SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES

Vol. XXXVIII.—No. 21.
[NEW SERIES.]

NEW YORK, MAY 25, 1878.

[$3.20 per Annum.
[POSTAGE PREPAID.]

IMPROVED FEED WATER HEATER AND PURIFIER.

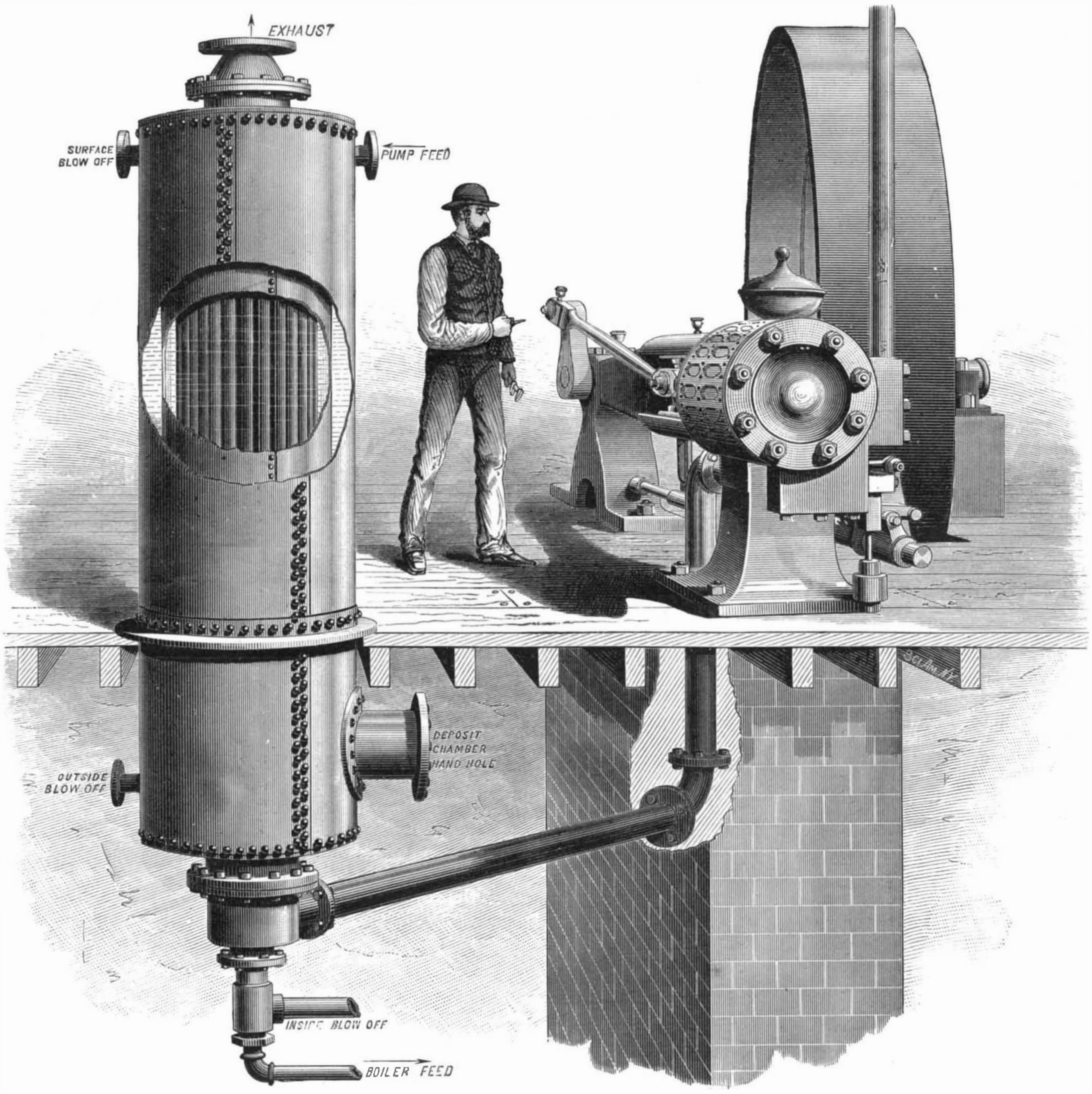
That there are utility and economy in a steam boiler heater that will warm the feed water to 212° with a part of the heat of the waste fuel, which escapes with the exhaust steam of a high or low pressure engine, is a matter scarcely to be doubted. The best mode of accomplishing this end, and at the same time preventing the formation of scale and the accumulation of dirt and grease in the boiler, are practical questions which should demand the attention of steam users.

The heater and purifier which our engraving illustrates has some new features, and is the invention of Mr. T. J. Lovegrove, of Philadelphia, an engineer of ability and experience.

The heater consists of an outer water chamber, from 12 to 16 feet long, the diameter depending upon the horse power of the engine, in which the cold water is pumped at the top and falls through water of about 200° Fah. After remaining in this chamber one hour it flows over the top of the inside apartment, of the same length, where it remains the same time. The inside chamber is supplied with copper or brass tubes, which are claimed to present sufficient surface to heat the water to a temperature of 212°. The exhaust steam has an uninterrupted passage through the tubes, with ample area to prevent loading the engine with back pressure. The double chamber prevents the tubes from becoming foul.

The outside case has a nozzle in which the dirt accumulates. This is large enough to receive a small shovel after the cap is removed. It also has a lower and upper blow-off. The inside chamber has a blow-off at the bottom only.

The tubes are expanded in a brass tube-sheet with a gum expander, which prevents the hardening, as is the case with the metallic expander. The deflection of the long tubes amply provides for their expansion and contraction.



LOVEGROVE'S IMPROVED FEED WATER HEATER AND PURIFIER.

The inventor submits a tabular statement of tests of this heater at the cotton and woolen manufactory of Messrs. James Smith & Co., Philadelphia, from which it appears that the percentage of gain due to the apparatus was 22¼ per cent.

For further information address Mr. T. J. Lovegrove, 3,326 N. Broad street, Philadelphia, Pa.

RECENTLY at the Middlesex quarry at Portland, Conn., three drill holes were made from 8 to 9 inches in diameter, 17, 18, and 19 feet deep, and about 35 feet apart. It required several kegs of powder to load them, and all were fired simultaneously by means of an electric battery. A solid block of stone, moved out several inches, measured 110 feet in length, 50 feet in width, and 22 feet in depth, and contained 121,000 cubic feet of stone, or 12,100 tons in weight.

Novelty in Yarn.

Mr. Louis Cordonnier has hit upon a singular method of producing a novelty in yarn; this is not surprising when we consider the immense number of varieties of cloth which our neighbors designate as *nouveautés*, and what we term "fancy cloths." After having tried every imaginable way of weaving to produce different effects, there hardly remains anything new but to return to the spinning. Mr. Cordonnier takes a mule, and places upon this another row of rollers, through which, at a different speed, he passes a colored or plain thread, but twisted in the reverse way of the direction of the yarn to be operated upon. In this way, when the spindles revolve, the two threads are twisted, but the additional yarn is at the same time untwisted; he then takes this doubled yarn, and twists it again with the same or any other yarn, but running it again in the opposite direction, which untwists the first thread, and produces a very singular effect, and one which in the loom will no doubt produce a novelty.—*Textile Manufacturer.*

Sir John Franklin.

In 1872, while Captain Edward Potter was wintering in Repulse Bay, he obtained a few spoons and other relics of Sir John Franklin's ill-fated expedition from two Esquimaux of the Nechelli tribe. They told him that a party of white men came, a long time before, to the place in the Gulf of Boothia where the Nechelli were then wintering, and all had died there from exhaustion and want of food. This information, which seemed improbable then, was confirmed by later reports. During the present year, however, Thomas F. Barry, who was with Captain Potter in 1872, brought back the intelligence that while his vessel, the A. Houghton, was wintering last year at Marble Island, in the upper part of Hudson Bay, he obtained from some Nechelli a silver spoon with Franklin's crest on it. These Nechelli told him exactly the same story respecting the party of white men that he had heard from others at Repulse Bay five years before. This corroboration led Chief Justice Daly, President of the American Geographical Society, to see Barry, with whom, he tells us, he had a long, full, and very satisfactory conversation. On the authority of Joe Ebbering, so well known in connection with Hall's Expedition, Justice Daly states that Barry speaks Esquimau very well, and the Justice is thoroughly satisfied of Barry's truthfulness. The Nechelli whom Barry met last winter, gave substantially the same account as the others, and two, who were between fifty and sixty years of age, said they had seen the white men. The Nechelli offered to go and point out the spot where the cairn still remains, with the books or papers that were put under it; but it involved a journey of over 400 miles, and those in the vessel were not provided with the equipment necessary for such an expedition.

Whatever conjectures may be indulged in, we think with Justice Daly there is sufficient information communicated to Captain Potter to justify a search for the spot where the Nechelli say this party of white men died, which could be done at a comparatively small expense, and might very well be undertaken by some of those private persons who have money and public spirit enough for enterprises of this kind.

Apart from the interest that is felt in knowing the fate of the officers and crews of the Franklin Expedition, there is the expectation that where the last of them perished some record will be found which will be of scientific value if it should contain the observations made over this part of the Arctic region by the expedition. The record of his journey is the very last thing that an explorer will part with; everything will be sacrificed for its preservation; and the assurance, Justice Daly thinks, may be felt that some memorial containing documents and papers, the precious record of their labor and fate, was erected in the vicinity of the place where the last of them died, in the hope that at some time in the future it would be found by civilized man.—*London Times.*

A QUANTITY of well executed counterfeit trade dollars has been captured in Cincinnati. They are composed of block tin, bismuth, and pulverized glass. They possess pretty nearly the standard weight, and have the exact color and the true ring of the real dollars. The only means of detecting them from the genuine is by means of a weigher or by pressing them between the teeth, when the glass which they contain emits of a cracking sound.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

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VOL. XXXVIII., No. 21. [NEW SERIES.] *Thirty-third Year.*

NEW YORK, SATURDAY, MAY 25, 1878.

Contents.

(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT
No. 125,
For the Week ending May 25, 1878.

Price 10 cents. To be had at this office and of all newsdealers.

THE BLACK SILK DECEPTION.

It is a matter of fact too well known to require any demonstration that the quantity of black silk used for wearing apparel far exceeds the amount of colored silk similarly employed. It may perhaps be said that there is no fabric made which finds a more extensive utilization than does black silk, and certainly there is none with which every retailer of drygoods and every experienced fair shopper thinks he or she is more familiar. The seller is always quite willing to affirm that his silk will "wear like a board," although his neighbor's, he insinuates, probably will not, and he is equally ready to advocate the mooted questions of cachemire" or "satin finish," or "soft" or "stiff" silk, just in accordance with the views of the customer being served. The latter has her own predilections in favor of "yellow edge" or "white edge," distinctions for which we never could trace any reason, as different manufacturers do not seem to confine themselves to particular colored edges as indicative of degrees of excellence; and she further knows that silks are apt, 1st, to crack wherever folded; 2d, to pull, so that where once was a smooth fit wrinkles appear, which on nearer inspection are found to be due to the opening of the threads; and, 3d, to become "shiny," or rather to assume a greasy appearance at all prominent portions where the fabric is rubbed.

There also exists among purchasers an undefined knowledge that black silk is weighted in the dyeing, that is, that the dye makes it heavier. Dealers generally admit this in a matter-of-course way, and the buyer is led to believe that the treatment which the silk undergoes is a quite necessary industrial process incident to its manufacture; and that it in no wise reduces wear, makes the silk richer, etc. It is true enough that all dye must render the fabric more weighty; and the average purchaser does not trouble herself, so long as the silk is fine appearing and cheap, to question how much of it is owing to the art of the dyer and how much of it to the silkworm.

More interest, however, might be and perhaps will be taken when it is known that there is now no such thing as a good black silk in the market; and that the black silks now sold in this country, whether domestic or foreign, are such grossly adulterated fabrics as to amount to impositions and swindles of the most reprehensible character. In justice to most retail dealers it should be said that they are the victims of the manufacturers' deceptions, and should, therefore, be classed with the public at large; but there are many firms who have their silks expressly made and expressly weighted according to their orders, and they sell over their counters, as silk, stuff which contains less silk than it does adulterant.

We have frequently stated the fact that by no means all the ingenuity in the world is enlisted on the side of rectitude, but that a very goodly share is devoted to nefarious ends. Progress follows experience regardless of the end in view, and this silk iniquity is an excellent example of the fact. Mr. Lewis Leigh, of Pittsfield, Mass. (a well known silk dyeing expert, to whom we are indebted for the facts in this article), has exhibited to us samples of silk from which he has removed all the dye, and has weighed the resulting pure silk fabric, the result showing, in many cases, that the dye exceeds 150 per cent, and in some reaches 400 per cent, as compared with the quantity of silk. It would astonish some of our fair readers vastly to compare with the original fabric the wretchedly thin webs to which fine, lustrous, thick silk becomes reduced after treatment. They might well wonder not merely how some silks wear, but how they even hang together, for the dye does not add a particle of strength, any more than does the paint on an oilcloth, to which it bears some analogy. The weighting of the silk is not done, as some suppose, by dyeing the finished fabric. In fact, the silk after leaving the loom, beyond simple brushing, undergoes no further treatment. The dyeing processes are carried out on the thrown silk thread, which after boiling receives a large quantity of nitrate of iron in solution. It is then treated with soap and alkali to "kill" the iron, or rather the acid effects of the salt. Another bath of nitrate solution follows, and then another application of soap, and thus these processes are repeated according to the weight desired. The operation is one of building up. When honest silks were made a single process or so of this kind answered all the purpose; but vicious ingenuity discovered that by repeating the operation the thread would be made heavier, and the more numerous the repetitions the greater the weight added.

Bluing by prussiate of potash, which is the next process, is followed by baths of gambier, cutch, or other astringents fastened with tin salts. The fabric after passing through this liquor is cleansed and treated with acetate of iron. Then another gambier bath, and as this stage of the operation also adds weight there is a chance for more repetitions. This, however, is virtually a tanning process through the action of the astringent on the gelatine of the silk, and the result is pretty much the same as that of tan on leather. The fabric is now a heavy, dirty, dull looking stuff. To brighten it it is put in a logwood dye bath, with large quantities of soap, often as much as 8 ounces to the pound. The soap is retained in considerable quantities in the silk, and with the alkali already in the material forms a kind of grease which friction and wear speedily bring to the surface. This is the secret of "shininess" and the wearing smooth of black silks of all grades.

So far the swindling process is the same for all varieties of silks. Now, however, the dyer's art extends to finishing the thread so that the completed fabric shall be soft and satin like, or "scroopy," as the peculiar rustling quality which a stiff silk possesses is technically termed. For the first the thread is sometimes treated with oil and soda; for the second, a little acid goes in. Ladies who think that soft silks and stiff silks possess materially different qualities will thus perceive that there is really no ground for difference at all. After the thread is treated as above described it is wound and woven, and the fabric goes to the market.

It may be asked whether all black silks are thus adulterated. We are positively informed that such is the case. The normal condition of honest black silk is about 17 per cent of dye. Twenty-five years ago the highest percentage reached was 33, but then in the interval dyers have grown wiser.

We have shown the cause of "shininess." Cracking at folds is in the same way due to the extra weight. Just as an oilcloth cracks and breaks when folded at a sharp angle, so does silk, and that the threads pull apart is not at all to be wondered at when the miserable, thin little fabric which bears all the weight of dye is regarded. Colored silks, probably in some measure owing to the smaller demand for them and in great degree to the difficulty of concealing the swindle under various hues, are rarely adulterated. Browns, drabs, slates, and similar shades contain, as a general rule, about 25 per cent weighting, which is not objectionable, but rather gives fullness to the goods. It is generally obtained from a sumac bath. Silks dyed with the anilines being specially bright and highly colored are not weighted, as the addition of the necessary materials to this end tends to obscure the delicacy and brilliancy of the hue.

In order to exhibit the exact weighting of the black silk now sold in New York drygoods stores, we have collected from the six leading houses below named twenty-eight samples of silks of low, medium, and best qualities, as indicated by the price per yard. These, provided with identification marks which gave no clew to their maker's or seller's names, were sent to Mr. Leigh, with instructions to remove the dye, and send us the weights of the pieces before and after the process. In returning them, he states that the general quality of all is good, and that that of Nos. 1, 10, 13, 7, 8, and 17 is especially excellent.

TABLE SHOWING WEIGHTING OF BLACK SILK.

No.	Where obtained.	Price per yard.	Manufacturer.	Relative per cent dye.	Weight of sample in gr. before and after removal of dye.
1	A. T. Stewart & Co...	$7.50	Bonnet.	$33\frac{1}{3}$	26 to $19\frac{1}{2}$
2	" ...	3.25	Ponson.	$77\frac{3}{11}$	$19\frac{1}{2}$ to 11
3	" ...	2.00	——	$83\frac{1}{3}$	$16\frac{1}{2}$ to 9
4	" ...	1.00	——	$109\frac{1}{11}$	$11\frac{1}{2}$ to $5\frac{1}{2}$
5	" ...	2.00	Am. special order.	$78\frac{4}{7}$	$12\frac{1}{2}$ to 7
6	" ...	1.25	"	$71\frac{3}{7}$	12 to 7
7	Arnold, Constable & Co	4.00	Tapissier.	$46\frac{10}{15}$	22 to 15
8	"	2.50	Guinet.	$52\frac{12}{19}$	29 to 19
9	"	1.25	"	$76\frac{4}{21}$	$18\frac{1}{2}$ to $10\frac{1}{2}$
10	J. & C. Johnston	3.50	Maison Hamot.	$38\frac{3}{17}$	$23\frac{1}{2}$ to 17
11	"	2.50	Teillard.	$82\frac{6}{17}$	$15\frac{1}{2}$ to $8\frac{1}{2}$
12	"	1.00	Tapissier.	$91\frac{2}{3}$	$11\frac{1}{2}$ to 6
13	Lord & Taylor........	4.50	Bonnet.	$36\frac{2}{3}$	$20\frac{1}{2}$ to 15
14	"	3.75	Giraud.	$81\frac{27}{33}$	30 to $16\frac{1}{2}$
15	"	2.75	"	$85\frac{5}{7}$	26 to 14
16	"	2.00	Guinet.	$71\frac{3}{7}$	12 to 7
17	James McCreery & Co	4.00	Special order.	50	30 to 20
18	"	3.00	"	$74\frac{6}{31}$	27 to $15\frac{1}{2}$
19	"	2.25	"	$76\frac{12}{13}$	23 to 13
20	"	1.40	"	$116\frac{2}{3}$	$19\frac{1}{2}$ to 9
21	"	1.10	"	$111\frac{1}{9}$	19 to 9
22	"	1.50	Cheney Bros.	$17\frac{1}{7}$	$20\frac{1}{2}$ to $17\frac{1}{2}$
23	Boutillier Bros........	3.00	Teillard.	$61\frac{7}{13}$	$52\frac{1}{2}$ to $32\frac{1}{2}$
24	"	2.25	Bellon.	$63\frac{7}{11}$	27 to $16\frac{1}{2}$
25	"	1.15	"Sans Nom."	$107\frac{1}{7}$	14 to 7
26	"	1.15	Givernaud (Am.)	$92\frac{4}{13}$	25 to 13
27	"	1.50	"	$83\frac{29}{37}$	34 to $18\frac{1}{2}$
28	"	1.75	"	$83\frac{29}{37}$	34 to $18\frac{1}{2}$

No. 22 Mr. Leigh states to be mainly made of waste, and to be of such poor quality that it can easily be sold at a low price without adulteration. Hence the low percentage of dye. Omitting this sample and comparing averages of the others, the following relative percentages of weighting are found:

Silks retailing at and over $3 per yard........... 55 + per cent.
" " under $3 and at and above $2..... 74 "
" " under $2 and at and over $1....... 94 "

Average all grades............................ 74 + per cent.

From this it is evident that the lower the price the greater the weighting. Thus, when silk is bought at a dollar a yard, about fifty cents is paid for dye and fifty cents for silk; when purchased at $3 per yard, $2 goes for silk and $1 for dye. Supposing a dress pattern of 20 yards of $1 silk be purchased, then, one half of this being wasted in dye, the wearing value of the silk is represented by $10, or half the amount paid. The same amount of $3 silk costs $60, and its wearing value would be $40. But there is four times as much silk in the $3 fabric as in the $1 goods; hence $40 must be divided by 4, which gives 10 as the wearing value. So that it would seem that the person who buys a $1 silk really gets as much for his money as the buyer of the $3 silk, assuming that the resistance to wear is directly proportional to the quantity of silk present. In fact, however, the discrimination is largely against the buyer of the $1 silk, which is relatively of poorer material, besides being overloaded with a greater percentage of weight. So that in this, as in most all other cases where adulterations are brought to light, the cheaper goods are the most falsified, and, of course, the poorer people who are obliged to purchase these materials are the greatest sufferers.

POWER OF RIVERS.—According to Dr. Young, water moving with a velocity of 900 feet per hour tears up fine clay; at 1,800 feet carries fine sand; 3,600 feet, fine gravel; 2 miles an hour, moves pebbles as large as a hen's egg. Mr. Login believes that when a river has the proper load of sediment it loses in abrading power.

A NEW OPPORTUNITY TO SECURE FOREIGN TRADE.—SCIENTIFIC AMERICAN EXPORT EDITION.

The interest which is now everywhere manifested abroad in American productions and inventions, the constantly augmenting desire which is evinced for knowledge concerning the latest outcome of American ingenuity or progress, has reached a remarkable degree of intensity, perfectly comprehensible from one point of view, yet really anomalous when differently regarded. The enterprise of our people is proverbial. With a pertinacity and vigor wholly unrivaled, our manufacturers and inventors have gone on improving, and originating, and extending, with a celerity and a success which have drawn upon us the attention of all the civilized world. To merely say that a device is American abroad carries with it the inference that it is the latest novelty of its kind; and not only this, but that it is probably something original, different, and better than anything of Old World production. The legitimate result of this is, as we have stated, the concentration of the world's gaze upon our mechanical and industrial advancement, and the production of a demand for the output of our abilities. The demand, though now assuming immense proportions, is of spontaneous growth; it is the natural sequence of the energy and the striving for higher development which have been characteristic of our inventors; but it is not due to any of that business sagacity and push evinced abroad by our manufacturers which they exhibit at home. And just here is the apparent anomaly, though only apparent. In a generation we build 80,000 miles of railroad, and maintain it in successful operation; and, naturally, all mankind seeks our means of accomplishing such grand results. We make magnificent extensions in the telegraph, and the world seeks our means for doing likewise.

Of late our foreign trade has fairly come of itself to our doors, and not waited for the enterprise of our manufacturers to seek it out. Russia orders forty locomotives at once of us for her railways. Russian and Turkish officials have come to our factories to buy their war material. Foreign engineers contract here for the deepening of their harbors and water-ways. The foreign farmer buys his reaper in the United States; and in event of a great European conflict, such as seems imminent, this country would become the great source of supplies of the civilized world. The leading foreign technical periodicals surrender large proportions of their space to minute details concerning our railways, our iron and steel works, and our mining resources, and systematically republish every new American invention of merit which appears in these columns. All these signs would be unmistakable, even if the demand were not already enriching those enterprising manufacturers who, unlike the great majority of their brethren, have bestowed special attention to the forwarding of their foreign trade.

For some months past we have been perfecting arrangements to enable manufacturers and exporters to avail themselves of the foreign markets, and to build up their business abroad in a manner that is at the same time most efficacious and least expensive. We are now in a position to announce that we shall begin in June next the publication of an Export Edition of the SCIENTIFIC AMERICAN, which from the outset will have a larger foreign circulation than any other periodical of like nature which leaves this country. Instead of a merely commercial sheet to be glanced over and thrown aside, the SCIENTIFIC AMERICAN EXPORT EDITION will be a large and splendidly illustrated periodical, published once a month. Each number will contain nearly one hundred large quarto pages, comprising the four preceding weekly numbers of the SCIENTIFIC AMERICAN, with which will be incorporated a number of pages devoted especially to business announcements intended for foreign buyers. It is well known to every one accustomed to advertising abroad that to be effective an announcement must be large, striking, and kept constantly before the class to be influenced; and that the few lines often so valuable here because of the close attention given to the advertising columns by wide awake American readers, are not so efficient elsewhere. Accordingly we have placed the rate of charges for space in our Export Edition so low that a large and finely displayed announcement can be regularly maintained, embodying a handsome engraving of the invention or product, at an expense not more than that which an advertisement of a few lines would cost in an ordinary newspaper.

Commencing with the first number and regularly thereafter, we are able to guarantee for the SCIENTIFIC AMERICAN EXPORT EDITION a wide circulation in all the commercial cities and marts of the world.

The SCIENTIFIC AMERICAN is now generally regarded as the exponent and representative of American inventing and manufacturing genius and interests. Those who read it are in general men of intelligence, whose advice is constantly sought for the selection and purchase of improved supplies of all kinds; hence they are those beyond all others with whom the American manufacturer needs to come in contact. The SCIENTIFIC AMERICAN forms the source of knowledge of the nation's progress in industry and invention to influential readers all over the globe. Inventions and products are there presented to the world in a manner such as no private means of introducing them abroad can begin to rival, either in point of cheapness or efficacy, and the fact of being represented in our columns is apt to be everywhere considered proof of utility, novelty, and superior value.

Those who desire to have their announcements published in the first number of the SCIENTIFIC AMERICAN EXPORT EDITION are requested to send us their copy and engravings therefor without delay.

Among the influential manufacturing firms who have already availed themselves of the advantages of our Export Edition are the following:

Fairbanks & Co., 311 Broadway, New York, and St. Johnsbury, Vt., Manufacturers of the celebrated Fairbanks Scales, the Standard Scales of the World.

H. W. Collender, 788 Broadway, New York city, Makers of celebrated Billiard Tables.

H. L. Judd, 87 Chambers street, New York city, Manufacturer of Hardware for Upholsterers, Builders, House Furnishing, Stationers, Fancy Hardware, etc.

Wilkinson Brothers & Co., Manufacturers of Papers for Covers, Wrapping, etc., 72 Duane street, New York.

Photo Engraving Co., 67 Park Place, New York, Relief Plates for Printing, Engravings, etc.

Macgowan & Slipper, 30 Beekman street, New York, Printers of Books, Newspapers, Drafts, Checks, Commercial Printing of every kind.

Volney W. Mason & Co., Providence, R. I., Makers of the Celebrated Elevator Hoisting Machinery.

Alexander Brothers, Philadelphia, Pa., Manufacturers of Pure Oak Tanned Leather Belting.

The Baldwin Locomotive Works, Philadelphia, Pa., Manufacturers of Locomotives of every description.

Messrs. Carr & Hobson, New York city, and Clintonville, Conn., Manufacturers of Agricultural Implements.

Messrs. Simpson, Hall, Miller & Co., New York city, and Wallingford, Conn., Manufacturers of Fine Electro Silver Plated Wares.

Messrs. C. B. Rogers & Co., 109 Liberty street, New York city, extensive Manufacturers of Woodworking Machinery.

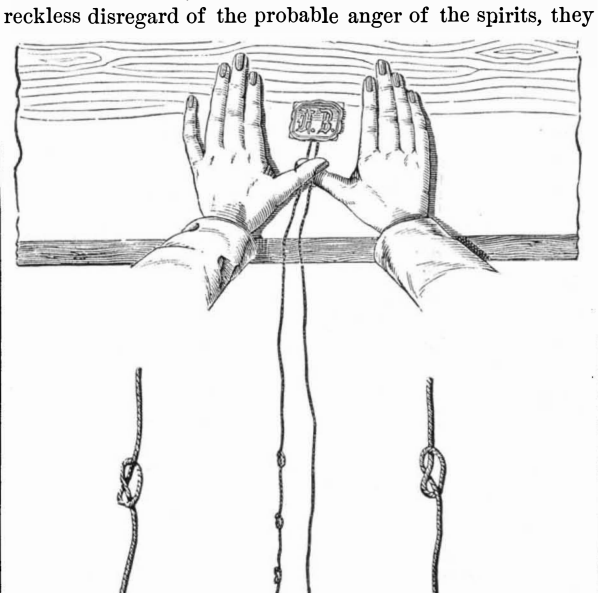
The Rue Manufacturing Co., 523 Cherry street, Philadelphia, Pa., Manufacturers of Rue's Little Giant Injector for Feeding Boilers.

Stout, Mills & Temple, Dayton, Ohio, Manufacturers of the American Turbine, the Standard Water Wheel of the World

The Reading Iron Works, 261 South Fourth street, Philadelphia, Pa., Manufacturers of Wrought Iron Pipes, for Steam, Gas, Water, Oil Wells, Forgings, Presses, etc.

SPIRIT STRINGS AND MORBID MINDS.

Mr. Henry Slade will be remembered as the medium through whom spirits of the departed, in consideration of five dollars, paid to him in advance, communicate with beloved dwellers on the lower sphere by means of a slate. Two years ago Slade and his slate went to England, and contrived, during a session of the British Association, to have his performances called to the notice of that body, which, much to his disgust, declined to investigate him. Drs. Lankester and Donkin, however, undertook that task, and with reckless disregard of the probable anger of the spirits, they



grabbed Slade's slate at an inopportune moment during the *séance* and discovered an already written reply to a question, the former nicely prepared before the slate was held under the table. The result was that Slade was brought before a police magistrate, and given ample opportunity to prove his tricks to be supernatural, in open court, which he declined, preferring to let unbelieving witnesses go through the same performances and explain the jugglery. He was consequently convicted as a cheat and impostor, and sentenced, but a technical flaw in the proceedings required their review. Before this could be done Slade ran away from England, and lately he has turned up on the Continent, this time with a string, wherewith he has entangled the wits of sundry learned professors, one of whom has written an essay, not merely explaining how Slade deceived him, but evolving a profoundly metaphysical theory, substantially

Professor Zöllner, the essayist in question, occupies the chair of Physical Astronomy in the University of Leipsic. He is a scientist of great ability, an original investigator in the domain of physics, and the inventor of the wonderfully ingenious horizontal pendulum, whereby the most minute measurements possible may be made. For such a man to be deceived by the jugglery of a professional cheat is always a matter for regret, inasmuch as it leads others to give credence to statements which otherwise their common sense would force them to reject. Still there is nothing anomalous in the occurrence, except perhaps in the circumstance that the elaborate hypothesis presented by the professor setting forth the lucid proposition that it is quite possible that that which he cannot understand is directly owing to a condition which no finite intellect is capable of conceiving. shows an unusual intellectual fog. It only affords new evidence of a curious mental condition, to which we shall allude after explaining Slade's new *modus operandi*, which will be easily understood from the annexed engraving, which accompanies a translation of Professor Zöllner's paper in the *Quarterly Journal of Science*.

The professor, previous to attending the *séance*, sealed together the ends of a piece of hempen cord, using his own seal. Four strings were thus prepared. "I myself," he says, "selected one of the four sealed cords, and, in order never to lose sight of it, before we sat down to the table I hung it around my neck, the seal in front always in sight." The engraving shows the position of the cord as well as that of the professor's hands, to which Mr. Slade's left hand and that of another gentleman were joined. "The unknotted cord was firmly pressed," he goes on to say, "by my two thumbs against the table's surface, and the remainder of the cord hung down in my lap." Although Slade's hands "always remained visible," yet by "his presence, without visible contact, and in a room illuminated by bright daylight," four overhand knots, such as shown in the illustration, were formed in the cord. Not only was Professor Zöllner "*perfectly* convinced," but Professors Fechner, Weber, and Scherbner, well known German scientists, were equally satisfied of the reality of the observed facts.

We cannot give space to the long essay wherein Professor Zöllner sets forth his hypothesis; but the sum and substance of it is, that, given an overhand knot, we, being "three dimensional beings, can only untie or tie such a knot by moving one end of the cord through 360°, in a plane which is inclined toward that other plane containing the two dimensional part of the knot," that is, the half hitch only. "But if there were beings among us who were able to produce, by their will, four dimensional movements of material substances, they could tie and untie such knots in a much simpler manner by an operation analogous to that described in relation to a two dimensional knot." The two dimensional knot is the half hitch or kink in the string, which a two dimensional being, the professor thinks, could undo only by carrying one end of the latter over a circle of 360°, while a three dimensional person simply gives the kink a twist and out it comes. The little difficulty, however, is to conceive of four dimensional space—length, breadth, thickness, and—what? Still, this does not trouble the professor; the hypothesis, somehow, enables him to reach the conclusion that either Slade's tricks must be accounted for by this "enlarged conception of space," or—somebody is a humbug. To proving the first, the essay is devoted; to disproving the second, we have ten lines in the concluding paragraph, wherein, referring to the unfeeling British magistrate again, Professor Zöllner says that Slade "was innocently condemned—a victim of his accusers and his judge's limited knowledge."

"Every one," says an old Scotch saw, "has a bee in his bonnet." The morbid mental conditions are confined to no particular class of people, and that they are not taken into greater account in determining the why and wherefore of apparently anomalous human action is due simply to lack of general appreciation of their extent. Between that feeling which impels a cultivated, well educated man to believe in the possibility of perpetual motion and that overwhelming influence which irresistibly impels such actions as those of the kleptomaniac, or those of a person who, like the Boston boy-murderer, kills for the love of killing, a connection is traceable. Investigations, and notably those of Dr. Hammond or Professor Huxley, have been directed mainly to the extreme apparently most dangerous to society; and that "unconscious cerebration" or "morbid impulse" drives people to abnormal actions or to the commission of crime, is demonstrated beyond reasonable doubt. It is questionable, however, whether those who show these grosser manifestations of the disorder really are the most dangerous to society. A man with a tendency to steal can be put under restraint, and his influence to a certain extent nullified; but when the disease affects leaders of thought, in other regards brilliantly sane, then, through them, its baleful influence reaches thousands. Without that positive proof which is only to be determined by much needed direct research—a most delicate and most difficult undertaking—the cause of the ailment can only be surmised. It may be due to over brain work, to a too close habit of laborious theoretical speculation, to impairment of the faculties by age, all tending to produce impairment of brain substance. Professor Zöllner adds but one more instance to the many which constantly come under our notice. The Keely gulls were conspicuous examples, and almost any one's experience will suggest others. We simply regard these people as mentally ill. We believe that their brains, carefully examined, would exhibit mechanical lesions, and the statements or actions governed by the injured part of the organ are therefore fit subjects for the study of the physician, not of the physicist.

THE TRANSIT OF MERCURY AND THE INTER-MERCURIAL BODY.

The observations of the transit of Mercury across the sun which were conducted at the various astronomical observatories throughout the country on May 6 yield varying results, the planet in some instances being apparently found to be ahead and in others behind predicted time. A large number of excellent photographs were, however, obtained and by the aid of these and a comparison of the data determined in various localities reliable results will probably be reached. At the Naval Observatory in Washington, Professor Newcomb found that the planet came into view twenty seconds ahead of the time predicted by Leverrier and more than a minute ahead of the American table. The statistics are as follows: Internal contact at ingress, from Leverrier's tables, 10h. 4m. 53sec.; observation, 10h. 4m. 38sec. Internal contact at egress, from Leverrier's tables, 5h. 34m. 17sec.; observation, 5h. 33m. 51sec.

The object of observing the transit of Mercury is altogether different from that sought in observing the transit of Venus. In the latter case the aim was to determine the sun's distance from the parallax, and to this end the observations were made from localities on the earth's surface where the latter was greatest. Mercury is situated at a much greater distance from the earth than Venus, and its orbit is smaller, while it is so difficult of observation that the position of its orbit is very imperfectly known, a fact indicated by the difference above noted between Leverrier's and the American tables. Now, if accurate data relative to this orbit can be obtained, in such lies the determination of the question of the existence of the alleged Vulcan or inter-Mercurial planet. It will be remembered that by observing the perturbations of Uranus, Leverrier reached the conclusion that the same could not be produced save by the influence of some undiscovered planet, and assuming the existence of this body he calculated its position, and on pointing his telescope to the point in the heavens where his calculations led him to believe it would be found he made the magnificent discovery of Neptune. Reasoning analogous to this induced him always to believe in the existence of some body which causes the perturbations of Mercury. He found that the perihelion of that planet advances much more rapidly than can be accounted for by any definitely known disturbing cause. In other words, as the planet sweeps around the sun in its nearly circular path and reaches the point nearest the sun (the latter being eccentrically placed as regards the orbit), it advances about 246 miles, or one thirteenth of its diameter, at each recurring revolution. As the planet approaches its aphelion the effect of a large motion of the perihelion would be to cause the planet to be further advanced in its orbit, and hence the time of transit would be hastened, and this would point to the existence, or rather tend to confirm Leverrier's hypothesis, of some unknown attracting matter exerting an influence.

That this result has been realized by the observations of Professor Newcomb is evident from the foregoing figures, and the same appears to be true from most of the uncorrected data telegraphed by other observers throughout the country to the daily journals.

Of course, admitting the probable presence of an undiscovered attracting body to be substantiated, it by no means follows that that body may be the imaginary Vulcan. It may simply be an aggregation of meteoric masses, or matter existing in the corona and protuberances of the sun itself.

The observations of the total solar eclipse of July 29 next will perhaps shed some light on this last possibility, and may even be the means of revealing Vulcan, if it exists, as one of our correspondents, who has made that supposititious planet the object of much study, published the fact some time ago that Vulcan ought to be quite near the sun at the time mentioned. Meantime, in order to know exactly how far the results of the recent observations tend to substantiate the conclusion indicated, it will be necessary to wait until the astronomers at the different observatories make their comparisons and final corrections, which will probably occupy considerable time.

OUR NAVAL NECESSITIES.

The New York *Tribune*, in an editorial on a "new navy," points out the inefficiency of our present marine, and advocates its rehabilitation in a general way singularly free from practical suggestions. Speaking of our numerous small vessels our cotemporary says: "Let us have a well considered system of replacing them by the best men-of-war that can be built, on patterns suited to our peculiar needs." If the *Tribune* will kindly indicate what manner of system it knows of that will afford the "best men-of-war," it will do the country a genuine service, and possibly settle a problem on which millions have been expended by foreign nations, and which seems no nearer solution than at the outset.

Out of 150 vessels borne on our Navy Register it appears that but 29 are suited for general cruising purposes. To these last the *Tribune* urges the objections that they are not iron clad, not heavily armored, and are merely thin "iron pots," besides being contemptible in the eyes of third rate European powers. All this is true enough, and it might be added that we have spent enough money in tinkering these inefficient hulks to have purchased a powerful ironclad fleet; but then it by no means follows that such a fleet should have been organized, or that the same is now necessary. We do not defend the waste of national funds which might much better have been left in the pockets of the taxpayers, but supposing we had constructed an iron fleet in answer to the demands that have been renewed by the *Tribune* and those who share its opinions about every year since the war, how much better off would we be? We built one ironclad fleet of monitors. Most of them are in the scrap heap, and the rest are rapidly gravitating thither. Their laminated armor is as pregnable to heavy modern projectiles as so much wood. We launched several very expensive and presumably swift cruisers, and in our anxiety to make them fast we gave them so much machinery that it was scarcely practicable to stow their coal, berth their crew, or accommodate their guns. Several of them were speedily consigned to the limbos of Navy Yard Rotten Rows.

Fortunately we proceeded no further, for had we followed England's example the outlay might well have been enormous. We should have had a fleet of Warriors, another of Minotaurs, of Captains, of Glattons, of Inflexibles—each in turn as one type of vessel superseded the other, and each probably in answer to such demands as that of the *Tribune* for the "best men-of-war that can be built." Each also in turn would have been discarded, and now, instead of complacently profiting by her immensely expensive experiments, at no cost to ourselves, we should be sharing with England the unenviable possession of a vast fleet and the annoying consciousness of its inefficiency.

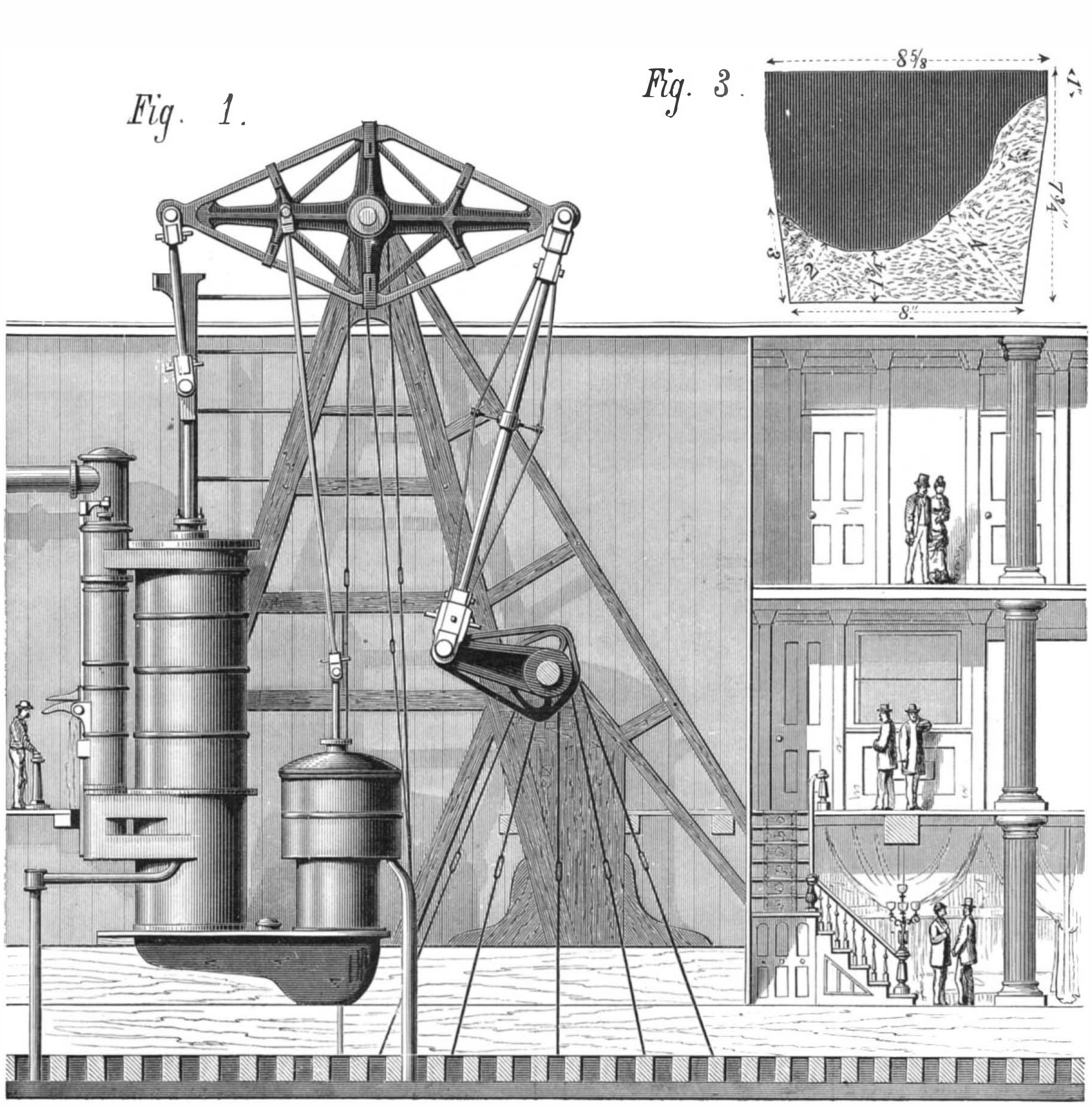
The *Tribune* greatly underrates the productive ability of our people when it asserts that a "navy cannot be improvised in time of danger," and at the same time shuts its eyes to already demonstrated fact. With an improvised navy we maintained and compelled respect for the most extensive blockade ever known, despite the utter negation of its possibility by foreign military authorities. The improvised Confederate rams and our own hastily built gun boats alike did splendid service. We improvised the revolving monitor turret, the only really efficient system of ironclad ever contrived, and so revolutionized the naval armaments of the world. We improvised fixed and movable torpedoes, and for the first time demonstrated the enormous capabilities of the weapon which is chiefly to decide all future conflicts. This was done with the genius of the country divided against itself.

In our present navy, though it is small and inefficient, we have a reliable nucleus for as great a one as we choose to organize; and we possess the best and most skillful torpedo service in the world. A few staunch cruisers might, perhaps, profitably supplant some of our older vessels, but we see no present necessity for any further change in our naval status. The necessities of future wars may safely be left to the inventors.

THE ACCIDENT TO THE MACHINERY OF THE STEAMER OLD COLONY.

Since last summer, three New York steamboats have been disabled by the breakage of their engines—the Harlem, the Dean Richmond, and the Old Colony. When the Providence, one of the very largest and finest steamers plying on the Sound, was "laid up" for the winter, a flaw was discovered in one of the main journals of the paddle shaft to be so serious as to make a new shaft necessary before recommencing the coming summer trips between this city and Fall River. In every one of these cases flaws in the wrought iron were indisputably apparent, undoubtedly the cause of fracture, and in the three first mentioned were attended by a marked crystallization of the iron. We referred to the breakage of the working beam of the Harlem at the time of the occurrence, and spoke of the flaw and crystallization at the point of fracture in the lower strap, and of the good fibrous iron in the upper strap. When the accident occurred to the Dean Richmond, the connecting rod broke first, afterwards the beam and other parts; it was then that a very extensive flaw appeared in the center of the connecting rod, which extended to within a few inches of the circumferential surface.

From the accompanying illustrations and description it will be seen that exact information has been obtained respecting the accident to the engine of the Old Colony, and, classifying this with the others already mentioned, a subject presents itself for the attention and investigation of constructing engineers. That subject embraces the forging of iron, the most suitable iron for heavy forgings, the manner and place of welding, and the reduction of strength by crystallization. The strains that require wrought iron shafts to be 24 inches, and connecting rods 12 inches in diameter, can only be withstood by sound castings and forgings of the best quality of iron, and to secure these practical science and skilled workmanship are indispensable.



MACHINERY OF THE OLD COLONY—BEFORE THE ACCIDENT.

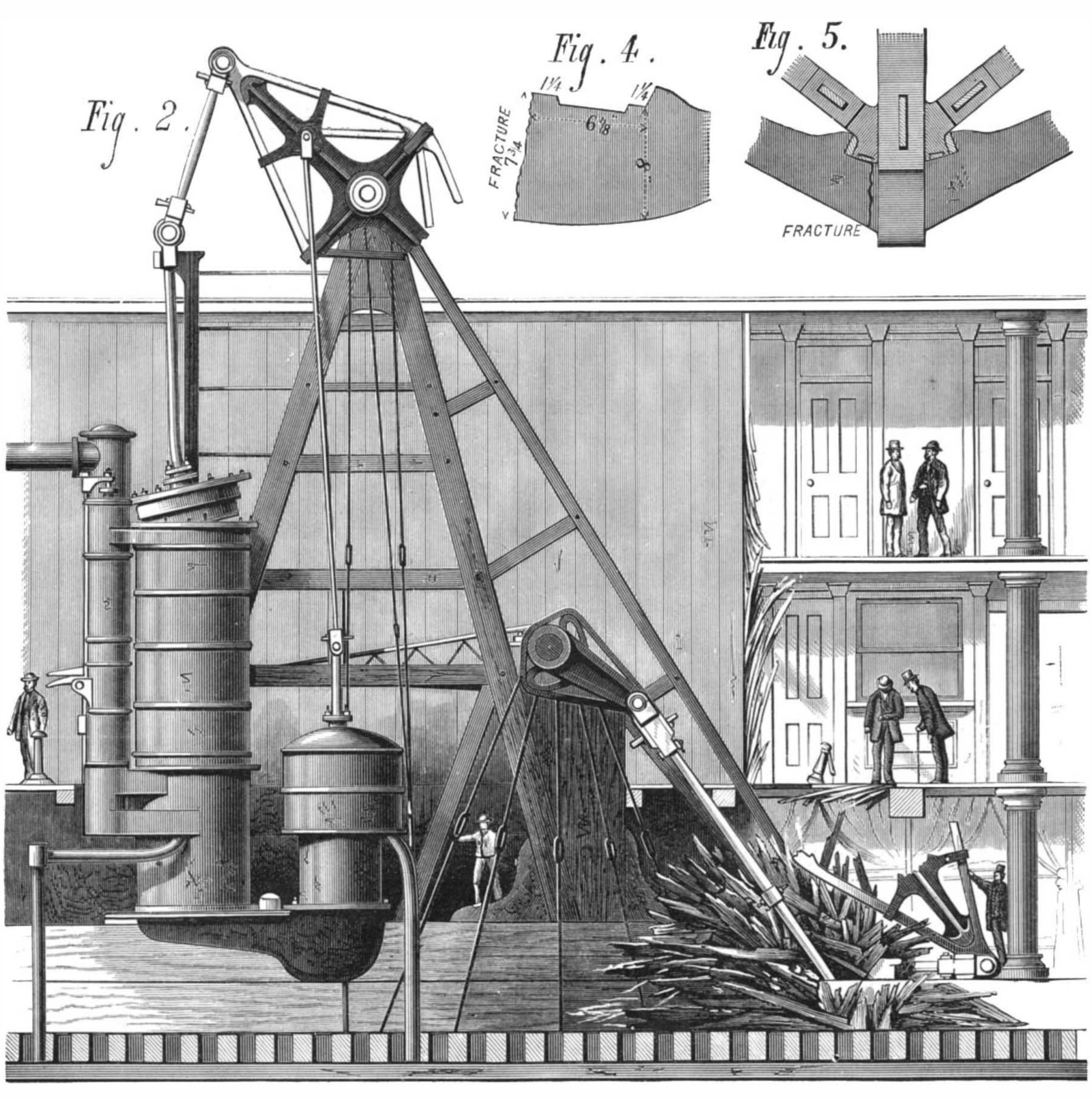
The steamer Old Colony, one of the older boats on the New York and Fall River line, was built by John Englis & Son, at Greenpoint, L. I., in 1865. Her length between perpendiculars is 322 feet; beam, 42 feet; depth, 14 feet. The engine of the Old Bay State was constructed at the Allaire Works in 1847, and this engine was taken out and put in the Old Colony. Since that time many parts have been renewed and little is left of the original engine. Fig. 1 is a general view of the engine in working condition. The cylinder is 81 inches in diameter; stroke, 12 feet; has the Stevens cut-off; length of beam (center to center), 22 feet; length of connecting rod, 23 feet; diameter at middle, 11 inches; diameter at ends, 9 inches; diameter of paddle wheel shaft, 18 inches. The crank is of cast iron hooped with wrought iron bands. The condenser is a jet and not a surface one. The boilers are placed on deck by the starboard and port guards. The diameter of the paddle wheels is 38 feet; width of bucket, 2 feet 2 inches.

The center keelson is made of live oak, 14 inches by 30 inches deep, resting on frames 17 inches deep; the frames are of chestnut, hackmatack, and oak.

The accident occurred between Point Judith and Gull

Light, or about two hours' run from Newport, to which place the Old Colony was being steered. The weather at the time was fine, the sea smooth, and the engine working remarkably well. The steam pressure was 27 pounds, cut-off at a little more than half stroke, and the engine making 16½ revolutions per minute. Without warning the lower strap of the beam broke near and aft the center strap, when the piston was taking steam for an upward stroke. The position of the engine after the accident is indicated by Fig. 2. The breakage of the strap was immediately followed by that of the cast iron skeleton frame and upper strap. The aftward half of the beam fell, carrying with it the connecting rod, which in its fall struck a wooden transverse beam, and broke off at a short distance from the forked end.

The detached half of the working beam with the forked end of the connecting rod fell directly on the center keelson, and fetched up against the mast, as represented in Fig. 2. Of course the fall of the beam with the heavy piece of connecting rod was somewhat broken by striking the partition, cabin stairs, and the transverse wooden beam, which were all shattered to pieces. The keelson and frames are strong, but had the beam fallen at either side of the keelson there might have been still more serious damage. The motion of the vessel caused the crank to make four or five revolutions after the beam broke, and the greater length of the connecting rod being attached to the crank pin, the broken end of the rod moved backwards and forwards on the top of the center keelson. The piston struck the cylinder head, forcing it off the cylinder flanges and causing other damage. The engine, like all others in the N. Y. & Fall River steamboats owned by the Old Colony Steamboat Company, is provided with an automatic arrangement that shuts off the steam instantaneously if the piston either in its ascent or descent should through any cause exceed the regular stroke. As the clearance between the piston and the cylinder head was about ⅜ or ½ inch in the Old Colony's engine, the advantage of this automatic mechanism was realized, for the steam valve closed just as soon as the piston exceeded the stroke, and prevented steam entering the saloons. Singular was it that no person was hurt or scalded, and still more remarkable that one of the oilers who was oiling the crosshead guides at the time of the break escaped unhurt. Fig. 3, p. 322, represents the flaw and break in the wrought iron strap as it appears when viewed endways, or as a transverse section. The flaw at the time of observation was black and smooth. Looking at it through a magnifying glass, very small bright spots were seen, indicating crystallization and attrition. The portion of the strap that broke at the time of the accident, and which is indicated in the lower part of Fig. 3, shows crystallization. The broken wrought iron connecting rod also exhibits crystallization. The breaks are short and indicate brittleness rather than fibrous toughness. Fig. 4 represents a side view of the wrought iron strap at the point of fracture, and Fig. 5 shows the strap with its connections. The figures indicate the exact dimensions of the flaw and iron.



MACHINERY OF THE OLD COLONY—AFTER THE ACCIDENT.

The question naturally arises: Was this a flaw in the forging that was always there? or was it a flaw that had gradually increased in size as the iron gradually increased in crystallization? About this there are different opinions. Our own opinion coincides with that of the master mechanic of the company's extensive repair works at Newport. He says: "My theory regarding the breaking of the beam is, that the strap was fractured slightly while being forged, and that it gradually increased as the fibers of the iron became crystallized. Concussions, strains, friction, etc., will undoubtedly produce crystals in iron. After a critical examination of the working beam of the Old Colony, and a microscopic inspection of the fracture, I am convinced that it was absolutely impossible to have foreseen, by the closest scrutiny or observation, the fracture or defect in the wrought strap of the beam before the iron separated, which I believe in this case was instantaneous."

PÉLIGOT has found in the skin of silk worms a substance, tunicin, which has the composition and properties of cellulose.

WHAT ARE THE CAUSES THAT AFFECT THE TASTE OF DRINKING WATERS?

An examination of the annual reports of the water boards of most of our larger cities, extending back over a period of some years, reveals the fact that water stored in reservoirs, both natural and artificial—no matter from whence the source of supply—is subject to an occasional phenomenal occurrence that manifests itself in the sudden appearance of an exceedingly unpalatable taste, accompanied quite often with a peculiar odor. The cause of this taste, which has everywhere been likened to that of cucumbers, has been for many years a prominent subject of inquiry among scientists; and, although some advances have been made towards a solution of the mystery, the ultimate "wherefore" remains nearly as deeply hidden as ever.

It is very clear that a complete and satisfactory answer as to the cause of the evil cannot be founded on chemical analysis alone. We can ascertain by this means the amount of inorganic matter very accurately; but it is rarely that the presence of these, in water, do any further harm than that of causing an unnecessary waste of soap—a matter of household economy not connected with our present inquiry. As to the organic constituents, to which we must look, as a source of anything that may render water disagreeable to the taste or smell, or deleterious to the health, chemistry can aid us but little. The best the chemist can do in the premises is to tell us (and that only approximately) the quantity of organic matter in a certain measure of the fluid; and, by a still further refinement of his analysis, the presence or absence of nitrogen, thus allowing us to judge of its animal or vegetable origin. Beyond this he cannot specify its nature, condition, or source.

Neither can any help be expected from the zoölogist toward a solution of the question. Careful and accurate examinations of the affected waters, both by the naked eye and the microscope, made by specialists in this department of natural history, have failed to show in them any more than a normal quantity of animal life, and this not of a character nor in a condition to produce any effect whatever.

It is the botanist then, probably, to whom we shall have to look mainly for an elucidation of the matter, although it must be confessed that the results that we have received from this quarter so far are eminently unsatisfactory and inconclusive. The evil that we speak of is not confined to any one region or district, but extends pretty widely over the Eastern and Middle (and perhaps other) States. We have precisely the same reports from New York, Brooklyn, Albany, Troy, Poughkeepsie, Hartford, New Haven, Boston, Charlestown, Burlington, Lynn, and many other cities. Many of these cities have wisely taken measures to investigate the trouble, and in doing so have called to their aid the services of well known and able scientists. Let us examine the opinions of the latter.

When the Croton supply of the city of New York became offensive in 1859, Dr. John Torrey (who, with Dr. James R. Chilton, was commissioned to examine it) reported that, in his opinion, the peculiar condition of the water "was owing to a rapid and abundant growth of a microscopic, conferva-like plant, which abounds in a volatile, odorous principle soluble to some extent in water." He referred this plant to the genus *Nostoc.* He thought it probable, moreover, that it occurred more or less every summer, but only occasionally by excessive growth communicated an offensive odor and taste to water, and was thus brought into popular notice.

In Poughkeepsie, in 1875, during a like contamination of the water, Mr. C. Van Brunt, after a careful examination, ascribed the peculiar taste, not to the growing confervæ in the reservoir, but to the disintegrated plants diffused through the water, and undergoing decomposition in the service mains, especially near the hydrants, where the taste was observed to be most marked and unpleasant.

In 1871, Hartford suffering from the same evil, a committee, aided by Professor C. T. Jackson, made an investigation. Starting with the theory of an organic growth on the inner surface of the pipes, they ascribed the offensive taste of the water to the breaking up of the organisms and their subsequent decay in the "dead ends" of the service pipes.

On one of the occasions (1865) of an impurity of Rensselaer Lake, from whence Albany derives its supply, the board of health invited Professor Philip Ten Eyck, Drs. Hun, Vanderpoel, Mosher, and Boulware to carefully examine the lake and reservoir. Their report stated that they attributed the evil to vegetable matter, brought into the lake by the streams upon which it depends for its supply.

Finally, not to multiply cases, Boston having several times suffered from the same evil, occasion was taken on a recurrence of the trouble in 1875 to make a thorough investigation. At this time only one of the two storage basins was affected by the unpleasant cucumber taste. Dr. Farlow, on request, made a botanical examination of both basins. This gentleman stated in his report that the plants found in both basins were practically the same; and in neither one of them was there found any peculiar vegetable organism that might not be expected in any fresh water pond of that region. After a thorough examination, both of the living plants and those in a state of decay, he gave it as his opinion "that the cucumber taste is not caused by the presence of any living plant, nor by any plant undergoing any form of decomposition, which can be detected by the microscope," and "that there is no probability of obtaining any definite results from the botanical side of the question, unless many months, or even years, be devoted to the subject."

A great number of theories have been advanced in regard to the origin of these impurities, but unfortunately they have emanated from those who know little or nothing about the subject experimentally or otherwise, and are consequently of little importance. The few examples given may be said to comprise about all of the opinions of the different gentlemen who have investigated the subject in the interest of science, and whose names are a sufficient guarantee that their statements are worthy of consideration. How far these opinions are consistent with facts will be examined further on. The following data, gathered from the reports of various water boards, show all that is positively known on the subject up to the present time; and, while they may add nothing more than that already given towards a solution of the problem, they at least narrow the question down to limits within which future investigations may perhaps meet with success. We learn, then, that:

1. The appearance of these impurities is confined to no particular season. They have occurred in spring, summer, and autumn, and occasionally lasted through a whole winter. 2. As to duration, they have appeared suddenly, lasted a few days only, and then as suddenly disappeared; at other times they have continued a few months. 3. They have affected water supplies procured both by gravitation and pumping. They have appeared in reservoirs (both natural and artificial) fed by rivers and creeks, and by lakes, sometimes small and shallow and sometimes large and of great depth. In 1854, when the water in Cochituate Lake, Boston, became bad, *several wells* near the lake and in other places were similarly affected, as were the waters (usually remarkably pure) of

Jamaica Pond, and those of Round Pond (which supplies Haverhill) and the Chicopee river.

Now, in the light of such facts, let us examine the opinions that scientists have given us. In the first place, we may exclude from any consideration whatever the theory that the contamination is due to the decomposition of leaves, twigs, or other parts of the higher plants that have fallen or been swept into reservoirs. Careful examination and experiment have demonstrated that such an opinion is untenable.

Now we know that the minute plants known as fresh water algæ begin their growth only when the warmth of spring awakens their spores to life, and that they reach their greatest development in midsummer, and then, fruiting, decay and disappear till another spring. Dr. Torrey gave it as his opinion that the offensive taste was due to such plants in a *vigorous state of growth*. Now if this be so why should the same offensive taste arise in late autumn and continue all winter, when all plants of this kind have disappeared? Besides, we should state here, that during an excessive mortality among the fish in the Passaic river last June, the water was filled with unusual amounts of aquatic plants of a low order of vegetable life, yet no complaint was made either of the appearance, odor, or taste of the water. It is evident, therefore, that we shall have to look further for a cause.

In examining the second opinion that has been advanced, we are again met by difficulties. Dr. Farlow failed to detect any difference between the cryptogamic flora of the infected waters of the Bradlee basin and that of the sweet waters of the Brookline reservoir. Moreover, his experiments proved that none of the algæ found in either reservoir would produce the cucumber taste during decomposition. If, then, as it seems generally admitted, this peculiar impurity be due to some vegetable organism, it must be (reasoning from analogy) some particular species, since in every case it is accompanied by so distinctive a taste. Dr. Farlow remarks: "Undoubtedly the most disagreeable odor ever found in fresh water may be produced by nostocs, using that word to designate the order *Nostochineæ*," but "the important point is that it is during their decay that the odor is found. A genus, *Coccochloris*, belonging to an order allied to the nostocs, consists of an effused mass of transparent mucus, in which are imbedded green globules, often not more than three ten-thousandths of an inch in diameter. The latter, in the process of decay, might readily become diffused through water, and elude anything but a high power of the microscope to detect them."

But whence come the germs from which these plants are developed simultaneously in such exceedingly diverse habitats as still waters exposed to heat and light in open ponds, pure waters lying in the obscurity of wells, and occasionally, though rarely, the flowing waters of rivers?

The superintendent of the Albany Water Works, Mr. Geo. W. Carpenter, without announcing it as a theory, has asked whether "we may not conclude, from all the evidence advanced, that the impurities are 'climatic;' that the atmosphere is the great reservoir containing the spores, and that large bodies of water, stored as city supplies, frequently are liable to be affected when the temperature and other conditions of the air and water are favorable to the development of these germs?"

As having a bearing on this view of the matter, we may mention some observations that have been made at Paris during the present spring. An epidemic of typhoid fever having arisen in Paris, it was determined to examine the dust from the atmosphere of Prince Eugene barracks, where several deaths had occurred. After the evacuation of the barracks some of the dust, which must have been constantly in suspension in the air during the presence of the soldiers, was scraped from a window-sill in one of the rooms and moistened with water. It *evolved during this operation a most disagreeable odor*. Under the microscope it was found to contain several algæ, more especially that species known to botanists as *Coccochloris Brebissonii*. There were also numerous *vibrions*, some *bacteria*, and some *monads*.

Such, then, are the facts, as we find them, regarding this peculiar phase of the contamination of water when stored in reservoirs, a phenomenon for which, notwithstanding the most searching examinations and chemical analyses, science has thus far failed to find a satisfactory reason.

Communications.

The Patent Law Discussion.

To the Editor of the Scientific American :

Your issue of April 13 contains an article upon Section 11 of the bill now before Congress for the amendment of the patent law. I had considerable share in the preparation of the bill, and have advocated it before the committees both of the Senate and House of Representatives.

Mr. J. J. Storrow, of Boston, has also participated in the preparation of the bill and advocated it before the committees. I think you will see from our arguments before the committees, which were reported and printed, that we fully believe the patent law to be of the greatest value to the country, and that we would not willingly do anything to impair its efficiency or impose any unnecessary burden upon inventors. Mr. Storrow in connection with Mr. Coffin, who was employed by us to collect information in relation to our industries, presented to the House Committee a most remarkable collection of facts bearing upon the influence of the patent law upon the progress of inventions and the growth of our agricultural and mechanical industries. In my argument before the same committee, I called attention especially to the advantage which this country had derived from its patent law, by placing the advantages of the law within the reach of the poorest inventors, and bringing its stimulus to bear directly upon large numbers who are not reached practically by the laws of other countries. Section 11, to which you object, which provides for the payment of fees at two periods during the term of a patent, to preserve it in force, was the subject of a careful consideration. The arguments against the section did not escape our attention. They are certainly entitled to much consideration. Whatever else may be said about the section in question, it certainly was not brought forward and supported by us "in obedience to the wishes of wealthy corporations," or in the belief that it would operate especially for the interests of such corporations.

We certainly did not intend to "discriminate against inventors of limited means" or to subject them "to the mercy of grasping corporations." On the contrary, we came to the conclusion that the interests of poor inventors, as a class, would be promoted by the provision. We found a widespread complaint that many patents for inventions of little or no value in themselves, and which never brought any profits to the inventors, were often bought up for trifling sums by speculators, to embarrass subsequent meritorious inventors whose inventions had gone into actual use. We had ourselves known of aggravated cases of this abuse of patents, not for the interests of the poor inventors, but for the interests of some speculator who had discovered an opportunity, not to use the invention, but to use the patent to compel, either by threats of litigation or by actual litigation, the owners of subsequent inventions in actual use to purchase the prior invention at a price not measured by its actual value, but by the value of the inventions which were in actual use. We had seen a "grasping corporation" formed for the actual purpose of purchasing a worthless patent, and levying under it a contribution upon one of the most important industries of the country, to the advancement of which no person interested in the corporation had ever contributed a cent. We had seen the property of large numbers of manufacturers placed under attachment at the suits of this corporation. We had good reason to believe that this illegitimate use of old unused patents was a frequent one, and that by it many poor inventors, whose inventions had gone into actual use, were robbed of the fruits of their inventions. We were forced to believe that the interests of poor inventors as a class demanded that the evil should be removed, or at least mitigated as far as possible. If we could have devised a remedy which would not impose any additional tax upon inventors, we should have been glad to do so. None occurred to us; none has been suggested which seemed deserving of much consideration. It has been thought by some that the Patent Office should be required to investigate the practical value of inventions, upon the application for patents, and to issue patents only to those which could be proved to be of very considerable value. This idea was much discussed in England a few years ago. I suppose I need not enter into an argument to show that such a plan for eliminating patents for trifling or worthless inventions would be utterly impracticable; that while it would impose additional expense upon the inventor, its results would be unsatisfactory both to the public and the inventor. The plan proposed in Section 11 allows the inventor to obtain his patent upon the present terms, and leaves it for him or his assignee to decide, after trial, whether it is worth while to keep it in force by the payment of $50 or $100 at the ends of the prescribed periods.

It is often necessary to make a choice of burdens, and it seemed to us that the burden of the tax upon inventors imposed by Section 11 is small in comparison to the extortionate demands to which they are liable under the color of State patents, in the hands of speculators and "grasping corporations," and to which they are compelled to submit. The danger that such claims may spring up after an invention has gone into use is so great that it seriously affects the value of all patents, and thus frequently prevents inventors from selling their inventions at their full value. If you add to this the consideration that the evil to which I refer had become so serious that it was creating a hostility to patents which threatened to sweep away the patent law altogether, I think you can hardly fail to agree that it was high time, in the interests of inventors, to bring forward some remedy. The operation of the law will be to greatly reduce the number of patents which are never used to protect an industry, but only to levy contributions on subsequent inventors and the users of their inventions.

In conclusion I wish to add that I am glad you have called attention to the subject, not because it has given me an opportunity to present my own views, but because we have felt that the amendment of so important a law as the patent law is a delicate matter, and we have been desirous that all objections to which the proposed amendments are liable, should be brought forward and fully considered by the public and by Congress. I should be glad to have the attention of inventors and manufacturers especially invited to the various provisions of the proposed amendments.

Boston, April 8, 1878.

CHAUNCEY SMITH.

THE companion of Sirius can be seen with telescopes of 6 inches aperture and larger sizes; but not with smaller instruments.

Thymol, the New Rival to Carbolic Acid.

For the last ten or twelve years, the industrial and medicinal applications of carbolic acid, or phenol, have become so manifold, and its utility so generally known, that its use has gradually extended itself and made it even a common antidote in the household. There always has been, however, and always will be a prejudice against employing it when something else can be substituted for the same purposes, with less objectionable odor. It would seem, from all accounts, that such an article has been found in thymol, a chemical to which we briefly referred in a recent number of the SCIENTIFIC AMERICAN. We are made the less suspicious of this new antiseptic, for the reason that it is not put forth in the interest of any manufacturer, but is brought into notice by medical journals as an article that has stood a successful test, in the practice of some of the most noted German surgeons, for the last two years. Thymol is a homologue of phenol, or carbolic acid, and exists in the oils of thyme, American horsemint, and a few other plants. It is a crystalline, nearly colorless body, with a pleasant odor and an aromatic, burning taste. Its specific gravity is 1·028, and it melts at 44° C. It dissolves in 1,200 parts of cold water, 1 part rectified spirit, 120 parts glycerin, and ½ part caustic alkalies. It was discovered in 1719 by Caspar Neumann, examined chemically by Lallemand and Leonard Doveri, and first used to deodorize unhealthy wounds by Bouillon and Paquet, of Lille, in 1868. In 1875 several German surgeons published investigations of its antiseptic properties, which are estimated to be from 4 to 25 times as powerful as those of carbolic acid. It is prepared from either of the oils above mentioned by treating them with an equal volume of a 20 per cent solution of caustic soda, separating the alkaline liquid, and neutralizing it with hydrochloric acid, when thymol will float upon the surface. It may also be obtained by submitting the oils to a low temperature for a few days, when the thymol crystallizes out. Its powerful antiseptic action, exceeding, under some conditions, that of carbolic acid, its small activity as a poison (about one tenth that of carbolic acid), and the absence of irritating effect when applied to the skin, all point to its use as a substitute for carbolic acid in the now well known antiseptic treatment of surgical cases elaborated by Professor Lister. This substitution has been made with great success by Professor Volkmann, of Halle, who has achieved such brilliant results in surgery by Lister's method. His assistant, Dr. Ranke, reports fifty-nine operations in which thymol was used with strikingly good results. For the spray solution, this gentleman used a mixture of 1 part thymol, 10 of alcohol, 20 of glycerin, and 1,000 of water. For the gauze dressings used by Professor Lister, others were substituted, made by saturating 1,000 parts of bleached gauze, with a mixture of 500 parts spermaceti, 50 of resin, and 16 of thymol. The present cost of thymol is about five times that of the best carbolic acid, but as one part of the former seems to do as much work as 25 parts of the latter, the advantage of price is on the side of thymol.

The Great Cincinnati Organ.

Up to the present, the Boston Music Hall organ has ranked as the largest instrument of the kind in America. It was built by E. F. Walcker & Son, of Ludwigsburg, Würtemberg; begun in 1857 and finished in 1863. The cost of the instrument proper was about $50,000, and $20,000 additional were expended on the case. It is about 47 feet in width, and the two projecting central towers are 60 feet high. There are 89 stops, 5,474 pipes, 13 combination pedals, and 12 couplers. The motor for operating the six large bellows is a 10 horse power steam engine. The organ just erected in the Cincinnati Music Hall was built by Messrs. E. & G. G. Hook & Hastings, of Boston, Mass., and is the largest one ever built in this country, and ranks about the fourth or fifth in size in the world. It is 50 feet wide, 30 feet deep, and 60 feet high. There are 6,237 pipes, and 96 stops. We are informed that the design of the case was drawn by some of the most talented pupils of the Art School. To give an idea by comparison of the size of this instrument, we append the number of pipes and stops in some of the very largest European organs. That in the Albert Hall, London, is the largest in the world. Albert Hall organ, 111 stops, 7,879 pipes; St. Sulpice, Paris, 100 stops, 6,706 pipes; Cathedral at Ulm, 100 stops, 6,564 pipes; St. George's Hall, Liverpool, 100 stops.

The interior of the Cincinnati Music Hall is of tulip wood finished in oil. It is 192 feet long, 112 feet wide, and 70 feet high. The stage is 112 feet wide by 56 feet deep.

Formula for Copying Ink.

Professor Gintl proposes the following: A concentrated solution of logwood is treated, first, with 1 per cent of alum, and then with the same proportion of lime water until a permanent precipitate is formed. A few drops of a weak solution of chloride of calcium are added, until a bluish black color is obtained; then hydrochloric acid is added drop by drop until the liquid turns red. A little gum and about 1 per cent of glycerin are then added, and the ink is ready for use.

WALKING UPON THE WATER.—It is stated that H. Dusseault lately accomplished the feat of walking upon water at Taunton, Mass. He walked a quarter of a mile on Taunton river in six minutes. He wears a pair of patent shoes made of tin, about one foot wide and three feet long, in which air is confined, and he makes his way in a kind of skating gait.

OUR SIMIAN VISITORS.

The New York Aquarium now possesses the most extensive collection of anthropoid apes ever brought to this country, and one which, as a subject of study, is of the highest interest to all naturalists. The animals number five chimpanzees and one orang-outang. One of the former is the survivor of the pair imported some months ago; the others were brought over together, and have been on exhibition for some weeks. All are apparently strong and healthy, and as the atmosphere in this city is dry and unlike the vapor laden air of England and Northern Europe, which has proved so destructive to the exceedingly delicate and sensitive lungs of these creatures, it may be reasonably hoped that they can be maintained for a sufficient period to admit of a thorough investigation of their natural growth and development being made.

The oldest chimpanzee is about half grown, and his age is probably seven or eight years. In common with the others, he is covered with long straight black hair, thick on the head and back, but sparse over the front of the body. On the arms the arrangement of the hair is precisely the same as in man, that is, the hair from the shoulder to the elbow points downwards, while that between hand and elbow points upwards. The meeting is at the elbow, where there is a pendent tuft. Why the hair is thus placed on man and on the larger apes it is difficult to conjecture. Dr. Wood suggests that "if the long hairs were to hang along the arm and wrist, they would get into the hand and interfere with the grasp, while by their reverted growth such an embarrassment is removed." The nostrils are mere holes in the face, any semblance of a nose being absent; and the muzzle projects, giving the face a peculiarly brutish expression. Generally the chimpanzee is of affectionate and amiable disposition, especially when it has been reared in captivity; and it has been supposed that this mildness may be characteristic of the species. The old specimen at the Aquarium, however, apparently negatives this, as he is exceedingly savage. On the keeper entering his cage he pounds the floor with his powerful arms and legs, and if the man is unwary, the animal strikes at him and attempts to seize him by the throat. When irritated or whipped, it cowers into the corner of its den and protrudes its lips, making a kind of short grunting howl, and then suddenly leaps at the aggressor, pounding the floor with astonishing rapidity. When quiet the creature lies lazily on its back, apparently taking no interest in its surroundings. When food is offered, it starts up and performs a kind of dance on all fours, and finally snatches at the object. This dance it sometimes repeats, although for no visible reason, accompanying itself with a kind of quick howl.

The four smaller chimpanzees, ranging from four to two years of age, each exhibit their human-like peculiarities in much greater degree than the older animal. If placed erect, the largest measures about 2½ feet, though the stature seems to be smaller owing to the thick-set build. They are playful, and manifest their emotions in unmistakable manner. Dr. Dorner, the zoölogist of the Aquarium, states that when three of them were liberated from the boxes in which they were transported, and placed together in a large cage, their signs of delight at meeting were most remarkable. They rushed together and embraced each other, and then, as if actuated by a common impulse, began a minute inspection of their new quarters. This done, they met on the floor, and seemingly communicated impressions. Suddenly the two males set up an animated howl, the motive apparently being disapproval of their companion, a female; and then both gave way to the most excited grief, which was only relieved when the keeper took them in his arms and quieted them, as if they were babies. It required patient and systematic treatment, our informant states, as is sometimes necessary with obstinate children, to get a final understanding in the group. The youngest of the five, which, as already remarked, was one of the original pair imported, is especially affectionate and wonderfully childlike. The refusal of the keeper to take her in his arms elicits a crying fit, followed by a paroxysm, in which the animal wreathes its arms over its head and screams with rage, the whole performance reminding one of the behavior of an over-indulged child when crossed. Another peculiarity of the chimpanzee is the care it exercises in eating. Nothing is put in its mouth that is not critically examined with the utmost deliberation, and with an owl-like expression of wisdom. There is never any of that sudden seizure and instant cramming of food into the cheeks, after the fashion of the lower orders of monkeys.

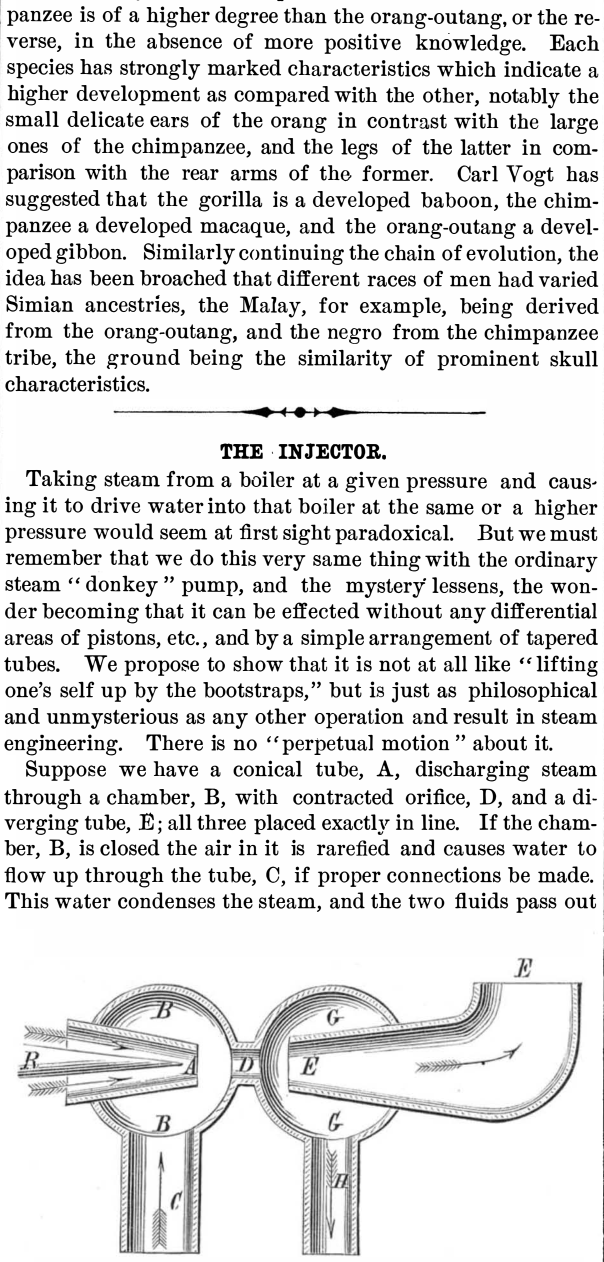
The orang-outang is probably the most valuable specimen in the collection, owing to the scarcity of its species even in its native country, Borneo, and its extreme susceptibility to atmospheric changes. It is one of the most hideously repulsive brutes that can be imagined. It is a nearly full grown male, some four feet in height, and showing on its face the remarkable callosities which are indicative of adult years. The paunch is large and protuberant, the head exhibits the heavy bony ridges peculiar to the species, and the body is quite thickly covered with long red hair. The differences between the orang-outang and the chimpanzees are clearly marked. The orang has a short round skull, the chimpanzee a long one. The arms of the former extend when the animal is erect to about the ankle joint, those of the chimpanzee to nearly half way up the calf (the gorilla's finger tips, it may be added, extend a little below the knee). The orang, when on all fours, rests its hands on the backs of the fingers between the large knuckles and first joint; the chimpanzee, between the first and second joints. The chimpanzee uses its hind members more as legs than as arms. For example, in climbing a rope it will go up hand over hand and foot over foot regularly, grasping its first hold with a hand. The orang, on the contrary, uses all four members indifferently for like purposes. It may grasp at first with a foot and pull itself up, seizing hold with a hand afterwards, its entire motion showing it to be more at home moving among tree branches than under any other circumstances. The anatomy of its rear members, different from that of those of the chimpanzee, shows clearly the distinction. The orang's hind limbs, besides being comparatively short, are loosely jointed at the hip bones, and the strong ligament (the *ligamentum teres*), which in man, the gorilla, and the chimpanzee binds the thigh bone to the hip joint, is absent. The result is that their tread is very unsteady, and the legs can be bent or twisted rearward in curiously complicated contortions. The orang at the Aquarium is quiet and harmless. It moves about but little, preferring to keep rolled up in its blankets, which it adjusts with ludicrous care and gravity. The general appearance of the animal conveys the impression that it is lost in deep meditation, and as this look is maintained while it carefully piles its food pans together and sits in them, its proceedings are laughably absurd.

It is hardly safe to accept the conclusion that the chimpanzee is of a higher degree than the orang-outang, or the reverse, in the absence of more positive knowledge. Each species has strongly marked characteristics which indicate a higher development as compared with the other, notably the small delicate ears of the orang in contrast with the large ones of the chimpanzee, and the legs of the latter in comparison with the rear arms of the former. Carl Vogt has suggested that the gorilla is a developed baboon, the chimpanzee a developed macaque, and the orang-outang a developed gibbon. Similarly continuing the chain of evolution, the idea has been broached that different races of men had varied Simian ancestries, the Malay, for example, being derived from the orang-outang, and the negro from the chimpanzee tribe, the ground being the similarity of prominent skull characteristics.

THE INJECTOR.

Taking steam from a boiler at a given pressure and causing it to drive water into that boiler at the same or a higher pressure would seem at first sight paradoxical. But we must remember that we do this very same thing with the ordinary steam "donkey" pump, and the mystery lessens, the wonder becoming that it can be effected without any differential areas of pistons, etc., and by a simple arrangement of tapered tubes. We propose to show that it is not at all like "lifting one's self up by the bootstraps," but is just as philosophical and unmysterious as any other operation and result in steam engineering. There is no "perpetual motion" about it.

Suppose we have a conical tube, A, discharging steam through a chamber, B, with contracted orifice, D, and a diverging tube, E; all three placed exactly in line. If the chamber, B, is closed the air in it is rarefied and causes water to flow up through the tube, C, if proper connections be made. This water condenses the steam, and the two fluids pass out



through the diverging "Venturi" tube, E E. If this last be sufficiently "flaring" and the course of the jet unbroken, the water will be able to rise in the tube, E E, to a height (or against a pressure) proportionate to the amount of taper of the diverging cone. If the tube widen, say, from a in section to b, this pressure of the water column will be equal to $\frac{V^2}{2g}$ times the difference between the atmospheric pressure and the square of the smaller section divided by the square of the greater. It is common to make this ratio of diameter $\frac{a}{b} = 0{\cdot}16$; then $\frac{a^2}{b^2} = 0{\cdot}0256$, and as $1 - 0{\cdot}0256 = 0{\cdot}9744$, we have the height in feet corresponding to the water pressure $H = \frac{V^2}{2g} \times 0{\cdot}9744$.

But we may wish to make the taper ratio $\frac{a}{b}$ greater, so as to make H greater; and we may assume $\frac{V^2}{2g}$ = this height.

The mixed jet must be kept at such a low temperature as not to be vaporized in the second chamber, G; that is, less than 212° Fah. (= 100° C.). Otherwise, steam will escape from the pipe, H, if there be such a discharge.

To improve the machine we can either increase the useful section of the orifice, D, by moving the pipe, A, further back, or keep this nozzle there and lessen its steam discharge by inserting a conical rod, R.

What we want is to get all the steam condensed by water in the first chamber (A), and to keep the temperature of the mixture lower than that of corresponding saturation at the mean pressure that there is in the second chamber (G).

(If G communicate with the air, this temperature of saturation is 212° Fah.)

If the feed supply be lower than the steam jet (as in the diagram), there will be in B a mean pressure correspondingly lower than that of the atmosphere. If the feed supply be higher, there will be a corresponding increased pressure.

If the chamber, G, communicates with the air, the temperature of the liquid jet entering it will be lower than 212° Fah.

We can obtain at will either quantity or velocity (that is, pressure) of conveyed water.

Raising the temperature of the supply water increases the quantity of conveyed water, and lessens the velocity of the mixed streams.

Lowering the temperature of the mixture rapidly increases the proportion of conveyed water. At 212° Fah. the water has maximum velocity and is in minimum quantity.

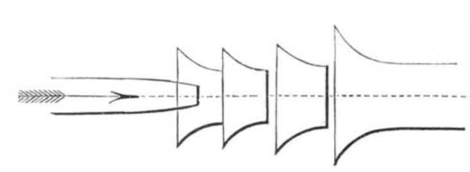
With dry steam the proportion of conveyed water increases over that obtained with "wet" steam.

The injector is a much more economical boiler feeder than pumps are; but, considered simply as a water raiser, its duty is comparatively low (about ⅕ that of the pump), most of the heat of the steam being employed in raising the temperature of the feed.

To get the best mechanical performance out of an injector we wish to place it as high up as possible. This diminishes the pressure in the chamber, G (if closed), and lowers the temperature of the steam jet—that is, the temperature of saturation due to the reservoir pressure in G. The work of getting the water into G will then be just as in a suction pump, and practicable up to about 25 or 26 feet lift. This will give the greatest possible fall of steam temperature between the boiler and the injector orifice, and thus secure the highest mechanical effect attainable here; and an injector working thus will differ from one doing ordinary feeding, with steam about 212°, just as a condensing engine differs from a non-condensing.

The water raising performance of the injector increases rapidly with great heights, and on account of its great convenience the machine is hence good for draining mines, etc. It should be remembered that it is best for this purpose to give it all the height of draught it will stand.

A water jet may be substituted for a steam jet, and we may consider water jet injectors at some other time.



Using several successive funnels has the useful effect of permitting the water raised to arrive at the injector with considerable velocity.

The jets may be used as a condenser, and then become an ejector.

An injector may be used to advantage in working a hydraulic press, where a pump of sufficient power is lacking.

The very causes of weakness of the steam injector as a draining pump (the disproportion existing between the possible and the actual lifting height of a liquid, and also the disproportion between the specific gravities of the steam and the liquid raised by it) make it a more satisfactory device for a gas pump.

The exhaust nozzle of a locomotive is an instance of an injector used as a gas pump; the employment of an intermittent jet being found an advantage for the purpose named. The injector is also used as a blower and ventilator, in which case it is really a gas pump.

One of the most important steps in the progress of the injector is its special adaptation to locomotive feeding, etc., by employing two devices—one a lifter, calculated for the difficult suction and the varying steam pressures; the other, a forcer, taking the water from the lifter and putting it at any desired temperature or pressure into the boiler.

The beauty of this combination is that by using only part of the steam in the lifter the increase of temperature of the water is very slight; the supply may, therefore, be quite hot without bringing the temperature in the condensing space up to 194° Fah. (about the maximum).

Also the forcer is fed under invariable pressure by the lifter, and is not dependent upon variable degrees of vacuum. No Watt's regulation is thus necessary.

IF any one doubts the onward march of improvement let him remember that the old plan of fastening your napkin around your neck at dinner time has been done away with by the patented invention of Marshall Burnett, of Hyde Park, Mass. You clamp a sort of a wire fence to the edge of the table before your dinner plate. The fence is jointed like lazy tongs. You place your napkin on the fence and pull the latter up under your chin when you are taking soup; push down the fence and napkin when you are done.

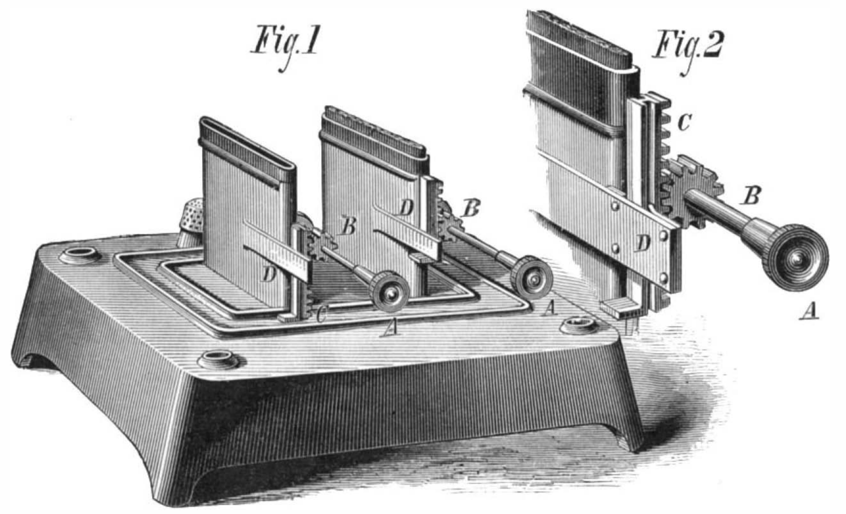
HEAT, LIGHT, AND TIME.—A recent patent for a nursery lamp shows a plan for warming liquids, giving illumination, and showing the time; which latter is done by the fall of the oil in a tube, the flame being gauged to consume a given quantity of oil per minute.

WINTERBURN'S REGULATOR FOR OIL STOVE WICKS.

We illustrate herewith a simple little device for regulating the height of the wicks of kerosene oil stoves. It often happens that these wicks are carelessly turned down so far that a spark enters the space above the oil, and, igniting the gas therein, causes an explosion. The present contrivance prevents this, and at the same time offers a convenient means of limiting the movement of the wick while being turned upward. The cog wheels which act against the side of the wick to lift it up and down are of the usual kind, placed alongside the burner, and are rotated by the milled heads, A. On the shaft of the latter is a wheel, B, Fig. 2, which gears in the rack, C, which is supported on the spring. D, attached to the burner. The rack moves up and down in ways on the face of the spring When the wick is turned down as far as it ought to go, the lower end of the rack strikes against the body of the stove and prevents any further motion of the screw. It is thus rendered impossible for the light to be carried down into the oil. The upward movement of the rack is limited by the offset on its lower end coming in contact with the spring, as shown on the right of our engraving, Fig. 1.

When the wick becomes so much burned away as to necessitate readjustment of the raising and lowering mechanism, this is easily done by simply moving the rack to one side, the spring bending, and turning up the wick sufficiently before putting the rack back in its place.

Patented June 19, 1877. For further particulars address Mr. A. Winterburn, 16 and 18 De Witt street, Albany, N.Y.



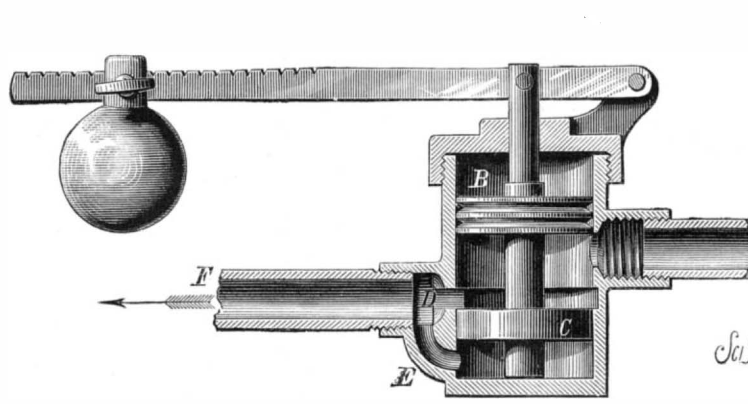
WINTERBURN'S REGULATOR FOR OIL STOVE WICKS.

IMPROVED DIFFERENTIAL PRESSURE REGULATOR.

There are many cases where it is desirable to employ steam for heating, drying, or other purposes, at a less pressure than that existing in the boiler which supplies the engine. The object of the present invention is to enable the steam to be taken directly from the main pipe leading to the engine at any desired pressure, which will not be subject to variation by changes of initial pressure in the boiler. A is the main steam pipe, to which the branch leading to the regulator is attached. The latter is a cylindrical vessel, in which moves the piston, B. The periphery of this piston is channeled to allow of water packing. The stem is continued upward through the casing cover, and to it is attached a lever with adjustable weight. The stem is also continued downward, and carries a second piston, C. As the steam enters between these pistons and acting equally on both, the pressure is balanced, and the steam is free to pass out of the delivery port, D, and thence through the channel, E, to beneath the piston, C. Its pressure here is balanced by the weighted lever, which is suitably adjusted. The supply is then delivered, as indicated by the arrow, through pipe, F. In case the steam pressure should rise above that for which the weight is adjusted, it will be clear that the piston, C, will be lifted and the weighted lever raised. As the piston, C, rises it closes the delivery port, D, and thus the supply of steam is reduced or cut off until the pressure beneath the piston, C, is sufficiently lowered to enable it to descend. The annular groove increases the available area of discharge, and also allows the steam to circulate around the piston, C, when the same closes the port in order to balance it circumferentially.

The device is exceedingly simple in construction and positive in its action, and as it may serve the purpose of saving a special boiler for delivering steam at low pressure it is valuable in point of economy. Patented March 12, 1878.

For further particulars relative to sale of patent, address the inventor, Mr. S. Ashton Hand, 1,506 Arch st., Philadelphia, Pa.



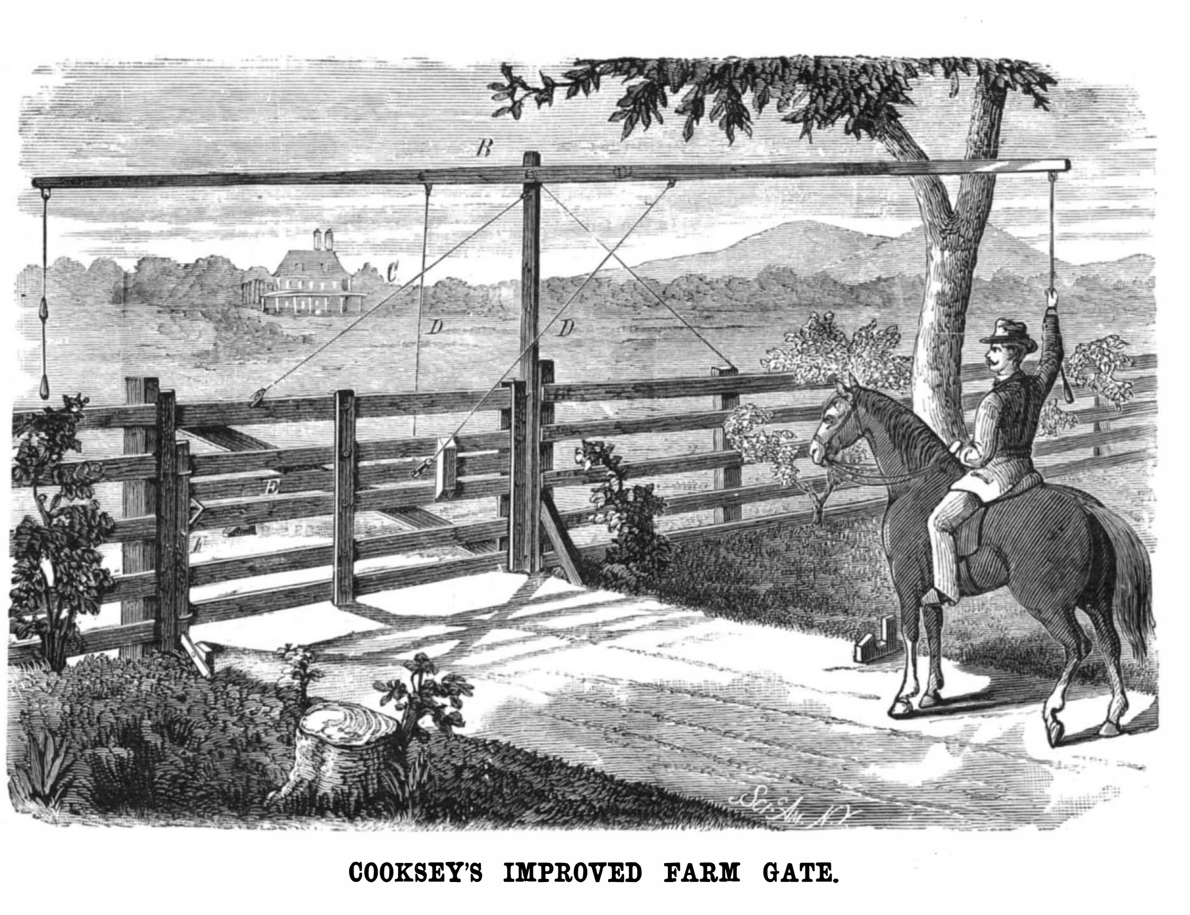
HAND'S DIFFERENTIAL PRESSURE REGULATOR.

IMPROVED FARM GATE.

We illustrate herewith a new farm gate, which may be easily opened without dismounting from on horseback or from a vehicle. The advantages claimed for it are, that it cannot become jammed by frost, wet weather, or snow; that it is so simple that any farmer can make it; it is constructed entirely of wood or iron, opens gently and noiselessly, cannot sag, has a double latch fastening bottom and top, is cheap, and the mechanism is easily attached to any ordinary gate.

The mode of operation is clearly shown in our engraving. On the wire, A, being pulled down, the lever, B, is tilted, so that by the wire, D, the bar, E, is moved sidewise, lifting, by an elbow lever, the vertical bar, F. The end of the bar, E, serves as an upper latch, and the lower end of bar, F, as a lower latch; and it will be evident that both are simultaneously retracted as the wire, A, is pulled. After passing through the gate, which is suspended by the wire, C, the operator pulls the wire on the opposite end of lever, B. The lower latch is thus raised out of a small post, not shown in the engraving, but which is placed beside the fence so as to hold the gate open, and, in the manner already described, causes the gate to swing shut.

For further particulars address the inventor, Mr. N. B. Cooksey, Altamount, Effingham county, Ill.



COOKSEY'S IMPROVED FARM GATE.

WEIGHT OF STEAM.—27·2222 cubic feet of steam at the pressure of 1 atmosphere weighs 1 lb. avoirdupois.

Irradiation.

It is well known that pictures of intensely bright subjects are often too broad. This is frequently observable in connection with light hair in enlargements made in the camera. It is also remarkable in the case of astronomical views of the sun, in which the apparent size of the sun varies according to the length of the exposure. The *Mittheilungen* says that M. Angot has made some precise experiments on the origin of this fault, from which it is supposed that it is possible to calculate the amount of the error. M. Angot took several photographs of an object consisting of two right angles separated by a dark space. Exact measurement of the various images taken under different circumstances furnished the following results: The intensity of the light increases the size of the photographic image. When, however, the light is weaker the image is rather within the geometrical size. Duration of exposure has a similar effect as intensity of light, but there is no proportion between the degree of increase. The irradiation increases also with the sensitiveness of the plate. On removing the stops from the lens, and at the same time considerably increasing the light, it was seen that the images decreased in size as the diameter of the lens increased. Also, pre-exposing the plate exercised an influence on the size of the image. Upon a pre-lighted plate the image is smaller than on a fresh plate. M. Angot finds the explanation of all these appearances in the curvature of the rays of light at the edge of the lens; and, according to this hypothesis, a plate of a certain sensitiveness, and taken with a certain exposure, remains unaffected so long as the strength of the light does not exceed a certain degree.

Natural from Artificial Butter.

The *Pharmaceutische Central-Halle*, after pointing out the unsatisfactory nature of the ordinary microscopical and chemical tests, indicates the following olfactory reactions as at once decisive and simple. An ordinary cotton wick is dipped in clarified melted butter, ignited, and, after burning for two minutes, is extinguished. The vapor arising from the wick is then examined by the sense of smell; when, in the case of artificial butter, the characteristic disagreeable odor of an extinguished tallow candle will be perceived; but in the case of natural butter, simply the well known smell of fried butter. The other method is a little more complicated. Here one volume of melted butter is mixed in a glass retort with two volumes of a mixture consisting of one volume of concentrated sulphuric acid and two of spirits of wine. This is distilled by the flame of a spirit lamp, and a few drops of the distillate are rubbed on the hand. In the case of natural butter this produces an odor of butyric ether; in the case of artificial butter, the repulsive smell of old tallow. The *P. C.* remarks, by way of caution, that in both cases the melted butter must have been freed from all traces of casein.

Charcoal Pencils.

The *Correspondenz* extracts from the *Papier-Zeitung* a description of a new sort of charcoal for drawing with. The ordinary drawing charcoal is made by charring pieces of wood, so that every knot in the wood remains, and there are often scratchy pieces and bits of unequal softness. The new pencils, which have been patented by Herr Heilmann, are made as follows: Sawdust of wood, taken from lime, willow, or even poplar trees, is pressed between wooden moulds having grooves about the size of those made for lead in lead pencils; it is then dried in air and charred in a retort. The hardened sticks are now rubbed smooth, cased in paper, and packed in bundles of twenty-five. The fibers of the wood having been freed from every foreign substance, the charcoal made from it can be moistened with any sort of liquid. Thus, moistened with gelatine it can be used instead of black chalk, or it may be moistened with linseed oil, or with lime water. The charcoal is also prepared of a catechu brown.

FANGS OF SERPENTS.

BY C. FEW SEISS.

The venomous serpents are divided into two groups, namely, *Solenoglypha*, including the rattlesnakes, vipers, etc., and *Proteroglypha*, embracing the cobras, coral or bead snakes (*Elaps*), and venomous water snakes of the East (*Hydrophidæ*). Fortunately, harmless serpents are, throughout the world, by far the most numerous. In the States north of Maryland, there are only two species of poison-fanged serpents (the rattlesnake and copperhead), while the non-venomous number eighteen species.

The fangs of serpents vary in number, shape, and size. In the viper, *Pelias berus*, the only venomous one of the three species of serpents found in Great Britain, the fangs are two in number, and are situated in the superior maxillary bones. There are no other teeth in the maxillæ, but there is a row of small teeth in the palatine bone on each side. The bite of the viper is often extremely painful, but rarely if ever fatal. The viper is not found in the United States. I remember on one occasion, in Maryland, a gentleman conducted me to a wood to show me a "viper" he had a short time before killed, and gravely informed me it was an "extremely poisonous species." It, however, proved to be a harmless hog-nose snake, *Heterodon platyrhinus*.

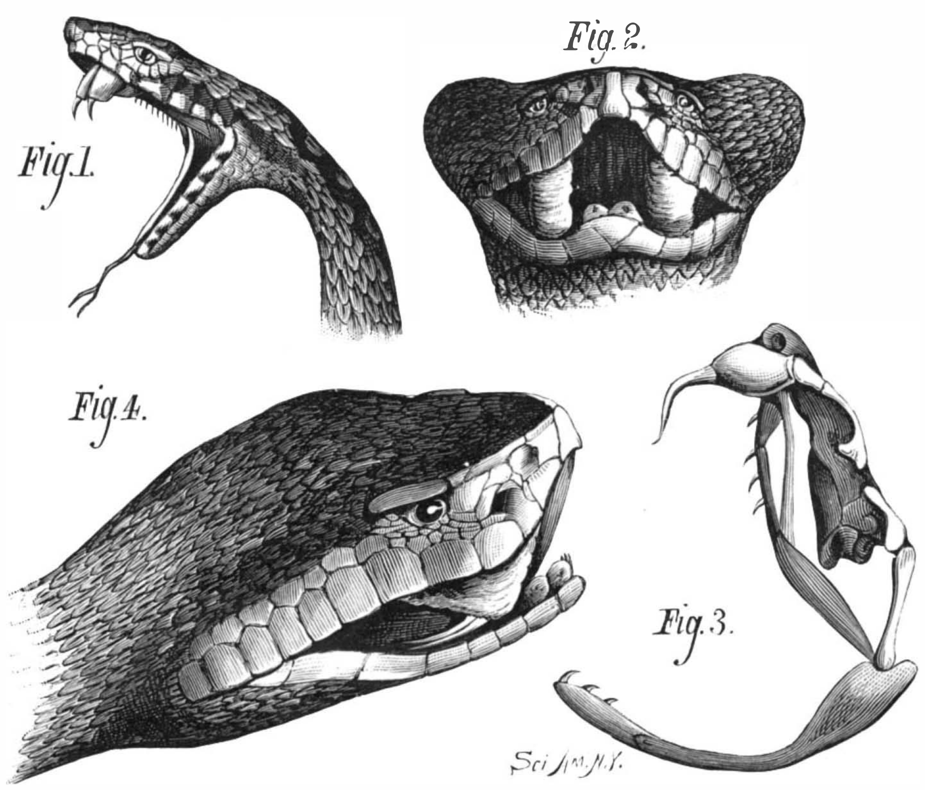
Fig. 1 shows the head of a viper, with fangs thrown forward in a position to strike.

The fangs of the rattlesnake (*Crotalus*) are also two in number, situated as in the viper. They are curved backward, and hollow, save at the tips, where they are solid, and turned slightly forward. The minute opening through which the venom is ejected is in front, about one twelfth of an inch from the needle-like point. The glands in which the venom is secreted are oval or almond-shaped, two in number, situated one on either side of the upper jaw, behind the eye. Each gland has a duct connecting with the base of its fang. These poison ducts are kept closed by an arrangement of muscular fibers when the fangs are not in use, but at the moment when the snake strikes these ducts are forced open by certain muscles of the head, and the poison shoots through the ducts and out of the openings near the points of the fangs into the wound. When not in use the fangs lie upon the gums in the roof of the mouth, buried in the folds of mucous membrane.

Fig. 3 represents half of the skull of a rattlesnake, viewed from the side, with the fang thrown outward and forward, ready for action.

The deadly machuca, of Nicaragua (*Bothrops atrox*, Wagler), has four great fangs in the upper jaw, two on each side. Fig. 4 is the head of the machuca, two thirds natural size, drawn from a large specimen in the Academy of Natural Sciences, Philadelphia. Fig. 2 is a front view of the head, showing the mucous folds covering the basal portions of the fangs. On the right side of the jaw of the specimen examined, one fang is drawn back against the roof of the mouth, while the other is thrown forward. This seems to show that the fangs are capable of independent motion, but we have no proofs of this fact. It may be they were thus forced apart when the serpent was killed, yet they seem to lie in a natural and easy position. In view of the serious results which have followed the bite of our *crotalus* and moccasin, armed with only two fangs, how much more deadly must be the machuca, driving venom into four wounds at once!

The beautiful harlequin or bead snakes, *Elapidæ*, are provided with two or more nearly permanently erect, grooved fangs in the upper jaw. These are generally small, not greatly curved, and project only slightly below the basal membrane. The poison glands of our Southern species of *Elaps* are small when compared with the above mentioned serpents. They are generally considered harmless snakes.



FANGS OF SERPENTS.

Salt River, Arizona.

It was long supposed that the brackishness of Salt river, Arizona, was caused by the stream running over a bed of salt somewhere along its course. Its waters are pure and fresh from where it heads in the White Mountains to within 50 miles of where it empties into the Gila. Fifty miles from its junction with the Gila there comes into it a stream of water that is intensely salt. This stream pours out of the side of a large mountain, and is from 20 to 30 feet deep. It is very rapid, and pours into the Salt river a great volume of water. Here could be easily manufactured sufficient salt to supply the markets of the world. All that would be necessary would be to dig ditches and lead the brine to basins in the nearest deserts. The heat of the sun would make the salt. Were there a railroad near the stream its waters would doubtless soon be turned and led to immense evaporating ponds. It is supposed that the interior of the mountain, out of which the stream flows, is largely composed of rock salt.

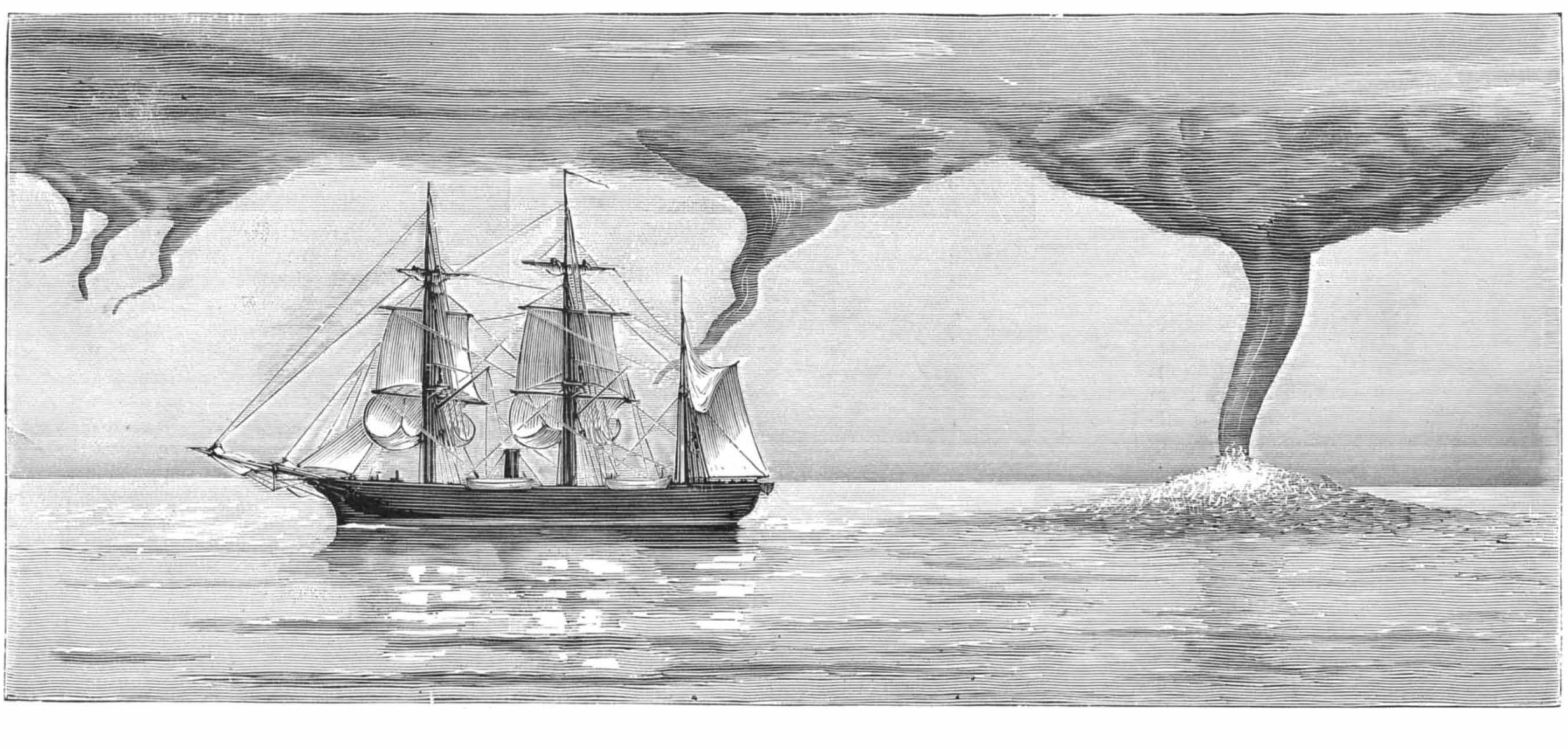
WATERSPOUTS.

The theory of the waterspout is still somewhat unsettled, notwithstanding the numerous observations which have been made. Generally it appears as a diminutive whirlwind, lasting from a few seconds to an hour, and reaching down from the under surface of a cloud to, or nearly to, the surface of the earth or sea. In the center of this whirlwind appears a slender column of water or of dense vapor, probably hollow, and the air whirling around it is sometimes an ascending, but more generally a descending current. The cloud bursts of Eastern Nevada, which have at times caused much damage, are of the latter type. Certain portions of the globe are peculiarly subject to waterspouts, which thus, like cyclones, have somewhat of a local character. Our engraving, for which we are indebted to the London *Graphic*, represents the British ship Boxer surrounded by waterspouts during a recent cruise on the west coast of Africa, when unusual facilities for studying the character of such phenomena were offered.

Progress of the Electric Light.

The Cleveland (Ohio) *Herald* lately witnessed a trial of the electric light at the establishment of the Union Steel Screw Company, in that city. The apparatus used has been constructed for the illumination of a large carpet mill in Philadelphia. It consists of a Brush dynamo-electric machine of 12,000 candle power, arranged to give four separate currents, each running an electric lamp of 3,000 candle power. Two of the lamps were placed on the third floor and two on the fourth floor of the immense building, and when the engine was started up the machine started at the same time, and, without the slightest manual interference, the lamps flashed out their light in all its magnificence. The effect was most brilliant. The rooms were flooded with a pure white light like the light of the sun, and it streamed out at all the windows, illuminating houses and streets for a long distance in every direction. The light was very uniform and steady, free from the flickering that used to be an accompaniment of electric light, and, considering the enormous illuminating power, the light was unexpectedly soft and endurable to the eyes. An opportunity was afforded to test the character and whiteness of the light. Worsteds, scarfs, afghans, etc., of brilliant shades, were hanging against the wall at one side of the room, and it was noticed that the colors were brought out as clearly as by the full light of the sun. Estimates were made as to the amount that the light furnished by this apparatus would cost, if used by the Screw Company as it was used on this occasion, and it was ascertained that the total cost of the whole light from the four lamps, including the items of consumption of carbon in the lamps, interest on the investment, and wear and tear, would not exceed thirty cents an hour. The light produced was photometrically equal to 800 gas burners, burning five feet of gas per hour each. This amount of gas would cost $8 per hour.

PEAT PRODUCTS.—The ultimate elements of peat are essentially those of wood and coal, viz., carbon, hydrogen, oxygen, and nitrogen. If, therefore, peat be distilled, the resulting products are the same; and in this way peat has been made to yield ammonia, acetic acid, pyroxylic spirit, tar, naphtha, oils, and paraffin—all of great value in the arts.



THE BRITISH SHIP BOXER SURROUNDED BY WATERSPOUTS.

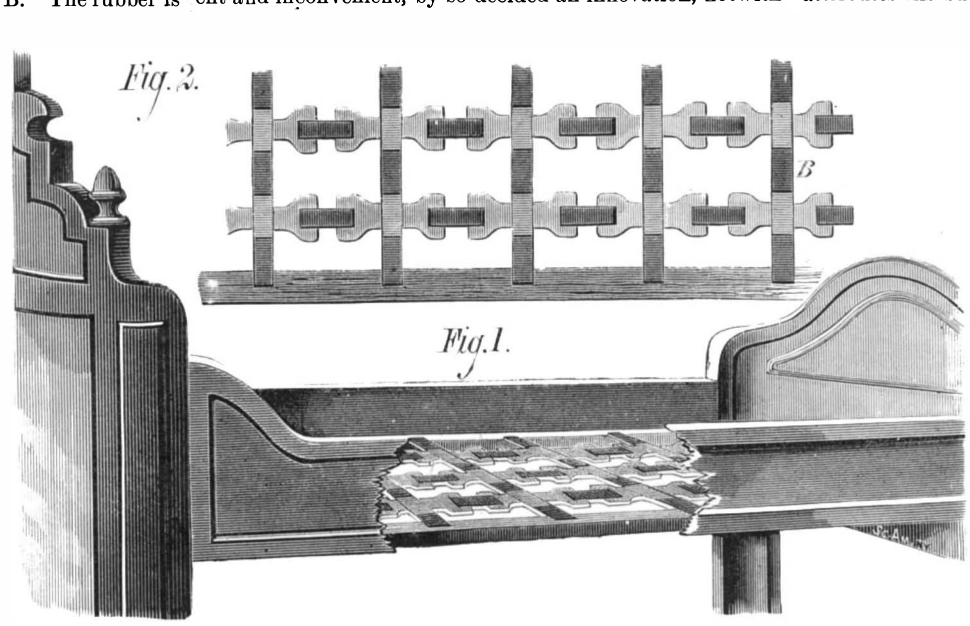
Coloring Principle of Wines.

The solid residue deposited from wines in the process of fermentation is treated while still fresh with four or five parts of alcohol at 60°, and allowed to macerate for about a fortnight; it is then filtered under pressure, and the filtrate distilled in a water bath, so as to get rid of the alcohol; what remains behind is evaporated under a vacuum, at a moderate heat, the residue of this last evaporation, refiltered, forms the natural coloring principle of wines. This is readily miscible with white or nearly colorless wines, imparting a pleasing natural hue, without introducing any injurious ingredient

IMPROVED SPRING BED.

We illustrate herewith a simple form of spring bed, constructed of wood, in pieces shaped as represented in Fig. 2, at A, and connected by bands of rubber, B. The rubber is fastened to the wood by rivets, a piece of sheet iron being put over that part of the rubber which is joined to the wood, so that the former is tightly pressed and prevented from tearing away. The advantages claimed are that the springs can be fitted to any bedstead of any shape or make; its elasticity can be increased or diminished by increasing or diminishing the thickness of the rubber. It is durable, easily cleaned, and comfortable.

For further particulars address the inventor, Mr. Henry S. Cate, Millerstown, Butler county, Pa.



CATE'S IMPROVED SPRING BED.

A Hundred Years' Progress in Piano Making.

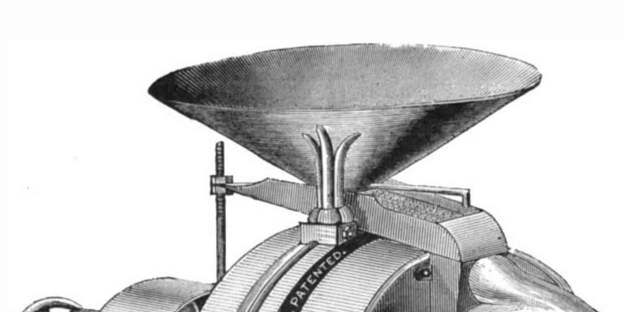
A harpsichord, said to have been played upon by Mozart, and bearing the date 1776, was lately offered for sale in this city at an auction of old furniture. As a musical instrument it was of small account, and the evidence of Mozart's use of it was too weak to give it much value as a relic; nevertheless it was a notable curiosity as an index of the past century's progress in the evolution of the piano. It was doubtless one of the best instruments made in that day. It had four and a half octaves, and the case is described as looking like a badly shaped coffin resting on a common table. The pedal was a plain piece of wood, the connecting string from which ran on the outside of the case. It could probably be made to-day for $50; its original price was about ten times that sum.

The recent development of the piano has been very rapid. Forty-five years ago, when Jonas Chickering began to make them in Boston, the best pianos were of five and a half and six octaves in compass and were made entirely of wood. The first American grand was made in 1824. The invention of the iron frame, in 1837, revolutionized the trade, and now our leading manufacturers have branch warehouses in Europe and export largely. The patented improvements have been numerous, the Steinways having secured fifteen, some of great importance. Weber has now a piano in his wareroom valued at $5,000, nine tenths of the value residing in the elaborate case. First rate grands are rated from $1,750 down to $1,000; squares from 1,000 down to $650; uprights, the same. Very good instruments, however, can be had at much lower prices.

IMPROVED GRINDING MILLS.

The accompanying engraving represents an improved twenty-two inch mill, adapted to grinding quartz, feldspar, foundry facings, chemicals, paints, and all kinds of grain. The shaft is placed horizontally, and the runner is rigidly secured to it, admitting of high speeding. Both runner and head stone are inclosed in a heavy case, cast in two parts. Each half is cast with its respective part of the frame and boxes, in which the shaft is journaled. On the outer faces of the cases trunnions are provided, to which the trunnion jack may be applied for taking the mill apart in making repairs or dressing. The inner portions of the case fit together with overlapping joints, and form a scroll extending around the burrs for ventilation and for the discharge of the product. The end of the shaft which receives the thrust in grinding is journaled in a partitioned bridge-tree box, in which there is an oil chamber in which the end is more or less submerged. The box fits in a sleeve formed in a very strong bracket arm, and is operated by a hand wheel in adjusting the burrs at either end of the mill. The shoe conveying the grain from hopper to stones contains screens, through which a strong current of air is forced by the fan attached to and operated by the shaft, making a final separation and cleansing of the grain. The shaft has a transverse slot through the end, in which a wrist pin can be adjusted for operating a reciprocating bolter.

The machine is strongly built of the best and most substantial materials. The husk case is sufficiently deep to receive the heaviest imported solid twenty-two inch French burrs. It makes from 500 to 1,200 revolutions per minute, requiring from eight to thirty horse power, and grinding, we are informed, from fifteen to seventy-five bushels per hour. For further particulars address the patentee and manufacturer, Mr. C. C. Phillips, 4,048 Gerard avenue, Philadelphia, Pa.



PHILLIPS' IMPROVED GRINDING MILL.

The Metric System in Practice.

Surgeon-General Woodworth, of the United States Marine Hospital Service, has issued an order relative to the adoption of the metric system of weights and measures, which will hereafter be employed for all official medical and pharmacal purposes by the officers of that department. Official indorsement and authorization of this kind will doubtless in time, little by little, result in the general introduction of the system. It is certain that without some such practical measures its common use would be indefinitely postponed, owing to the difficulty of supplanting the existing system (or rather want of system) of weights and measures, however incoherent and inconvenient, by so decided an innovation, notwithstanding the unquestioned advantages of the latter.

The order referred to prescribes that in expressing quantities by weight, the terms "gramme" and "centigramme" only will be used, and in expressing quantities by measure, the term "cubic centimeter." The metric system has already, under the act of July 28, 1866, been adopted by the Marine Hospital Service for the purveying of medical supplies, and the weights and graduated measures, as well as the glassware, hereafter furnished the medical officers, will be in accordance therewith. Simple rules for the ready conversion of terms of the United States apothecaries' weights and measures into their respective equivalents in metric terms are appended to the order, which, for all medical and pharmacal purposes, will afford sufficiently accurate results. Suggestions are also given as to the mode in which metric medical prescriptions might be constructed, and in relation to the preparation of requisitions for medical supplies in metric terms.

THE Norwegian Government has constructed a telegraphic line, 200 kilometers in length, composed chiefly of submarine cables, by means of which the fishers along the whole coast are enabled to gather at once on the approach of a shoal to any particular fiord.

Custard a Cholera Producer.

If the conclusions which Dr. W. R. Sevier, of Jonesboro, Tenn., has reached relative to a cause of cholera are substantiated by the experience of other observers as well as of himself, they are of the highest importance, and in any event worthy of careful examination. During 1875 a severe cholera outbreak occurred in the above named town, some thirty deaths taking place in a population of 1,500. Upon his analysis of the disease and its symptoms, Dr. Sevier, while attending the sufferers in that locality, reached the opinion that the malady was due to true blood poisoning, and undertook to combat it with chlorine instead of the usual specifics, opiates, quinine, brandy, etc., which had given unsatisfactory results. After some trials he obtained excellent effects from doses of sesquichloride of iron with hydrochloric acid and opium, losing but two out of fifty cases; and he attributes his success to the disinfecting properties of the chlorine as affecting the secretions of the stomach. In other words, his theory, expressed in general terms, is that decomposing food in the stomach is just as likely to cause cholera as a highly poisoned condition of the atmosphere. If the amount of animal food is in excess of the acid present, decomposition ensues and septic poisons are generated, and the alimentary substances most to be feared are custards and cheese. To these seemingly innocuous foods Dr. Sevier has traced cases of severe poisoning, and this although the preparations themselves showed no offensive properties. The poison existed, nevertheless, in the products of fermentative action. Custards, he says, are especially dangerous, and after they are prepared "should be kept at a very low temperature, and never be used after they have become in the least degree sour, or even insipid. I have seen them in the latter condition when an occasional bubble of gas arising to the surface was the only evidence of the mischief transpiring beneath, but, as demonstrated in the cases cited, intensely poisonous." The same invisible and destructive poison constituting the cholera miasm exists in the toxical principle of decomposing meat or fermenting custard.

As regards the existence of aeriform poison, Dr. Sevier regards the same as an epidemic influence as due altogether to the absence or to the deficiency of ozone in the atmosphere. When this element is present in sufficiency, it does not and cannot exist. The effect upon the system, he further considers, will depend on the amount of muriatic acid in the stomach. If the supply of this agent is sufficient to meet the demand, as heretofore suggested, no detriment to health from this poison will follow any amount or degree of exposure.

The Right Sort of Southern Spirit.

At a recent entertainment given by the Commercial Club, of Boston, to the visiting senators from the South, Senator Gordon said:

"These Southern friends and myself have come to look at your great factories, your manufactures, your great industries, and wonderful material developments, and to gather inspiration from that proverbial energy and enterprise which have enabled you to conquer unfriendly nature and to convert the bleak hills of New England into productive farms to support your commerce and your manufactures. We have come also to put you upon notice, and I take this occasion to serve that notice, that we of the South intend to enter the race with you in some of those branches of industry which hitherto have been yours peculiarly and almost exclusively. We have water powers unexcelled, which we are going to utilize, and even now are utilizing. We have a climate most balmy and genial and healthful. We have rich mines of coal and iron, and we intend to wake from their long sleep in their mountain beds these twin sons of Hercules, and set their arms to work in securing the great industrial wealth which awaits us. And if your people of the East are not alert and active we intend to overtake you in the race, to strain along abreast with you, and I am not sure but that on the homestretch we shall yet lead you on some of these lines of enterprise."

It is but a few years since the great West arrived at a similar conclusion, and to-day the vast agricultural resources of the West are surpassed in value by the newly created manufacturing interests. Before the waning nineteenth century comes to an end the same may be true of the South. The old time planter's ignorant prejudice against labor, particularly mechanical labor, is fast dying out. Raw cotton is no longer king. Possibly in the new regime the spinning jenny may be queen.

GLACIAL MOVEMENT.—The daily motion of the great Swiss glacier, the Mer de Glace, is from 7 to 36 inches, depending upon the season and the point of measurement. The motion of its tributary glaciers is less rapid.

MACHINERY VS. MANUAL LABOR.

A correspondent of the New York *Herald* has been interviewing the leaders of the leather trade, in Massachusetts, now the chief industrial interest of that commonwealth. In his talk with Mr. Coolidge, a large manufacturer, he was told that eighty per cent of the work on boots and shoes was now done by machinery; whereat he "could not fail to remark what a terrible blow this machinery had inflicted on manual labor."

His study of the statistics of the trade, as gathered by Mr. Wright for the State Labor Bureau, only confirmed this impression. He found that in 1865 there were in Massachusetts 206 boot and shoe factories, employing 52,821 persons. Now, while machinery has increased the productive capacity of each workman tenfold, there are 1,500 boot and shoe factories, employing only 51,280. A few lines above in the same article, Mr. Coolidge is credited with saying that there are 3,500 firms in Massachusetts engaged in the making of boots and shoes; and in the next day's *Herald*, the correspondent is accredited with the discovery that in 1865 there were employed in Massachusetts 30,000 more shoemakers than to-day.

Somebody's arithmetic is evidently at fault. The probability is that the figures copied from Mr. Wright's tables are most to be trusted; and that we are to take as evidence of the power of machinery to turn men out of employment the circumstance that there has been a diminution of about 1,500 boot and shoe makers in Massachusetts since 1865 (52,821 less 51,280), while the value of the annual product has been increased by upwards of $70,000,000.

Admit that it would be a serious thing to them to deprive 1,500 men, women, and children of their means of earning a living, notwithstanding the fact that the same cause increased tenfold the productive capacity and the earnings of 50,000 other men, women, and children. But has the introduction of machinery in shoemaking diminished the demand for labor in Massachusetts by that amount? The evidence does not show it. How many additional men, women, and children are required (above the number employed in 1865) to make ready for market, transport, and sell the additional $70,000,000 worth of boots and shoes? How many men are employed in making the leather used in making the increased number of boots and shoes? And how far would 1,500 operatives go to supply the demands of the numerous establishments devoted to the manufacture and sale of shoemaking machinery?

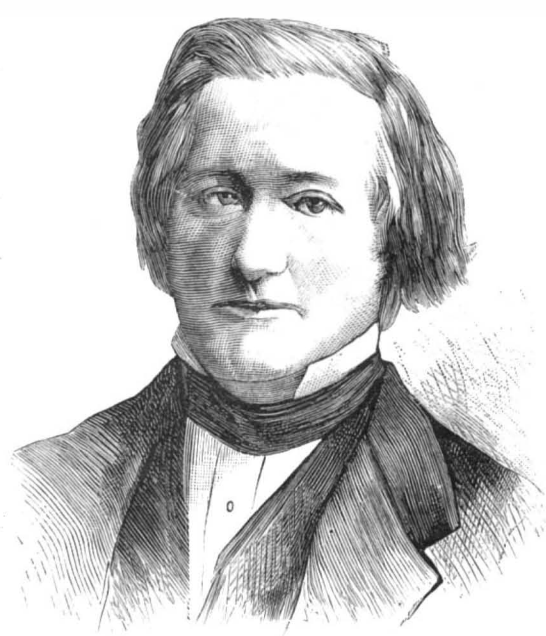
"Fifteen years ago," said Mr. Coolidge, "quite a business was done in importing calfskins to this country. We imported also a large quantity of manufactured goods from abroad for the retail business. All this is changed now; instead of importing we export. We are exporting leather very largely, and our facilities for manufacturing are being continually improved. There is no country in the world that can compete with us, as with the aid of the twenty-seven firms right around us here doing nothing else than selling boot and shoe machinery we can in a moment have all defects remedied; and in fact hardly a week passes but these men improve our machinery."

The introduction and improvement of machinery do undoubtedly make necessary a continual readjustment of manual labor, but it never diminishes the aggregate demand for such labor. Even in the extreme case of shoemaking, where within a few years four fifths of the work has been turned over to machinery, the increase of production made possible by the change, and the necessary development of collateral lines of productive labor, as in the manufacture of the new machinery and the production of the additional raw material used, far more than compensate for the relatively smaller number of operatives required. The logic of uncritical thinkers on this point appears to be something like this: Before the introduction of machinery the annual product was so much; the number of operatives so many. To-day the annual product is ten times what it formerly was; consequently the number of operatives should be ten times as many. But it is not. Therefore machinery has dealt a terrible blow to labor!

The essential condition of such an increase of production, namely, that there must be a corresponding widening of the market through diminished cost, possible only by the use of labor saving machinery, such loose reasoners leave entirely out of account.

M. VICTOR REGNAULT.

M. Victor Regnault was one of the few masters of science who have attained equal eminence in two great departments of philosophy, and it is even questionable whether he

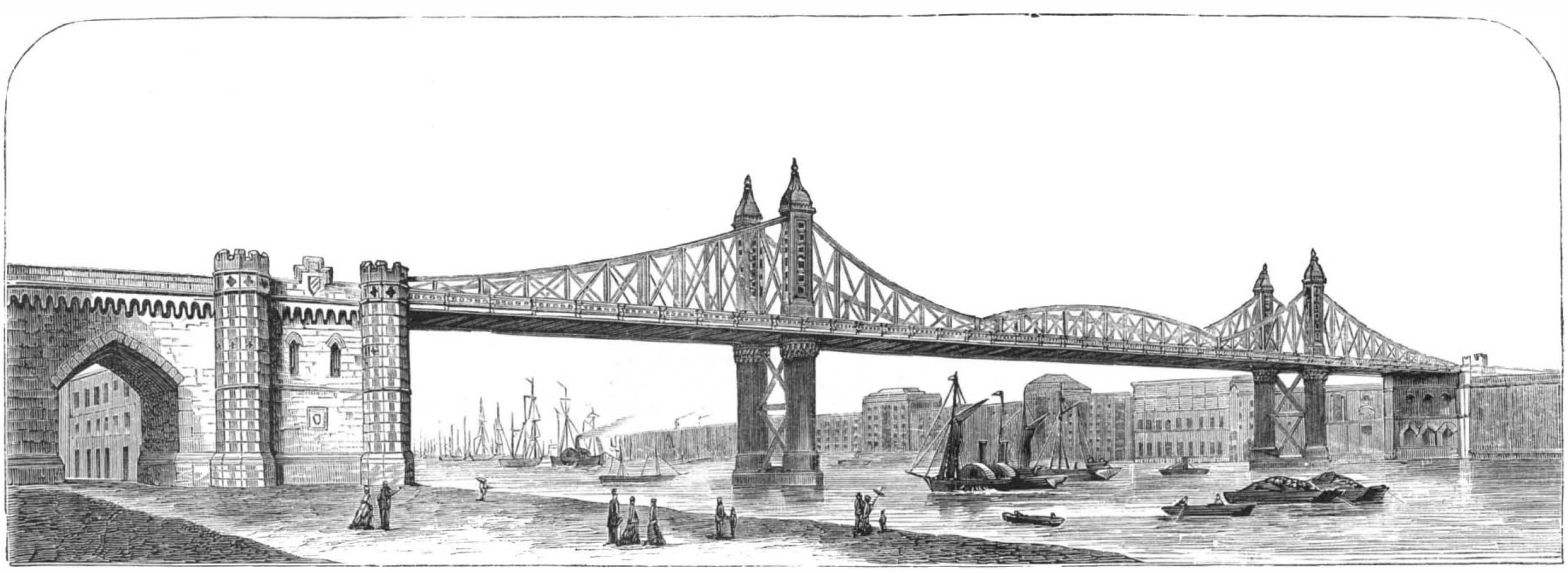


M. VICTOR REGNAULT.

achieved his highest reputation as a chemist or as a physicist. As a teacher and chemical investigator he has had few peers, and his large number of published works attest the thoroughness of his grasp of chemical science. As a physicist, his researches on the nature of gases are classic. He studied all the great experimental questions relative to heat, established the empirical laws of the elastic force of vapors, and measured their numerical coefficients with an accuracy that is marvelous, in view of the colossal nature of the task which he undertook. He was the father of Henri Regnault, one of the ablest painters France has produced, but who fell during the Franco-Prussian war. It is said that grief for this bereavement greatly impaired M. Regnault's health; and he suffered a still further loss in the destruction of the notes of his investigations, continued over many years, by the Prussians during the same conflict. After long illness he died in January last at the age of 68 years. We take the portrait herewith presented from *La Nature*.

PROPOSED BRIDGE OVER THE THAMES.

The increased traffic of London has reached such a point that the construction of a new bridge over the Thames below London bridge has become desirable. The Metropolitan Board of Works of that city has been for some time engaged in the discussion of plans, regarding which there is much difference of opinion. We copy from the London *Engineer* an illustration of one of three alternative designs proposed by Sir Joseph Bazalgette. In a future issue we shall illustrate another of Sir Joseph's plans—the one which he deems the most practicable—in which he proposes to construct the largest arch in the world, crossing the Thames near the Tower by a single span of 850 feet. The form shown in our engraving is much less expensive, but offers considerable obstruction to navigation. It is of a composite type, being a double cantilever bridge with a central bowstring span of 444 feet. Its appearance is quite graceful. Some doubt is, however, thrown upon the feasibility of securely placing the cylinders carrying the cantilevers, owing to the deep and narrow tideway and the nature of the Thames bottom, and it appears more likely that the single arch will be adopted.



PROPOSED BRIDGE OVER THE THAMES.

BASTARD PATENT RIGHTS.

Mr. Sayler's bill for the better security of property in patterns for metal castings (H. R. 2022) might better be styled a bill for securing to certain parties more than patent privileges in the absence of patent rights. It forbids the use of any metal casting as a pattern in moulding unless by the written consent of the owner or producer of the original pattern from which the casting was made; thus giving to pattern makers, unconditionally and for nothing, greater protection than inventors can secure through the agency of the Patent Office or the copyright act. The man who makes a positive and useful addition to the world's scientific knowledge or industrial achievement may enjoy a temporary exclusive control of his invention or discovery on proving his right and paying certain fees. Mr. Sayler's bill proposes to give to every maker of a moulder's patern, however common and simple its design, all a patentee's privileges for nothing and forever! and this at a time when the same legislative body has under consideration a bill for depriving inventors of no small part of the limited protection which patents have hitherto afforded them.

No doubt it is very annoying to pattern makers to have their unpatentable designs appropriated by others without their having to pay for patterns, but that is one of the conditions of every trade. Whatever is good and taking is sure to be copied with small regard for the introducer's feelings. Pattern makers suffer no more than other people, and there is no good reason why they should be specially exempted. There is certainly no just ground for giving them all the benefits of the patent law while exacting none of its conditions.

The sole object of the patent system is to encourage original research and invention for the advancement of science and the industrial arts; and it aims to secure that end by recognizing a temporary property right in new and useful inventions. No such end is proposed by Mr. Sayler's bill; nor would any such effect be produced by it. It aims simply to give special privileges to a class which has no right to such privileges. The bill was referred to the Committee on Patents, but might as fitly have been sent to a Committee on Indian Affairs.

The Ticinese in California.

One of the most industrious, frugal, temperate, and well-to-do elements in this cosmopolitan State is the Ticinese, composed of former inhabitants of the Canton of Ticino, Switzerland. Their number is estimated at 7,000, distributed principally in Marin, Napa, Santa Clara, and San Luis Obispo counties. The great majority are engaged in the dairy business, and notably so in Marin county. It is stated upon good authority that they manufacture fully one half the amount of butter and cheese made in this State, and the products of their labor always bring the highest price in the market because of the excellence of quality and fullness of weight. Quite a number of the Ticinese are small farmers, some of whom own their own land, but as a rule, both for farming and dairy purposes, the land is rented. Their property in milch cows, horses, wagons, and other things necessary to their business, is very large. As a reward of their unceasing industry and frugality they are never "hard up," and, when the proper occasion offers, are generous to a fault in spending their money. In their feasts and convivial parties they are as jolly a lot of fellows as ever sat down to do honors to the inner man. The Ticinese are a branch of the Italian family, and all speak the Italian language, their mother tongue.—*San Francisco Chronicle*.

A Method for Producing Cheap Heating Gas for Domestic Purposes.

That gas is the most perfect kind of fuel for either manufacturing or engineering purposes is a fact that has long been maintained by the most eminent metallurgists and engineers; and that, wherever it has been used for domestic purposes, it has been found to perform its office most admirably, is a fact that cannot be controverted. Yet, notwithstanding all this, its adoption as a calorific agent has been comparatively slow. Possessing the merits of cleanliness, freedom from trouble, simplicity of management, easy regulation of the heat employed, allowing it to be rapidly generated and as rapidly checked when no longer needed, together with numerous other advantages that will be obvious without enumeration, it may appear strange that this mode of heating has not enjoyed a far more extended application for various domestic purposes. The two great drawbacks that have operated to prevent this thus far seem to be the high price of ordinary illuminating gas, which renders the usual methods of generating heat to be more economical, and the impracticability of using, on a small scale, any of the gas generators and appendages that have hitherto been devised for the purposes of producing gas fuel for domestic uses. All of the apparatus thus far brought to the notice of the public by inventors has the great fault of being so bulky, cumbersome, and costly, as to adapt it for use only in such large establishments as clubs, hotels, hospitals, prisons, etc., in which the consumption of gas for cooking purposes would of necessity be large. What we want is a small, compact apparatus that shall produce a cheap heating gas, and one that can be afforded at such a price as to place it within the reach of every family of moderate means.

In 1872, prizes were offered by the Society of Arts, of England, for inventions that should tend to promote economy in the use of fuel for domestic purposes. After a careful investigation of the claims of a large number of exhibitors, it was found that inventors had made so little advance worthy of the name in the direction of fuel economy, that no prize could justly be awarded.

Among various inventions which made their appearance after the conclusion of the society's experiments was one by Mr. Joshua Kidd, based on the principle of the admixture of gases from ignited coal with the hydrogen from decomposed water. The remarkable feature of the process was the complete gasification of the fuel used, and it was this fact which led some gentlemen interested in the subject to adopt the idea and purchase the patent. A description of the apparatus, which two years of trial and experiment have enabled them to alter and adapt to carry out the principles of the original invention, forms the subject of a paper by Mr. S. W. Davies, in the current number of the society's journal. Numerous attempts have been made by previous workers in this direction to produce a cheap gas for heating purposes, by the action of water vapor on incandescent carbon. It has long been known that if steam be passed over coke or charcoal heated to redness, a decomposition of the steam takes place, hydrogen, carbonic oxide, carbonic anhydride, and a small proportion of marsh gas being produced. The composition per cent by volume of the mixed gas produced in this way is, according to analysis:

Hydrogen	54·52
Carbonic oxide	31·86
Carbonic anhydride	12·00
Marsh gas	1·62
	100·00

It is evident, therefore, that we have here a very important heating gas, could we succeed in producing it economically in considerable quantities. How to do this has formed the subject-matter of numerous patents, very few of which have been commercially a success, owing to the large and costly nature of the apparatus devised for carrying out the process. The apparatus under consideration will be seen to labor under neither of these disadvantages. It is small, compact, by no means costly, and combines a gas generator, boiler, and superheater in one; it generates its own blast, is continuous in its action, and so easily worked that a person of average intelligence may be taught to attend to it in a few hours.

The generator consists of a hollow cylindrical body or case, made of wrought or cast iron, terminated below by a cast iron bottom, with a hole in its center of about one half or one third its own diameter. Below this again, and forming part of the bottom casting, is a second hollow cylinder of the same internal diameter as the hole above it. In this lower cylinder the fire grate is lodged, the blast pipe opening into it below the fire grate. The grate fits loosely, and is attached to one side of the cylinder by a hinge, and supported at the other by a pin. When making gas it is necessary to close the bottom of the small cylinder air-tight. This is effected by means of a flat hinged plate, kept tightly pressed against it by a heavily weighted lever. In the upper cylinder there is a coil of thick wrought iron pipe, fitting closely and attached by means of supports. At the bottom the coil is protected from the intense heat of the fire by a thin lining of gannister. The two ends of the coil are turned outward at right angles, and pass, gas-tight, through the body of the generator. The lower end is connected with an arrangement for supplying water under pressure, and the upper with a steam pipe of smaller diameter passing down parallel to the generator, and terminating in a small steam tap in front of the blast pipe.

The top of the apparatus is a casting of rather peculiar shape. In its center there is a circular opening about nine inches in diameter, communicating below with a hollow inverted truncated cone projecting into the interior of the generator. At the apex of the cone there is a narrow cylindrical ring, the seat for a heavy conical valve, which fits it gas-tight. This is surmounted by a short cylindrical fuel box, carrying at its upper end a hopper, the opening between them being covered by an ordinary flat sliding plate or valve. Attached to the fuel box there is a short flue, used when lighting the fire, but closed when making gas. The whole apparatus is supported on three legs attached to the bottom casting.

It will be seen now that if a fire be lighted in the interior, and water driven through the coil, the water will be rapidly caused to boil, steam will be produced, which will accumulate in the upper part of the coil, and, if not at once allowed to escape, will take up a further increment of heat and pass into the condition of superheated steam. The tap in front of the blast pipe being opened, the superheated steam will pass down the small pipe outside the generator, and blow with considerable force into the blast pipe, carrying with it a stream of air. By apportioning the size of the steam jet to the internal diameter of the coil, a constant supply of superheated steam is obtained, and, as a matter of course, a continuous blast of air insured. In this way, then, the requisite oxygen to support combustion, and steam for decomposition, are driven into the apparatus with considerable force, and, after traversing the column of heated fuel, issue therefrom as a permanent gas. The gas thus produced is non-luminous, but burns with a reddish-blue flame. It is much richer in heat producing material than that produced by Siemens' method, and of course its calorific value is proportionally increased. The records of the author's experiments with the apparatus show that one ton of fuel (anthracite gave the best results) treated in it yields from 155,680 to 224,000 cubic feet of gas; that is, from three to four and a half times the quantity yielded by Siemens' process, the only patented one that has hitherto met with much success as a method of generating cheap gas for domestic and manufacturing purposes.

Siemens' generators are, moreover, large and costly, and the space occupied by the apparatus is very considerable. They are therefore only applicable to large manufacturing and metallurgical processes, while the generators under consideration can be made almost of any size, so as to adapt them for use in small manufactories or private establishments.

If, after thorough trial, the new method be found to meet all the requirements of the public, as it seems to have met the expectations of those who have been perfecting it, a great step will have been taken towards supplying one of the main desiderata that have thus far been wanting to make gas fuel more available for domestic use.

A Talk about Plumbing and Sewer Gas, by Ex-Alderman Gilbert, of this City.

To the Editor of the Scientific American:

As the story goes, a man was knocked down in one of our thoroughfares by a passing carriage. The people rushed to his assistance, when some one cried out, "It's only a plumber!" and the people passed on, leaving the fallen man to the care of the first policeman who might happen that way.

We often blame the plumber, when it is mainly the system upon which our houses are plumbed that is the cause of the sewer gas nuisance.

The ramifications of water and sewer gas pipes running through all parts of a house when taken as a whole are complicated, and being all hidden beneath the floors, are a mystery to most people; but when each room is taken separately, nothing is more simple. They consist of two pipes, one leading the water from the Croton pipe into the wash basin or other receptacle, with a faucet to shut off the water; the other pipe leads the waste water from the basin to the sewer, and when properly constructed is as tight from end to end as the water pipe.

Now the question is, Why should not the sewer pipe be as effectually closed at the side of the wash basin, to shut out the sewer gas, as the other pipe is to shut off the water, when it can be so easily done by means of a hinged valve on the inside of the basin, that shall rise by its own buoyancy and let the water off to prevent an overflow, and again fall back airtight when the water is let off at the bottom of the basin, thus enabling every one in self defense to see to it that no gas can possibly enter the room, however imperfect the general plumbing of the house may be? This valve may be applied to all basins now in use without alteration. The plumber in defense of his system will answer that the water trap under the basin prevents the passage of sewer gas into the room through the sewer pipe which enters the basin.

This water trap, like all other contrivances to prevent sewer gas from entering our houses, is hidden from sight within the sewer pipe, and an imperfection in it, an opening no greater than the thickness of paper, will allow the gas to stream through; and besides, when water is let off through the waste pipes in the lower rooms, it is apt to siphon the water out of the traps above, thus removing whatever obstruction these water traps might afford when full of water. But supposing the water trap under the basin to be full of water, will it prevent the passing of sewer gas into the room?

It is well known that water will rapidly absorb the gas produced by such impurities as enter the sewers, and we have scientific authority for stating that when the water in the traps becomes saturated with gas, the more ethereal qualities and those which are most detrimental to health will pass into the room.

The sewers are ample to receive all the impure matter from our houses and factories, and carry it off, together with the gas formed within the sewers, to the broad sheet of water that surrounds the city, where it would be rapidly absorbed.

All that need be done to accomplish this result is to abandon the abominable system of ventilating sewers, and allow the ventilation to go on naturally at their openings where they enter the bay and river. During the day while the waste pipes are in action we have all the water of the Croton river running through the sewers; this current of water is sufficient to carry off all the gas that has formed during the preceding night, and that it does carry it off any one can prove by taking off the manhole plate at midday at any point where the descent of the sewer is sufficient to move the water within it. At that time it will be found that the air in the sewer is comparatively free from gas. It is at night when the flow of the waste pipes is stopped that gas accumulates in the sewers, and instead of shutting it within them to be carried off to the bay and river as soon as the waste pipes are open in the morning, we have those ventilating pipes to draw the gas up through the houses with openings into the waste pipes of the rooms, and what gas is not left at these openings is carried out above the roof, to be brought down by the falling dew to poison the air we breathe, and from which there is no escape, when we open our windows for fresh air in a still night.

Of the effect of this sewer gas and other bad odors upon the health of this city, which ought to be one of the healthiest in the world instead of being one of the most unhealthy, it is only necessary to refer to the recently published opinions of Drs. Marcy and Hammond. Dr. Marcy says, "There are many days and nights, during the summer months especially, when our city is rendered almost uninhabitable by the dreadful stench. Even closing the windows on hot and sultry summer nights does not exclude the poisonous smells which penetrate everywhere, lurk in every place, and sow the seed broadcast of typhus, dysentery, cholera infantum, and the like." Dr. Hammond says, "The sickening character of the emanations in question is so indisputable that I do not suppose it will be denied by any one who has been subjected to the influence of the horrible stench; it oppresses us in the streets, disgusts us in our moments of relaxation, and, worst of all, it nauseates us at our meals."

"Dr. Chamberlain reports, from a recent conversation with Dr. Richardson, acting Secretary of the State Board of Health of Massachusetts, that there they never have a fatal case of scarlet fever or diphtheria without finding some cause for it in defective drainage, ventilation, or bad sewerage of the dwelling."

The above remarks of the three eminent physicians apply with great force to the sewer gas nuisance, and common sense would seem to dictate the necessity of an air tight covering at the end of every sewer or waste pipe which enters our houses, so placed that one can see that no gas can enter the room.

A most important branch of the plumber's trade, and one which should be skillfully done, is to so construct the basin of a water closet and its fixtures that when the pan or valve at the bottom of the basin is closed it shall be flushed with at least four inches of water, to always stand at that height in the bottom of the basin, and when one sees less than about four inches in the bottom of a water closet basin he may be sure that gas will pass into the room and should at once call in the plumber.

JOHN S. GILBERT,
Submarine Engineer.

ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, May 25, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H.M.		H.M.
Mercury rises	3 49 mo.	Jupiter in meridian	4 27 mo.
Venus rises	2 43 mo.	Saturn rises	1 50 mo.
Mars sets	10 11 eve.	Uranus sets	0 35 mo.
Jupiter rises	11 32 eve.		

FIRST MAGNITUDE STARS.

	H.M.		H.M.
Alpheratz rises	11 57 eve.	Regulus sets	0 36 mo.
Algol (var.) rises	1 40 mo.	Spica in meridian	9 05 eve.
7 stars (Pleiades) rises	4 00 mo.	Arcturus in meridian	9 56 eve.
Aldebaran rises	5 19 mo.	Antares rises	7 48 eve.
Capella sets	11 02 eve.	Vega in meridian	2 22 mo.
Rigel sets	6 26 eve.	Altair rises	9 01 eve.
Betelgeuse sets	8 00 eve.	Deneb rises	6 28 eve.
Sirius sets	7 27 eve.	Fomalhaut rises	2 40 mo.
Procyon sets	9 38 eve.		

REMARKS.

Mercury rises but 46m. before the sun, and is therefore invisible. Venus is in an uninteresting quarter, as there are no bright stars in her vicinity. She is in that section of the zodiac allotted to the constellation *Pisces*, the Fishes, and the brightest star (γ *Arietis*) within this space is of the third magnitude, and belongs, properly, to *Aries*. She is in conjunction with the moon May 28, in the morning, and is farthest from the sun May 30. Mars is in *Gemini* about 2° north of the central star (*Wasat*) of the constellation. This star (3d mag.) will be remembered by some as having served to indicate the position of Uranus shortly after its discovery, and when its elements were not fully known. Jupiter begins to retrograde this date. Saturn is situated almost exactly upon the *prime meridian* of the heavens, and with the two stars (Algenib and Alpheratz) which form the east side of the Square of Pegasus, indicates the course of this meridian through the pole.

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.

NEW BOOKS AND PUBLICATIONS.

SCIENCE LECTURES AT SOUTH KENSINGTON. Vol. I. Macmillan & Co., Publishers: New York city. Price $1.75.

This is a collection of excellent short monographs on scientific subjects which have already separately appeared in pamphlet form. It includes "Photography," by Captain Abney, "Fluorescence and the Absorption of Light," by Professor Stokes, Professor Kennedy on the "Kinematics of Machinery," Mr. Bramwell on the "Steam Engine," Professor Foster on "Electrical Measurements," Mr. Sorby on "Microscopes," etc., all being concise and well written essays on the several subjects.

A PHILOLOGICAL AND HISTORICAL CHART. By A. E. de Rupert. A. E. Barnes & Co., New York. Price $5.00.

This illustrates in a simple and comprehensive way the division of languages as classified by modern philologists. It shows the origin, development, progress or decline of the literatures of the world, gives a list of prominent authors and their best works, and many important historical facts. The chart is apparently the result of much careful study, and should prove valuable to educational institutions.

HOUSE DRAINAGE AND WATER SERVICE. By James C. Bayles. Published by David C. Williams, 83 Reade St., New York city.

The author in his preface states that this work is the outgrowth of the discussion of practical questions pertaining to plumbing and sewage in the *Metal Worker*, of which he is the editor. Its scope will be seen from the following subjects treated: "Hygiene in its practical relation to Health," "Sewer Gas," "Waste and Soil Pipes," "Traps, Seals, and Vents," "Water Service in City Houses," "Drainage of Country Houses," "Chemistry and Hydraulics of Plumbing," etc. The book is excellently well written, is replete with valuable information selected with good judgment, and will prove, we do not doubt, a standard guide to the trade to which it is more particularly addressed, as well as a useful work of reference for all interested in the very vital questions involved in the science of sanitary engineering.

Parts 26 to 30 of the New Encyclopedia of Chemistry, lately issued, carry the work forward from "Leather" to "Manure." The articles are remarkably voluminous, far more so than is usually possible in extended publications of this description, and they are well up to late advances in the science. The Encyclopedia will be completed in 40 parts, price 50 cents each. Published by J. B. Lippincott & Co., 715 and 717 Market street, Philadelphia.

Almanaque de la Gaceta Industrial for 1878. This almanac, issued by the above named journal, an excellent scientific periodical published in Madrid, Spain, contains in full the law relative to public works in that country, tables of Spanish exports, and a list of Spanish patents for the past year, besides the usual calendar.

Notes & Queries

(1) E. B. L. asks: What is the best material to fasten lithographs on paper to the ends of barrels, so as to stand outdoor exposure, the lithographs being varnished over after being put on? A. Try a strong solution of shellac in a saturated aqueous solution of borax; concentrate by evaporation.

(2) R. T. asks: 1. Can any part of the work on woodcuts done by machine? A. Yes; plain and circular ruling and shading, and also the removal of wood from the widest blank spaces, technically called "routing." 2. What are the wages of a good mechanical engraver in New York? A. From $3 to $5 per day, on salary; sometimes more by the piece. 3. Is there an American work on wood engraving? A. "Practical Instruction in the Art of Wood Engraving," by W. A. Emerson; and Watson's "Manual of Instructions in the Art of Wood Engraving."

What is a dollar in English money? A. The gold dollar is equal to £0·2056, or 4·11s. or 49d.

(3) Y. M. C. A. asks: Is there anything which may be taken to dispel stage fright? A. It is said that a few whiffs of ether may act as a relief.

(4) J. J. D. asks: What will cement leather and metal together? A. Melt together equal parts of asphaltum and gutta percha; apply hot under a press.

(5) E. W. W. asks: 1. To make an electro-magnet capable of holding 1,000 lbs., what should be the gauge and length of wire? A. About 50 lbs. of No. 12 copper wire, cotton insulation. 2. What diameter and length of arms of horseshoe core? A. $2\frac{1}{2}$ inches in diameter and 15 inches long. 3. How many coils deep should the helix be? A. About 16. 4. What power Grove battery to work it up to its full strength? A. 12 or 15 cups.

(6) B. E. writes: I have an electrical apparatus which at one moment has a strong current, and the next moment the action will almost cease. I use an induction coil with a Grove battery. What is the difficulty? A. Probably the trouble is with your battery. Clean the zinc and connections thoroughly, then charge the porous cup with strong nitric acid, and use in the jar a solution of 1 part of sulphuric acid in 12 parts of water. The zinc should be thoroughly amalgamated.

(7) H. McK. writes: I received some gold from the bank lately, and have found several pieces partially covered with a dark and hard scum. How can I get the scum off without injury to the coins? A. Boil them in a little strong lye, wash, and dip in warm dilute nitric acid for a few minutes; wash again.

(8) J. L. C. asks: 1. Would a bar magnet 9 inches long and 1 inch thick and wide act as a compass needle? A. Yes. 2. Would it still act as such if surrounded on all sides by iron? A. The attraction of the surrounding iron would destroy its accuracy of direction. 3. What power would be necessary to cause it to deviate from north and south? A. The smallest weight that could be imagined would cause a deviation. 4. Would the power necessary be increased by enlarging the magnet? A. To a certain extent.

(9) H. R. asks for a recipe for making gelatine for moulding plaster ornaments. A. Soak glue with 10 parts of cold water over night; then add 1 part of glycerin, heat to 190° with stirring, and run it into the well oiled pattern.

How is composition amber made? A. Dissolve shellac in an alkaline lye, then pass chlorine through the solution until all the lac is precipitated. After washing this must be melted and kept over the fire until it runs clear, taking care that it does not burn; it should then be run into moulds of the size of the pieces required.

(10) A. H. writes: We have a well the water of which is clear and uncolored, but at different times during the season tastes and smells very bad, especially when being heated. If nothing is done to it, it becomes good again after a time. Can you give any probable reason for its bad smell and taste? With a filter of sharp sand and wood charcoal pounded fine purify it enough for drinking purposes? A. The water may be contaminated by inflow from the surrounding soil or from decaying organic matter of vegetable or animal origin at the source of the spring. In either case, if the impurities are sufficient to discharge the pink color imparted to a sample of rain water by a trace of dissolved potassium permanganate, the water is unfit for drinking purposes. Fine grained wood charcoal, well burned, and reduced to a coarse powder, will deodorize a quantity of water containing 90 times its volume of ammonia, but the disinfection of some waters by it is not complete. It should be renewed at least once a week.

(11) O. M. asks: How is modeling wax made? A. Melt the wax with a little water in a capacious earthen or porcelain-lined iron vessel over a salt water bath; agitate and add cautiously about 2 per cent strong solution of potassium bichromate, acidified with one tenth its volume of sulphuric acid; cover, keep at a moderate temperature for several hours, and skim with a hot ladle into hot water; draw off the residue of wax at the bottom, disturbing the foreign matter as little as possible, strain it through a fine uncolored cloth, add it to the portion skimmed, and draw off into warm moulds.

How can I construct a small galvanic battery? A. Provide a small glass or earthen jar, a plate or strip of zinc, well rubbed with a little mercury and dilute sulphuric acid, a piece of clean copper about the size of the zinc, a few pieces copper wire, and some sulphuric acid diluted with 20 volumes of water. Join a wire to each plate, and suspend them facing each other, but not touching, in the acid solution contained in the battery jar. Electrical currents will then pass through any metallic circuit joining the connecting wires of the plates. See back numbers of the SCIENTIFIC AMERICAN for other forms of battery.

(12) H. S. asks: How can petrified wood be cut and polished? A. Use a strip or ribbon of soft iron supplied with water and sharp sand as a saw. Polish with moist emery grading towards the finest, and finish with tripoli.

(13) C. J. B. B. asks: How can old lard be clarified? A. Melt and agitate the material for 20 minutes with a quantity of granular charcoal free from dust. Strain off while hot into a small quantity of hot water; agitate briskly for a few minutes with the addition of about 2 per cent of a strong solution of alum, and let stand in a warm place to settle. Draw off the fatty matters into clean hot water, agitate, settle, cool, and press.

(14) S. T. W. asks how a bleaching preparation may be made. A. Dissolve 2 lbs. of sal soda in a gallon of hot water, and add 1 lb. of good lime; stir the mixture for a few minutes, allow to stand for half an hour, and then carefully pour off and bottle the clear liquid. Half a pint of this may be added to each tub of water.

(15) J. S. C. asks: What will prevent steel tools, particularly hand saws, which are in constant use, from rusting? A. Apply a little pure tallow occasionally.

What is the most convenient way of cleaning wood rasps that are clogged with wood and pitch? A. Use a file card, or a very thin and narrow piece of sheet copper.

(16) G. W. G. asks: Is there such a thing as sulphate of carbon, and if so, what is it like? A. No. You probably refer to bisulphide of carbon (carbonic bisulphide); this is a volatile limpid liquid, having a strong unpleasant odor. It refracts light powerfully, and is one of the best solvents for oil, caoutchouc, sulphur, etc.

(17) W. B. B. asks: 1. How can I make a cheap marking fluid for bar iron, steel, etc.? A. Common barytes (barium sulphate) ground with linseed oil to a paste and thinned with turpentine has given satisfaction. 2. Also one for use on boxes, kegs, etc.? A. Ground charcoal, 20 parts; ground manganese (black oxide), 1 part; rub into a paste with a small quantity of linseed oil, and thin with a solution of 1 part asphaltum dissolved in 10 parts of benzine.

(18) S. S. asks: What acid will eat into wood? A. Woody fiber is strongly acted upon by moderately concentrated nitric, sulphuric, and chromic acids, or mixtures of these.

(19) G. M. M. writes: I wish to make a new jaw for a broken cast iron bench vise, but have failed to make the steel weld to the cast iron, after several trials with borax, etc. How should it be done? A. If you make the iron sufficiently hot and let it run through the mould long enough, the weld will be perfect.

(20) C. S. R. asks: How can I obtain a small quantity of ozone, without expensive apparatus? A. 1. Suspend a stick of wet phosphorus in a bottle containing moist air or oxygen; after half an hour the odor of ozone can readily be detected in the atmosphere confined. 2. Place in the bottom of a clean, dry bottle a small quantity of potassium permanganate; pour over this enough sulphuric acid to cover it, and stopper the bottle. At the expiration of a few minutes ozone may be detected in the air within the bottle. Organic or readily inflammable matter coming into contact with the permanganate mixture will be quickly inflamed if the acid used be concentrated. For ozonizing air it is better to dilute the acid somewhat.

(21) C. L. asks: Is there any process by which iron rust may be removed from marble? A. It cannot be readily removed without somewhat defacing the polished surface of the stone. Attrition with moistened pumice powder will generally efface the stain, and the polish may be restored by rubbing first with rouge and finally with putty powder (tin oxide) under a piece of moistened woolen cloth disposed over a smooth block of wood.

(22) W. & D. ask: What should be the dimensions of a lighter to carry 2,000 bushels of green sand marl—about 100 lbs. to a bushel? A. You can readily make the calculation, estimating each cubic foot of displacement to require a weight of 62·5 lbs.

(23) C. H. B., F. C., L. G. W., and others who request information on the subject of electric engines, should consult the "Student's Text Book of Electricity," by Noad; on p. 279 they will find an account of some experiments, and also references to other good works on the subject; all of the latest steps in this direction appear in our columns. See SUPPLEMENTS 33, 38, 41, 43, 77, and 78.

(24) J. B. asks: Can you give me the recipe for making the soap used for "permanent" bubbles, rings, etc., in illustrating the interference of light? I have tried several recipes, but with poor success. A. 1. Take olive oil soap (genuine white castile), cut it into thin shavings, and dry thoroughly. Dissolve these shavings in alcohol until the alcohol is saturated. The solution should show a specific gravity of 0·88. 2. Mix glycerin with water until it shows a density of 17·1° Baumé. To 6·102 cubic inches of solution 2, add 1·52 cubic inch of solution 1, and boil until the alcohol is all expelled—until the temperature rises above 212° Fah. Cool and turn into a graduated flask, and add water to make the volume 6·102 cubic inches. Filter, if necessary, to remove oleate of lime.

(25) J. R. S. asks: To what extent is the value of a piece of silver or gold enhanced by the government stamp being placed thereon? A. The government stamp simply shows that the piece is of the standard weight and fineness required by law for its particular denomination. Its value is regulated like that of any other product, chiefly on conditions of demand and supply.

(26) L. T. writes: My attic is infested with bats. How can I destroy or drive them away? A. If you can securely stop all the cracks and outlets of the attic, a small quantity of sulphur burned in the rooms, on an earthenware dish, will doubtless accomplish all that is desired. If the room is large at least half a pound of sulphur should be used. It is well to remember that sulphurous oxide, the product of the combustion of the sulphur, forms with the moisture in the air a powerful bleaching agent; nothing of value should therefore be left in the sulphured atmosphere. Be careful not to breathe the irritating gas.

(27) W. C. Y. asks: How can petroleum be removed from carpets? A. Place that portion of the carpet that is spotted with the oil in front of a hot fire. The oil will thus evaporate.

(28) D. F. H. writes: We have a steam boiler of 5 horse power which is used 3 or 4 times a week. Will it do any harm to allow water to stand in it, if it is blown out once a week? A. No.

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

J. R.—The two larger pieces are orthoclase; the smaller one is argillyte.—I. L. M.—No. 1 is hornblende schist. No. 2 is ferruginous limestone. No. 3 is shale and limestone. No. 4. The earth contains a little copper as well as iron sulphide. No. 5 is dolomite and chlorite.—A. M.—It is a variety of chrysocolla—silicate of copper—sometimes used in jewelry and inlaid work.—J. E. H. No. 1 is clay slate or indurated clay containing iron sulphide. No. 2 is an impure limestone—also containing pyrites.—W. U. S.—The stove blacking contains a large per cent of iron oxide and sulphate, and sulphur or sulphides, besides organic carbon.—A. S.—No. 1 is bornite with impure chrysocolla—a valuable ore of copper. No. 2 contains limonite, bornite, cuprite, chalcopyrite, chrysocolla, and malachite; possibly auriferous. No. 3 is impure aluminum silicate. No. 4 is chalcopyrite and limonite. No. 5 is bornite, malachite, and chrysocolla. No. 9 is quartz with seams of ferropyrite and chalcopyrite (iron copper sulphide). No. 10 is a weathered calcspar containing chalcopyrite and ferropyrite.

COMMUNICATIONS RECEIVED.

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

Malaria and Light. By G. P.
Protection against Potato Bug, etc. By G. H. W.
Planetary Layer Formation. By G. R. C.
The Scientific Turkey. By F. H. J.
Preventing Flour Mill Explosions. By J. C. C.
What is Life? By A. W.
Lasting Bricks. By D.
Dividing the Circle into Odd Parts. By A. B.
Describing Polygons of Unequal Number of Sides. By H. G.
Preventing Collisions at Sea. By C. A. G.
Perturbing Compensations in Planetary Arrangement. By G. R. C.
Sewage Management. By C. S.
The Star Feed. By T. J. B.
The Torpedo Balloon. By F. P.
Creation and Life. By J. H.
Dredging Machinery. By F. A. G.
Cinders in the Eye. By H. E. R. and J. L.

HINTS TO CORRESPONDENTS.

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

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

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

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

April 2, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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

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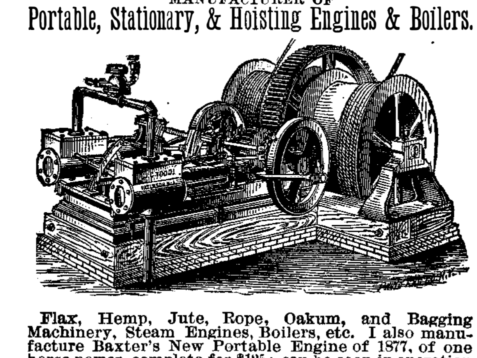

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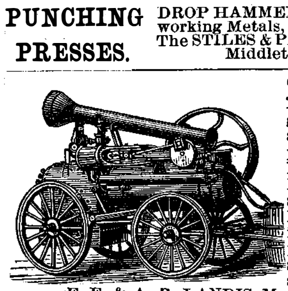

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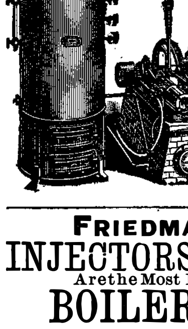

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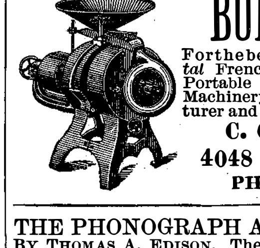

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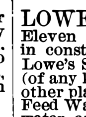

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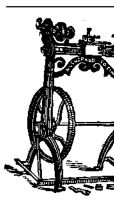

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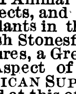

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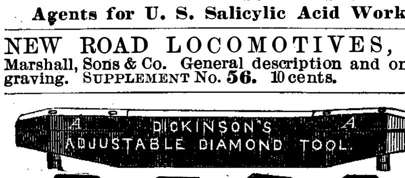

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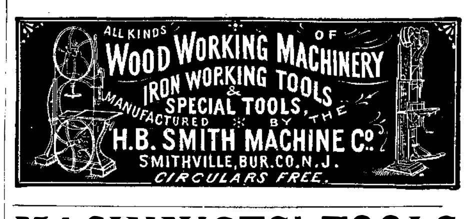

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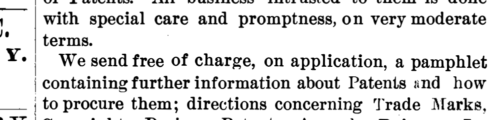

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