water, the ink becomes as bright as at first, and in this way a much larger number of letters may be pulled than if this process is not employed.

(13) C. C. C. asks: Is there no way in which rubber could be softened in process of making rubber stamps except by heat? A. Sulphide of carbon, benzole, turpentine, and the essential oils in general cause rubber to swell and soften. While thus softened it may be moulded; but as the oils or other liquids used escape by evaporation it shrinks again. Softening by heat gives more satisfactory results.

(14) T. B. asks: Which has the most friction, a locomotive crank pin seven inches in diameter or one four inches in diameter, the width of bearing being the same in both cases? A. The conditions being the same, the friction would be the same in both cases, but the loss of power would be greater with the larger pin, as the friction acts upon a longer radius.

(15) J. W. asks: 1. What sized belt will give 180 horse power under following conditions: Driving pulley 7 feet in diameter, driven 4 feet, belt in contact with one half the circumference of 4 feet pulley, speed of belt 3,300 feet per minute? Please give rule. A. Calculate by the following formula, $\frac{WS}{600}$ = horse power, W = width of belt in inches; S = speed of belt in feet per minute. In your case belt should be 33 inches wide in round numbers. In this case 600 is used for a divisor, because of the favorable conditions; for narrow belts use 800.

(16) E. H. asks (1) how much power a certain size pulley (say 12 inches diameter, 6 inches face) will transmit at a given speed to a pulley of equal size. A. We suppose your pulley of 6 inches face would run a 5 inch belt. A safe rule for the power of a belt is $\frac{W\ S}{800}$ = horse power, where W = width of belt in inches, and S = speed of belt in feet per minute. From this you can get the power of your pulley. 2. Can you recommend a book treating on the subject? A. "Cooper on the Use of Belting."

(17) L. J. C. asks for the best methods of sticking paper together to make paper boats, pails, or things similar. A. One of the following cements will probably answer: 1. Waterproof: gum rubber, 1 lb.; shellac, 2 lb.; benzole, 12 lb. Cut the gum rubber into fine shreds, and macerate it with frequent agitation in the benzole until dissolved. Then place the vessel (out of doors) in a bath of hot sand, and gradually add, with constant stirring, the powdered shellac. Heat and stir until a perfectly homogeneous mass is obtained—marine glue. In heating, the best vessel to use is a porcelain enameled iron dish. For a stirring rod use a pestle. 2. Gum rubber, 1 lb.; asphaltum (not tar), 2 lb.; benzole, q. s. Cut the rubber fine, macerate until it is dissolved in the benzole, then gradually add the asphaltum, triturate together in a mortar until all is softened and dissolved. It should have about the consistence of molasses. 3. Resin, 2; boiled oil, q. s.; plaster of Paris, 2; turpentine oil, ¼. Melt the resin in the heated oil, remove out of doors, and stir in the plaster and turpentine while hot.

(18) W. R. R. writes: We are building a water tank 15 feet diameter, 10 feet deep, to hold water pumped from a well; the water will be used to supply and wash out our locomotives. Should the inside of tank be painted? If so, what is best? A. Paint with brown oxide paint (oxide of iron), ground in and mixed with pure linseed oil.

(19) J. S. M. asks: Are the rims of railway car wheels chilled? If so, will the rim and center of the wheel, when remelted, be equally soft in temper? A. They are chilled, and when remelted, the effect of the chill is, to a great degree, destroyed.

(20) J. T. M. asks for a receipt for staining whisky barrels a weather-beaten color. A. Use a strong aqueous solution of green copperas (sulphate of iron) or nitric acid.

(21) C. W. V. writes: 1. I want to tin hoop iron. What can I use to take off the scale? I have tried muriatic acid, but it does not seem to clean it. A. Pickle in a bath of muriatic acid 1 part, water 20 parts, until the red oxide disappears, rinse and heat to redness to remove the scale, hammer on an anvil, and immerse in a bath of fermented bran water at 100° Fah. for about 12 hours. On removing brighten by pickling in oil of vitriol 1 part, water 20 parts, at 100° Fah. Finish by scouring with hemp and fine sand. This is the usual method. 2. Can I mix lead with the tin? If so, what proportion can be used? A. Lead can be mixed with tin up to 50 per cent, but in such a bath the lower portions soon become richer in lead on standing, and the results are not good.

(22) J. S. B. M. asks: 1. How can mica be dissolved so as to form a varnish? A. Mica cannot be dissolved so as to be useful in the way you propose. 2. What is the best article I can use to bring zinc (metal) to a high polish for engraved signs? A. Use fine pumice stone and a little oil first, and finish with fine tripoli.

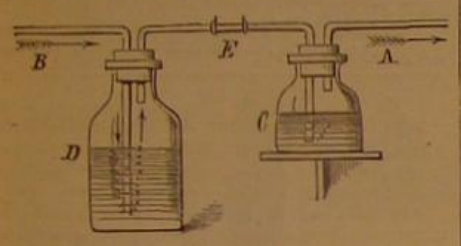
(23) E. H. B. asks: What is the method used to keep an ice house dry—the air dry—so that eggs or products similar can be kept in it for some months without spoiling? A. The dryness of an ice house depends more on its construction than anything else. The ice receptacle should be located so that the moisture of the room may be condensed on it and conveyed away.

(24) G. T. asks for a receipt for a first class office mucilage. Something that will not blister the paper as most of them do. A. Try the following: Good gelatin, 5 oz.; rock candy, 20 oz.; gum arabic, 3 oz.; water, 20 oz.; oil of cloves, a few drops. Soak the gelatin in the cold water over night, then heat to boiling for several hours (replacing the lost water), and gradually introduce the other materials.

(25) M. L. B. asks for a good receipt for a preparation that will effectually stop a constant steam leak when red lead is insufficient, such as around stud bolts, or cracks in castings, etc. I once was handed for trial a preparation resembling yellow clay to be ap-

plied just before turning on steam, that became very hard; but lost name of article. A. Iron cements or rust joints are generally used for such purposes. The following receipts are good: 1. Iron borings, pounded fine in a mortar, 1 lb.; sal ammoniac, in powder, 2 oz.; flowers of sulphur, 1 oz. Mix the whole thoroughly dry. For use mix 1 part of the above with 20 of fine iron borings, and mix with water to the consistence of mortar. Use at once. 2. Iron borings, 2 lb. (clean); flowers of sulphur, 1 oz.; sal-ammoniac, 1 oz. 3. 98 parts fine, clean iron borings, and 1 part each flowers of sulphur and sal-ammoniac, all dry. Mix thoroughly and moisten with hot water, when required for use. 4. Fine clean iron borings, 1 lb.; sal-ammoniac and spirit of salt, each half an ounce; water to moisten thoroughly when required for use. The joint should be allowed to rest for at least 10 hours before putting under pressure. For cracks calk in a little rope yarn fiber first, then calk in the cement.

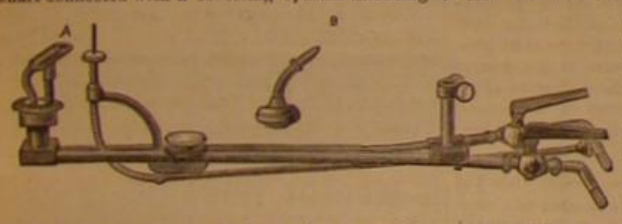
(26) C. M. asks for an easy chemical test for injurious gas in rooms warmed by a coal furnace. A. We know of no simple way of testing air for such impurities. Carbonic oxide, the most to be dreaded of such products of combustion is very difficult to detect, in such a connection by chemical means, but as it usually accompanies or is accompanied by carbonic acid gas, in such cases the detection of any considerable quantity of the latter serves as an indication of the presence of the former. Carbonic acid is detected in air by drawing the air through a solution of lime in distilled water (clear filtered). Carbonic acid precipitates carbonate of lime from such a solution, making the liquid more or less milky. It should be remembered that all air contains a trace of carbonic acid, hence the liquid will always be more or less affected. Experiment first with pure out-of-door air, then with the air of a badly ventilated room, passing about the same volume of air, and you will soon be able to judge whether very much



carbonic acid is present or not. A simple apparatus for such tests is made from two glass bottles with good stoppers and a few pieces of glass tubing, as indicated above. D contains the lime water. C, a safety bottle to prevent the entrance of air from the lungs entering through E. The mouth is applied at A. The air enters at B.

(27) R. A. & J. S. ask: Have you ever known machinery of 170 horse power driven by a rubber belt? What should be the width of a belt to convey that amount of power? A. Yes, if the speed of your belt is 3,000 feet per minute it should be about 90 inches wide. We refer you to two cases mentioned in "Cooper on Belting," page 137.

(28) A. M. B. and others inquire how to make an oxyhydrogen jet for a magic lantern. A. The cut shows a very convenient form of oxyhydrogen jet. It is provided with two interchangeable jets, A B; the spindle, which holds the lime cylinder, is adjustable lengthwise of the gas tubes, and is rotated by a flexible shaft connected with a revolving spindle extending to



the back of the lantern. The burner is supported by a rod (not shown) projecting from a movable base. The jet, A, is of the annular form, the small central jet being for oxygen and the annular jet surrounding it for the hydrogen. There is no internal communication between the two pipes. The jet, B, combines both gases in the chamber beneath, and is not safe unless both gases are under equal pressure. Common illuminating gas may be used in place of pure hydrogen in the jet, A, and it may be taken directly from the burner of an ordinary gas fixture. Where two lanterns are employed the dissolving effect is secured by turning off the oxygen.

(29) S. M. W. asks for the process of gilding on common stone china, such cheap ware and gilding as we see so frequently at present in the shops. Also can such ware be gilt by a gold solution without the use of fire? A. The gilding is done either by an adhesive varnish or by heat. The varnish is prepared by dissolving in hot boiled linseed oil an equal weight of either amber or copal. This is diluted with a proper quantity of oil of turpentine so as to be applied as thin as possible to the parts to be gilt. Let stand after varnishing about 24 hours, then heat in an oven until so warm as almost to burn the fingers when handled. The heat softens the varnish, which is then ready to receive the gold leaf, which may be applied with a brush or pledget of cotton, and the superfluous portions brushed off. Burnish when cold, interposing a piece of thin paper between the gold and burnisher. Where burning in is practiced the gold reduced to powder is mixed with powdered borax glass (anhydrous borax), moistened with a little gum water, and applied to the clean surface with a camel hair pencil. When quite dry the article is put into a stove heated to about the temperature of an annealing oven. The gum burns off, and the borax, by vitrifying, cements the gold with great firmness to the surface.

(30) M. M. H.—To temper gun springs, heat them evenly to a low red heat in a charcoal fire, and quench them in water with the cold chill off, keeping them immersed until reduced to the temperature of the water. Place an iron pan containing lard oil and tallow, in about equal quantities, over a fire, and place the springs therein, and heat the pan until its contents take fire; then hold the springs in the flames, turning them over and over and dipping them occasionally in the oil to keep them blazing; when the oil adhering to them blazes freely when they are removed from the flames, place them aside to cool off.

(31) B. A. and others ask how to produce an illuminating composition. A. Cleanse oyster shells by well washing, expose them to a red heat for half an hour, separate the cleanest parts, and put into a crucible in alternate layers with sulphur; now expose the vessel to a red heat for an hour at least. When cold break the mass, and separate the whitest parts for use. If inclosed in a bottle it is said the figures of a watch may be distinguished by its aid. To renew the luminosity of the mass place the bottle each day in the sun, or in strong daylight; or burn a strip of magnesium wire close to the bottle. The sulphide of lime will thus absorb light, which will again be available at night.

(32) A. R. asks how to utilize old bones for fertilizing purposes. A. Unless the quantity is very large, the bones should be crushed fine as possible with a heavy iron hammer, mall, or with a large stone mortar. Place the fragments in a heating compost of yard manure and ashes, taking care to moisten it frequently with liquid manure if to be had, or with water in default of the urine. By spreading a thin coat of fresh earth or plaster over the pile, the escape of the valuable ammonia will be prevented. Six months' time will suffice to disintegrate the bones and produce as complete and effective a manure as can be made on the farm. The proportion of ashes to bones should be at least an equal amount of ashes as of bones; more will do no harm. The larger the amount of manure, within reasonable bounds, the better; at least two or three times as much as of both the others is advisable.

(33) H. P. R. asks how to make a small battery for operating electric jewelry. A. The essential parts of such a battery are, two plates of carbon, one plate of well amalgamated zinc, and a solution made by dissolving 2 parts of bichromate of potash in 20 parts of hot water, and when cold adding 1 part of sulphuric acid. The zinc plate is placed between the two carbon plates, leaving a space on each side. The carbon plates are connected together and with one of the conducting wires, the zinc plate is connected with the other conducting wire. The zinc and carbon plates may be attached to a rubber stopper fitted to a small jar or bottle containing the bichromate solution at the bottom below the ends of the plates, and the solution may be brought into contact with the plates by turning the bottle down on its side. This battery works powerfully for a short time, but the solution soon becomes exhausted and must be replaced.

(34) M. B. B. asks: What is the best and easiest way of making a magneto or crank battery—one that can be made at home? A. There is no really easy way, but perhaps the easiest way is to mount an electro-magnet wound with No. 36 wire on a shaft so that it may revolve in proximity to the poles of a permanent U magnet. The sides of the magnet should be parallel to the plane of rotation of the electro-magnet and as near to the latter as possible without actual contact. The terminals of the magnet wire should be soldered to a commutator consisting of a split ferrule attached to an insulating cylinder on the magnet shaft. The ferrule should be divided at diametrically opposite points, and one end of the wire should be attached to each half of the ferrule. The commutator cylinder thus formed and connected is pressed by two springs insulated from each other and connected with metallic handles to be grasped by the person treated by the current. The commutator cylinder is turned upon its shaft until the maximum current is realized, when it is fastened. The machine may be driven by a small round belt, and its power may be augmented by using a compound permanent magnet.

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

M. M.—The boiler incrustation consists of iron, lime and alumina sulphate, carbonate and silicate, derived from impure feed water. It may injure the metal if allowed to accumulate.—C. S. T.—No. 1. Garnets—the stones are hardly clear or perfect enough to be of much value to jewelers. No. 2 Diallage—a lime magnesia silicate. No. 3. Limonite—an iron ore. No. 4. Marcasite—white iron pyrite. No. 5. Serpentine and calcite. No. 6. Calcite—crystallized lime carbonate.—F. F.—No. 1. Quartz rock. No. 2. Granite.—G. D. H.—It contains lead acetate, beside much organic matter. Would require a chemical analysis.

COMMUNICATIONS RECEIVED.

On a Method of Applying Tin Foil to Leyden Jars. By T. S

On Multicolor Printing. By E. G. B.

English Patents Issued to Americans.

From January 11 to January 18, 1881, inclusive.

Boats and vessels, masting and rigging for, J. McLeod, New York city.
Cake machinery, J. H. Mitchell, Philadelphia, Pa.
Caoutchouc, treating, G. M. Mowbray, North Adams, Mass.
Carpet-cleaning machine, W. McArthur, Philadelphia, Pa.
Dumping boats, N. Barney, Bergen Point, N. J.
Fog signal, F. Brown, New York city.
Grain drier, G. B. Boomer, New York city.
Metallurgical furnace, J. G. McAuley, Denver, Col.
Piston rod packing, C. C. Jerome, Chicago, Ill.
Screws, countersinking wood, J. Eckford, San Antonio, Texas
Tool holders, J. M. Bibbins, Williamsport, Pa.
Valves for steam engines, J. N. Rowe, Rockland, Me.
Waterproof fabric (2 cases), D. M. Lamb, New York city.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

January 18, 1881,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, 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. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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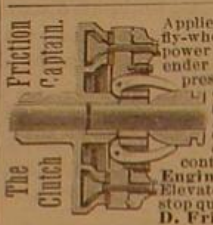

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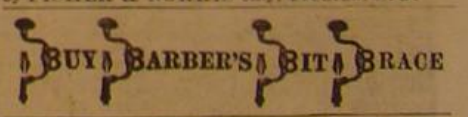

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