Correspondence

Practical Hints for Dressing Saws.

MESSRS. EDITORS :—I have been engaged more or less for the past seven years in lumber making, and presume my experience has led me to differ in some respects as to the best method of dressing mill saws. And I may here say, a saw may be hung true and right in every respect (which is a very important consideration), and yet, if it be not properly set and filed, it is impossible to make good lumber with the least expense of power. My plan of "dressing up" a saw is as follows :—First, widen the points of the teeth by holding a piece of steel, madefor the purpose, against the under edge, and using a light hammer on the top until the point is 1-32d part of an inch wider than the thickness of the saw. This process also draws and toughens the points, so that they are not so liable to crumble when sawing hard wood. Secondly, set the teeth as nearly alike, each way, as possible. Thirdly, hold the file perfectly square against the teeth, and point it straight. Fourthly, file the under edge of the teeth a very little beveling (I use a file right and left-handed) by holding the handle of the file a little above a level, which makes the file cut better and does not wear it out so fast ; then dress them to a square point from the top by holding the file right-handed on the upper edge of the tooth of which the under edge was dressed left-handed, and *vice versa.* If, upon trying the saw in a straight log, it should incline either way from a straight line, the next time in filing I alter the bevel on the under edge of the teeth to remedy it. After my saw is dressed so as to run straight, I hardly ever use a file except on the teeth to sharpen them, and the hammer and steel to keep the points as above stated and never have any trouble in running it straight. It will be observed, by practice, that this method saves considerable time and some files in sharpening saws. The "rake" must differ with different kinds of wood and hangings. In making new teeth I generally make them $1\frac{1}{4}$ inches at the root and two inches long, with the point inclined downward $\frac{1}{4}$ of an inch.

Your valuable paper has been a welcome visitor in our family for several years and is eagerly looked for by each member. I guess you can safely count on me as a life-subscriber. Since the war broke out my father commenced taking a daily paper in order to get the war news earlier, but there were so many reports and not a few of them contradicted next day, and someeven in the same column, thathe abandoned it, and said he had rather wait for the SCIENTIFIC and then he should have the news correctly given.

OTIS SMITH.

Curious Phenomenon.

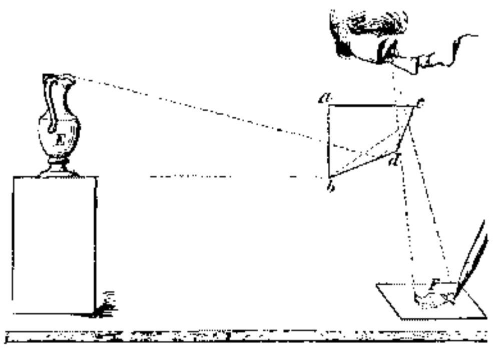
MESSRS. EDITORS.—I was much delighted with a natural phenomenon which my son observed a few days since while watching the movements of the fish in an aquarium belonging to a friend, and I thought it might interest your readers to call their attention to it. By placing the eye near the side or end of the vase below the level of the water, and looking upward, an inverted image of all the interior of the aquarium with its finny inhabitants sporting apparently in the air above the vase can be seen, as if the surface of the water was a mirror, and reflected all below, giving the fish the appearance of swimming on their backs. My friend had never observed this phenomenon, although he has spent hours watching the movements of his aquatic pets. I do not know whether this property of fluids in reflecting double is generally known. If you think it worth noticing you can inform your readers how to get an inverted view of their aquaria. From the foregoing it appears that the surface of transparent fluids have the property of reflecting from both the upper and lower surfaces.
A. F. WARD.

Phildelphia, Pa., December, 1861.

This is just as truly an original discovery of our correspondent as if it had never been made before. It so happens, however, that he is not the first discoverer. It has long been known that when light passes from one medium to another a portion of it suffers reflection from the surface at which the remainder emerges. The larger the angle of incidence the greater is the proportion of the light that is reflected, until an angle is reached at which it is all reflected. This angle varies with different media ; light passing from water into air is all reflected at any angle greater than 48° 35′, and from ordinary glass at any angle greater than 41° 59′, consequently a ray of light cannot come out of water or glass at angles greater than these.

Fish and other objects in an aquarium are reflecting diffused light in every direction, and that which reaches the surface of the water at an angle greater than 48° 35′ is all reflected as from the surface of a mirror, and if the eye is placed in a proper position to receive the reflected rays, an inverted image of the aquarium will be seen as if a mirror were placed with its face down upon the surface of the water.

This property of light was rendered available by Wollaston in the construction of the camera lucida, a little instrument that is used daily by the artist who makes the drawings for those engravings that are so universally admired in the SCIENTIFIC AMERICAN.



A glass prism, *a b d c*, is mounted at the end of a rod so that it may be supported at a suitable hight above the table. The prism has its angle, *a*, a right angle, and its angles, *b* and *c*, each 67½°, these being the proper angles to cause the ray of light entering the prism in a direction perpendicular to the side, *a b*, to be reflected by the two sides, *b d* and *d c*, vertically upward. If the light is then received by the eye, an image of the object, E, from which the light proceeds, is formed in the eye, and it of course appears in the direction from which the light enters the eye, that is vertically downward. An image, F, of the object is accordingly seen as if resting upon the table. As the light which comes from the table or from a pencil point upon it, passes through the glass prism, the table and pencil can be seen as well as the image, F, and thus the image can be correctly and rapidly drawn upon the table or upon a piece of drawing paper resting upon it.

The camera lucida is applied to the microscope for making drawings of objects too small to be visible to the naked eye, and it is much used in sketching landscapes, as it gives a perfectly accurate perspective.

Waste of Fuel in Steam Boilers.

MESSRS. EDITORS :—As you frequently request practical men to send you brief accounts of discoveries and improvements in their several branches of industry, I take the liberty of giving the result of some thoughtand observation in my own department—that of a steamboat engineer. I do so, however, with hesitation, knowing that the subject of my remarks is one that the whole engineering world has made a special study, to wit : The best form and arrangement of boiler for the generation of steam, and wherein the improvement I propose consists mainly in dispensing entirely with the good old plan of using a draft to make the fire burn.

I have long believed that the heat carried off up the chimney by this same draft has been almost the sole cause of that great loss that occurs in the practical application of coal to the generation of steam, the useful effect of the fuel being little more than a third of that which accurate experiments say it should be. To this source of waste I think much of the attention given to expansion, steam jacketing, superheating, &c., including volumes of abstruse calculations, might have been much more profitably directed.

My experiments to demonstrate the extent of this loss have been of a rude character, yet sufficient, along with a little reflection, to convince myself that it is far greater than commonly believed. I found that the temperature of the escaping gases at the foot of the stack, in a double-flued cylinder boiler, well set in masonry, and only moderately fired, were sufficient to melt zinc, or about 750°. In the case of our western river boilers, of same construction, we do not think we are quite up to our work, except the flame or gases, hot enough to be luminous, come nearly through the flues. In the first instance, the velocity of the draft is probably thirty feet per second ; in the latter, where the blast is used (a jet of steam in the flues) it is at least three times as great. Conceive of these columns of highly heated gases rushing off with such speed, and yet not taking with them the greater portion of the caloric produced in the furnace. To me it is impossible. But by comparing the relative volumes of heated gases and of steam from the engine, we may form a still better idea of the true condition of things. We have accurate data from which to calculate the volume of the gases that pass off in a given time. On the boat where I have lately been employed, we burn 450 bushels Pittsburgh coal per day, or, at 76 pounds to the bushel, 22½ pounds per minute. The engines are two 15-inch cylinders, 4½ feet stroke, cutting off at ⅝, and making, with 150 pounds pressure of steam, 25 revolutions per minute. We use a jet of steam 3-16th of an inch in diameter in each of the four flues, thus making a very strong draft. It has been ascertained by careful experiments that about 465 cubic feet of heated products result from the combustion of one pound of bituminous coal, which, multiplied by 22½ pounds of coal per minute, gives 10,385 cubic feet, as the bulk of the products in one minute. In the same time the engine has received 800 cubic feet of steam, at a little less than 150 pounds pressure, which, expanded ten times, is 8,000 cubic feet of steam, at about 220°

These are the respective volumes, approximately, the gases varying from a temperature of 700° to 1,100°, or about the point where they become luminous. Is it not evident that near one-half the coal will continue to be worse than wasted, requiring to be stowed, carried, put into the fire, &c., until a remedy is provided? But some one will say that this only takes place where coal is not burned in the present approved manner. But 8,000 cubic feet of steam, as above, is equivalent to as many cubic inches of water, which weighs 288 pounds. This, divided by 22½, gives nearly 13 pounds of water evaporated by one pound of coal, a very good result, and much greater than could be expected from our old-fashioned apparatus.

Having satisfied myself where the coal went I wished to remedy the evil. This seemed a more difficult task. Accident, however, gave me a hint that made all plain. I wished to get some large articles japanned, but the workman said his oven frame was too weak to support them near the top, and that the heat would not be great enough near the floor to harden the varnish, as the intensely-heated air always ascended to the upper part of the oven. I understood this before, and it now occurred to me that a boiler could be constructed to take advantage of this principle differently from the usual manner. The idea was to take the products of combustion from a furnace situated below the body of a boiler, up to the top of a steam-generating chamber, where, spreading out among finely-divided water surfaces, they would part with their caloric, become heavier and descend, giving place to hotter air from the fire, meeting continually cooler surfaces, then leave the boiler where the feed water enters. Thus the products of combustion would leave the boiler when sufficiently reduced in temperature, and reach the outlet flue—exactly the reverse of the usual plan of circulation—in which they are lastly exposed to the hottest surfaces, and leave the boiler with greater speed the more heat they contain. If a boiler could be constructed to operate in this manner I thought the great problem would be solved, for by this means we could have absolute control of the caloric, it being only necessary to expose the products to a sufficient cooling surface in order to abstract it all.

I think I have designed such a boiler. It is of the water tube variety, and may be either upright or horizontal ; to use the first is preferable. An upright boiler of this form, twelve feet in diameter, with 2-inch tubes, four feet long, contains 4,000 square feet of heating surface. A blast under the grate is required. An upper flue is open when the fire is first started, but closed when it burns clear, at which time the lower one is partially opened, in order to throttle the exit of the gases and allow only the circulation above described.

Many advantages, not at first apparent, are found to belong to this boiler. First, the grate surface need be no more than a tenth of what is usually allowed, the blast enabling a much deeper fire to be used in burning only one-half the coal now required for the same amount of work. Second, the blast will permit a much more perfect combustion to take place, thus consuming every particle of the fuel, while the construction and position of the furnace will prevent injury from the intense local heat. Third, the heat acting with the greatest energy near the surface of the water will produce the steam where it will have the least disturbing effect on the water. Fourth, the heated gases can be made to pass through the finest spaces without danger of spoiling the draft. Fifth, the coal can be regularly fed into the furnace without letting in cold air. This, in connection with the intense combustion insured by the blast will almost entirely prevent smoke, and tend to further economy. Sixth, the chimney need not be near so large in diameter as at present, and only high enough to carry off the gases. On the other hand, the plan has few objectionable features. The most important is, perhaps, the difficulty of managing an air-tight furnace. Better firemen will undoubtedly be required. A blast is inconvenient, but is indispensable. These objections, however, if the foregoing conclusions are sound, will sink into insignificance.

The main points to be settled are: First, is it true that so great a loss occurs from the cause stated? Second, will the proposed circulation of the heated products of combustion remove the evil? All else is of minor consequence. These are questions of the greatest importance to all who use and are interested in steam navigation, for it is justly conceded that if a boiler can be obtained that will utilize all the caloric produced in the furnace, steam will take the place of sails on every sea, thus inaugurating a new era in ocean navigation, and a profitable one to all connected therewith.

In this view of the matter, if the proposed change offers a reasonable hope of success, it is well worthy of consideration. I hope some of your many readers will give an opinion of its merits, that we may arrive nearer the truth, be the result favorable or unfavorable to my invention. J. S. Colvin.

Allegheny City, Pa.

[As our correspondent has stated, this is a most important question, but there are boilers in use in which the circulation of the heated products of combustion and the feed water is effected in the manner proposed. This is the case with the Dimpfel locomotive boiler. It is true, as stated, that the heated products of combustion in steamboat boilers generally leave the top of the chimney at a very high temperature, thus involving a great loss of heat. There is certainly wide scope for improvement in steam boilers and furnaces yet, so as to economize the heat. And, as has been suggested, this subject is far more worthy of attention than the expansion of steam, &c., as the loss of heat in furnaces is usually much greater than in cylinders. It must not be forgotten, however, that it is only by fair experiments that the value of any boiler can be determined.—Eds.

Hight of Vertical Jets of Water from Fire Engines, or Fountains.

A body falling in vacuum from the force of the earth's attraction, falls 16 feet in the first second, and at the end of the second it is falling at the rate of 32 feet per second; the velocity being constantly accelerated. If a flume or tank of water is pierced at its side, the water will issue with a velocity just equal to the velocity which a body falling from the level of the surface of the water would acquire when it reached the level of the orifice. If the jet is turned vertically upward it will rise in a vacuum just to the level of the surface of the water; but in the atmosphere the hight to which it rises is reduced by the resistance of the air. Small jets are reduced in hight more than large ones, and it is only by an elaborate series of experiments that the ratio between the theoretical hight of the jet due to its velocity, and the actual hight to which it rises in the atmosphere, can be ascertained. A German engineer has recently made such a series of experiments, and we translate the following account of them from Dingler's *Polytechnic Journal*:—

Until quite recently, the experiments made by the French philosophers, Mariotte and Bossut, over a hundred years ago, have been the sole guide for determining the hight of the jets of fountains or of fire engines. It is well known that the results obtained from these experiments have been insufficient, owing partly to the small pressures or heads employed, and partly to the poor instruments of that time. It is, therefore, of great importance to the scientific world that a comprehensive series of experiments have lately been made by a German engineer, Mr. Weisbach.

The following tables give the result from experiments made with two different mouthpieces. The first mouthpiece was $\frac{3}{8}$ inches in diameter, $5\frac{3}{4}$ inches long, and the convergence of its sides was $5\frac{3}{4}°$.

Head in feet.	*Hight of jet in feet.*	*Head in feet.*	*Hight of jet in feet.*
3	2,865	33	28,611
6	5,712	36	30,708
9	8,541	39	32,643
12	11,304	42	34,440
15	14,040	45	36,180
18	16,704	48	37,776
21	19,278	51	39,219
24	21,768	54	40,608
27	24,138	57	41,838
30	26,430	60	42,960

The second mouthpiece was $\frac{5}{8}$ inches diameter, $9\frac{5}{8}$ inches long.

Head in feet.	*Hight of jet in feet.*	*Head in feet.*	*Hight of jet in feet.*
3	2,844	33	30,338
6	5,700	36	32,724
9	8,559	39	35,022
12	11,424	42	37,254
15	14,250	45	39,420
18	17,082	48	41,424
21	19,845	51	43,299
24	22,560	54	45,090
27	25,218	57	46,740
30	27,810	60	48,360

The following are some of the results arrived at by M. Weisbach:—

1. The resistance of the air for small velocities of discharge of from 5 to 25 feet, or for jets of from 1 to 10 feet hight, is so small that the hight of the jet can be taken as equal to the hight corresponding to the velocity of discharge, without a perceptible error.

2. Under the same head or pressure the hight of the jet increases with the area or size of the orifice. The resistance of the air is smaller with thick than with thin jets; in order to obtain a greater hight, therefore, not only a greater pressure but also a larger orifice is required.

3. Under otherwise equal circumstances jets from circular orifices reach higher than jets from square or differently shaped orifices.

4. With equal velocity of discharge, and with the same area of the orifice jets discharged without contraction rise higher than those with contraction. The resistance of the air is greater with the former than with the latter. Under otherwise equal circumstances, and if the head or pressure is not very small, jets from small conoidal or conical and internally-rounded mouthpieces rise to a greater hight than jets from orifices in a thin plate.

5. With jets discharged from orifices in a thin plate, the coefficient, a, may be taken equal to 1, and the difference between j and h is perceptible only when the velocity of discharge exceeds several feet.

6. The hight of the jet, j, does not increase in a simple ratio to the theoretical hight, h, corresponding to the velocity; if h is not very large the hight of the jet is approximately

$$j = \frac{h}{a + bh + ch^2}$$

where a b c are coefficients, to be determined for each orifice by experiment.

California Sulphur and Alum.—At Coso, California, there is a peculiar volcanic district. There is no large district crater, but streams of sulphur pour forth from thousands of tubular openings. The sulphur congeals and is found hard in several places. Alum is also found in great abundance. It appears that as the sulphur congeals it throws out a coating of alum. These sulphur springs cover about two acres of ground. They are situated on the side of a volcanic hill, about 300 feet above the level of the plain, twenty miles south of Coso, and fifteen miles northeast of Little Owens's Lake.

Six immense mortars, cast at the Fort Pitt Foundry, Pittsburgh, were shipped from Philadelphia for the navy yard at Brooklyn. These mortars are three feet seven inches in diameter, and four feet six inches in length, and will throw a bombshell thirteen inches in diameter. Their weight is nearly two tuns.

Perennial Cotton.

R. C. Kendall, Esq., of Maryland, has been making great efforts for some time to introduce into the middle and perhaps other portions of the northern States of this country the cultivation of tree cotton. The cotton plant is divided by some naturalists into three species, by others into thirteen, and by others the several varieties are grouped into a single species. The species, whether one or many, are included in the genus *gossypium*, and they are generally classified in three divisions, herbaceous, shrub and tree cotton. That cultivated in the United States is the herbaceous, though even this forms a perfect woody fibre. It is in fact a little tree which dies in the fall or is killed by the winter. The shrub cotton resembles a currant bush in size, and the tree cotton grows to the hight of 15 or 20 feet, living 8 or 10 years.

Mr. Kendall says that the tree cotton produces the best quality of any and three or four times the quantity to the acre of any other variety. He thinks also that it will grow in any latitude south of New York, and perhaps much farther north. He has issued a pamphlet on the subject, which is published by Mapes & Lockwood, 23 Courtland street New York. We make the following extracts:—

MR. KENDALL'S FIRST SIGHT OF THE COTTON TREE.

Several years ago, while an employé in the Patent Office, I received and accepted a tempting offer from a Chilian gentleman of wealth, Senor Alsogara, to conduct certain matters on his estates. One holiday morning, not very long after my arrival at my temporary South American home, I set out on horseback along the course of a modest little river, called the Chipura, and forming the boundary between semi-civilization, and the territory of the Ypurian savages. Resolved to explore as much of my patron's domain as the brief May day would allow, I pushed briskly forward over the already frozen ground, covered fetlock deep with newly fallen snow, following the windings of the stream, whose ledgy banks of dark rock, generally thrust back, as it were, by alluvial bottoms from one to three hundred yards distant, indicated that the Chipura had one day been a river of ten times its present volume. After a ride of some two hours, in doubling an abrupt turn where the rocks approached very near the water, I came suddenly into full view of an object some two hundred yards distant, which presented the most magnificent spectacle I had ever seen—a perfect cone, or pyramid of pure, brilliant snow, elevated at its base perhaps seven feet from the ground, upon a shaft of whitish bronze; the whole structure cut clear and sharp against the dark wall of rock in the back ground. I had in northern countries, after a calm fall of snow, seen many a white pyramid, having an internal structure of pine or spruce, but knowing that in the present instance the snow had fallen during a violent gale, and observing that none of the pines about me bore any traces of it upon their branches, I rode forward in semi-bewilderment, to investigate the phenomenon.

It resolved itself, as I drew near, into a most perfect specimen of the *Gossypium Arboreum*, the perennial cotton tree. Its foliage had long been shed, but the pods remained, having fully burst, and turned out their spotless samples in almost perfect roses, covering the entire structure with a dense mass of spotless, glossy cotton. I had often seen and examined indefferent specimens of the perennial cotton shrub, but I had never seen anything even approaching in perfection that solitary tree.

The remainder of that, and many a saint day thereafter, was devoted to intimate companionship with, and diligent study of the habits, peculiarities and general economy of the beautiful *solitaire* of the Chipura.

WHERE IT WILL GROW.

Certain it is, however, that I found the finest specimens of the tree, bearing cotton of the longest staple and whitest, finest fiber, in a region where the snow lies three months out of the twelve; where the vicissitudes of climate are greater than they are in New England; and where not only the natives, but the furred animals, sometimes freeze to death. On the Atlantic side, the Gossypium Arboreum grows spontaneously and entirely hardy, as high as the parallel of 42°. That the tree readily adapts itself to all reasonable and very many unreasonable conditions of soil and climate, is conclusively proven by the fact of my having found it growing bravely at an altitude very nearly approaching the snow-line, on the eastern slope of the Bolivian Andes, in a soil as red with peroxide of iron as a well-burnt brick, and almost as hard. In the Desert of Alcamaya, I found it growing most determinedly in a bed of volcanic scoria, where never a drop of rain falls. In the vicinity of Arica and Tacna, in Peru, it thrives and produces cotton, growing in a waste of arid, burning sand. In the delta of the Guayaquil, it flourishes in an eternal quagmire; and on the eastern slope of San Gauy it clings to the bare calcareons rock, and lives. Everywhere in the low countries of the tropical regions, both the tree and staple degenerate; the former, in all cases, into a shrub, of from nine to twelve years duration; the latter always into a coarser, shorter, and under many conditions, into a meterial of no commercial value. In Peru, however, there are a few localities in which the tree cotton grows spontaneously, giving better results than shown by the general rule in a similar climate. In the valley of the Chira, latitude of 3° south, there has been, ever since 1851, an annual produce of perennial cotton, of six thousand bales, of one hundred and fifty pounds each, mostly of spontaneous growth; and any time during the past six years, worth in the port of Paita, whence it is shipped to England, sixteen dollars per hundred pounds—evidence conclusive that it is better than the best Louisiana.

Of 17,316 persons employed in the construction o the Roman railways, 6,781 are women, who assist the masons.

The Preservation of Stone.

[From the Chemical News.]

No one who has critically examined the various projects for hardening and protecting stone, which have during the last few years been made public, can have failed to remark the great importance which, in the majority of instances, is attached to the action of silica. Thus in reviewing the processes submitted to the Decay of Stone Committee, among the eleven proposals which have already been under consideration, no less than seven depend for their efficacy upon the action of this very substance under various conditions of employment. Advantage is taken of the mutual decomposition exerted between certain silicious compounds applied, and the materials constituting the building stone itself; or, otherwise, systems are founded upon the production of compounds from an alkaline silicate, and a soluble earthy salt successively applied. The known properties of silica and of the class of silicates have, no doubt, powerfully contributed to the formation and establishment of this opinion. The facility and cheapness with which they can be manufactured on the large scale, their inalterability under trying atmospheric influences, their all but complete indifference to energetic chemical reagents—all point to silica as the one fit material upon which the ingenuity and experimental resources of our chemists and practical men may be expended with the greatest promise of success. Let only a sufficient amount of silica be compelled to enter and occupy the pores of the stone and incrust all the exposed surfaces; let it be employed in a state of hydration or other suitable form in which it may gradually combine with the earthy constituents it there meets, and with its action unfettered by saline impurities the presence of which tend often to interfere mechanically with its successful employment and the strong presumption is that the Houses of Parliament will endure, so far as the stone is concerned, as long as the Pyramids.

The difficulty which besets many of the processes of silification is, that along with the needful silica, so much superfluous, and indeed, injurious matter is introduced that the valuable qualities of the silica are in a great measure counteracted; the disintegration of the stone sometimes caused actually by the efflorescence of these extraneous substances, and the porous character necessarily induced as the consequence of the gradual removal of the soluble salts in juxtaposition with the silica, almost undoing the binding and hardening action of this valuable material. From this train of reasoning, it became evident that if hydrated silica could but be deposited in the pores of a limestone or a dolomite, without the assistance of potash or soda as a vehicle, and there be left slowly to enter into a chemical union with the earthy bases of the stone, its action commencing unimpaired by the presence of extraneous salts, and its future efficacy undiminished by the progress of their removal—that if this could be accomplished there would be a far greater chance of ultimate success than has been offered by any plan yet made public.

It is well known that silica can, by appropriate means, be obtained in the form of a pure aqueous solution, and it was to this liquid that we accordingly directed our attention. This solution can be made in several ways:—

1. By dissolving sulphide of silicium in water, when sulphureted hydrogen is given off, and the silica remains completely dissolved, and in such quantity that the liquid gelatinizes when an attempt is made to evaporate it.

2. By precipitating silica in the gelatinous state from an alkaline silicate, by means of acetic or other weak acid, and after well washing, heating it for some time under pressure, with a small quantity of water in a closed vessel. A liquid is thus obtained which gelatinizes on addition of a saline solution.

3. By passing gaseous fluoride of silicium over crystallized boracic acid, and separating the hydrofluoric and boracic acids by digestion with a large excess of ammonia, a hydrate of silica remains, which, when well washed from the above acids, is very soluble in water. This solution gives no precipitate when boiled, but leaves silica as an insoluble powder on evaporation.

4. By the beautiful method recently pointed out by Professor Graham, in which advantage is taken of the new means of separating bodies by *dialysis*. A solution of silicate of soda, supersaturated with hydrochloric acid, is placed on one side of a parchment paper septum, pure water being on the other side; in a few days the hydrochloric acid and chloride of sodium will be found to have completely passed through the diaphragm, leaving the silica in aqueous solution, and so pure that acid nitrate of silver fails to detect chlorine in the liquid. This solution remains fluid for some days, but it ultimately gelatinizes. We have generally adopted this last plan of preparing the aqueous solution of silica, although a stronger solution is obtained by the method first given.

When a pure aqueous solution of silicic acid prepared as above is allowed to soak into the pores of chalk or dolomite, a process of hardening rapidly occurs, which goes on increasing for several days, whilst owing to its considerable depth of penetration, and to there being no soluble or efflorescent compounds to be removed, there is every probability that this hard silicious impregnation will afford permanent protection to the stone. We are now actively engaged in investigating the nature of the action which takes place, and already several curious and important results have been made out, from which we are led to anticipate that our experiments will ultimately be rewarded with complete success.

The Constitution of the Sun.

Further researches in the spectrum of artificial lights are showing that MM. Bunsen and Kirchoff were too hasty in their conclusions in regard to the substances which enter into the composition of the sun. It is found that the bright lines in the spectrum of a burning body vary with the temperature of the flame in which the body is burned. Professor Frankland, in a letter to Dr. Tyndall, published in the last number of the *Philosophical Magazine*, says:—

I have just made some further experiments on the lithium spectrum, and they conclusively prove that the appearance of the blue line entirely depends upon temperature. The spectrum of chloride of lithium ignited in a Bunsen's burner flame does not disclose the faintest trace of the blue line. Replace the Bunsen's burner by a jet of hydrogen—the temperature of which is higher than that of the Bunsen's burner—and the blue line appears, faint, it is true, but sharp and quite unmistakable. If oxygen be now slowly turned into the jet, the brilliancy of the blue line increases until the temperature of the flame rises high enough to fuse the platinum, and thus puts an end to the experiment.

As the lines of spectra vary with the temperature of the burning bodies, and as the temperature of the sun is very much higher than any which we can produce, it is impossible to tell what substances do produce the lines of the solar spectrum.

The Life Work of Agassiz.

Professor Agassiz, in an article in the *Atlantic Monthly*, makes the following statement of the result of his life's study:—

The education of a naturalist, now, consists chiefly in learning how to compare. If he have any power of generalization, when he has collected his facts, this habit of mental comparison will lead him up to principles, to the great laws of combination. It must not discourage us that the process is a slow and laborious one, and the results of one lifetime after all very small. It might seem invidious, were I to show here how small is the sum total of the work accomplished even by the great exceptional men, whose names are known throughout the civilized world. But I may at least be permitted to speak of my own efforts, and to sum up in the fewest words the result of my life's work. I have devoted my whole life to the study of nature, and yet a single sentence may express all that I have done. I have shown that there is a correspondence between the succession of fishes in geological times and the different stages of their growth in the egg—this is all. It chanced to be a result that was found to apply to other groups and has led to other conclusions of a like nature. But, such as it is, it has been reached by this system of comparison, which, though I speak of it now in its application to the study of natural history, is equally important in every other branch of knowledge.

New Discovery by Spectral Analysis.—It is stated in all the works on chemistry that the blue flame of a candle, alcohol, illuminating gas, paper, &c., is caused by the burning of the oxide of carbon; but Mr. Moren in a letter to the Abbé Moigno, editor of *Cosmos*, says that it is due to the combination of the protocarbide of hydrogen. He remarks:—"Spectral analysis proves this in an incontestible manner."

Patent for Turning Irregular Forms.—As several correspondents have recently made inquiries as to the period when the extended patent of the ingenious Thomas Blanchard, of Boston, expires, we answer, for all concerned, that it was extended for fourteen years by special act of Congress, January 20, 1848, and will therefore expire January 20, 1862.

Saving in Gas Bills.

It has long been known that the light of illuminating gas may be considerably increased by mixing with the gas the vapor of naphtha, one of the volatile hydrocarbons resulting from the destructive distillation of coal. As this vapor condenses at low temperatures it cannot be carried through pipes from the gas works, but must be mixed with the gas in the vicinity of the burner. It will be remembered that we recently illustrated an invention for which a patent is held by the Carbonized Gas Company, 476½ Broadway, in this city, by which the reservoir of naphtha is introduced into the midst of the chandelier.

In the last number of the *Chemical News* we find the report of W. Haywood, the engineer for the Commissioners of Sewers, of an experiment made in London to test the advantage of applying this mode of increasing light to the street lanterns. Moorgate street was selected for the experiment. Six lanterns on one side were provided with the common batswing burners, burning 5 cubic feet of gas per hour, and six upon the other side of the street were fitted with 2½ feet burners and with reservoirs of naphtha. The experiment lasted 30 days. The District Inspector of the Commission, who saw the lights nightly, reports his opinion that the light on both sides was perfectly equal. Mr. Haywood thinks that the light from the 2½ feet burners was inferior, though very slightly so, to that from the 5 feet burners. He comes to the conclusion that about 3 feet of the carbonized gas is about equal to 5 feet not carbonized. As the naphtha will not evaporate in cold weather, the apparatus will not operate out of doors in the winter, but Mr. Haywood thinks that it will save at least $5 to each street lantern during the summer months.

Some Facts in Relation to Light.

It has long been supposed that the chemical effect of light was confined to those rays which are refracted most—the violet end of the spectrum. At the last meeting of the American Photographical Society, the President, Professor Draper, remarked in the course of a discussion:—"It is a well established fact that all parts of the solar spectrum have an action on the photographic plate." And he exhibited a daguerreotype plate on which was an image of the spectrum complete in all its points. The action of the red and yellow, however, seemed to be of a reversed order from that of the indigo. The daguerreotype was one of two made in 1841; its mate was presented to Sir John Herschel.

In the Paris correspondence of the *Photographic News* we find the following statement:—

M. Baudrimont gives, as the result of his researches upon the chemical action of solar light, that—contrary to the opinion generally entertained—chemical rays exist throughout the whole extent of the solar spectrum. The facts observed also lead to the belief, that each species of colored light possesses a special action, and that each may be completely inert with regard to certain matters; but, on the contrary, very energetic with respect to others. Another series of experiments enables M. Baudrimont to establish the influence of the various colors of the spectrum upon the development of vegetation. Thus, for instance, no colored light permits vegetables to go through all the phases of their evolutions; none of them have flowered or fructified. Violet colored light is positively injurious to plants: they absolutely require white light.

Power of a Horse's Scent.—A correspondent of the *Homestead* says:—"There is one perception that a horse possesses, that but little attention has been paid to, and that is the power of scent. With some horses it is as acute as with the dog, and for the benefit of those who have to drive nights, such as physicians and others, this knowledge is invaluable. I never knew it to fail, and I have ridden hundreds of miles dark nights; and, in consideration of this power of scent, this is my simple advice: never check your horse at nights, but give him a free head, and you may rest assured that he will never get off the road, and will carry you expeditiously and safe. In regard to the power of scent in a horse, I once knew one of a pair that was stolen, and recovered mainly by the track being made out by his mate, and that after he had been absent six or eight hours."

The California *Farmer* states that the cultivation of beet-root sugar has been successfully tried in California. Large quantities of such sugar are now annually imported from France, but it is believed that the climate of California is well adapted for the sugar beet, and that it may be cultivated with profit.

An Improved Washing Machine and Wringer.

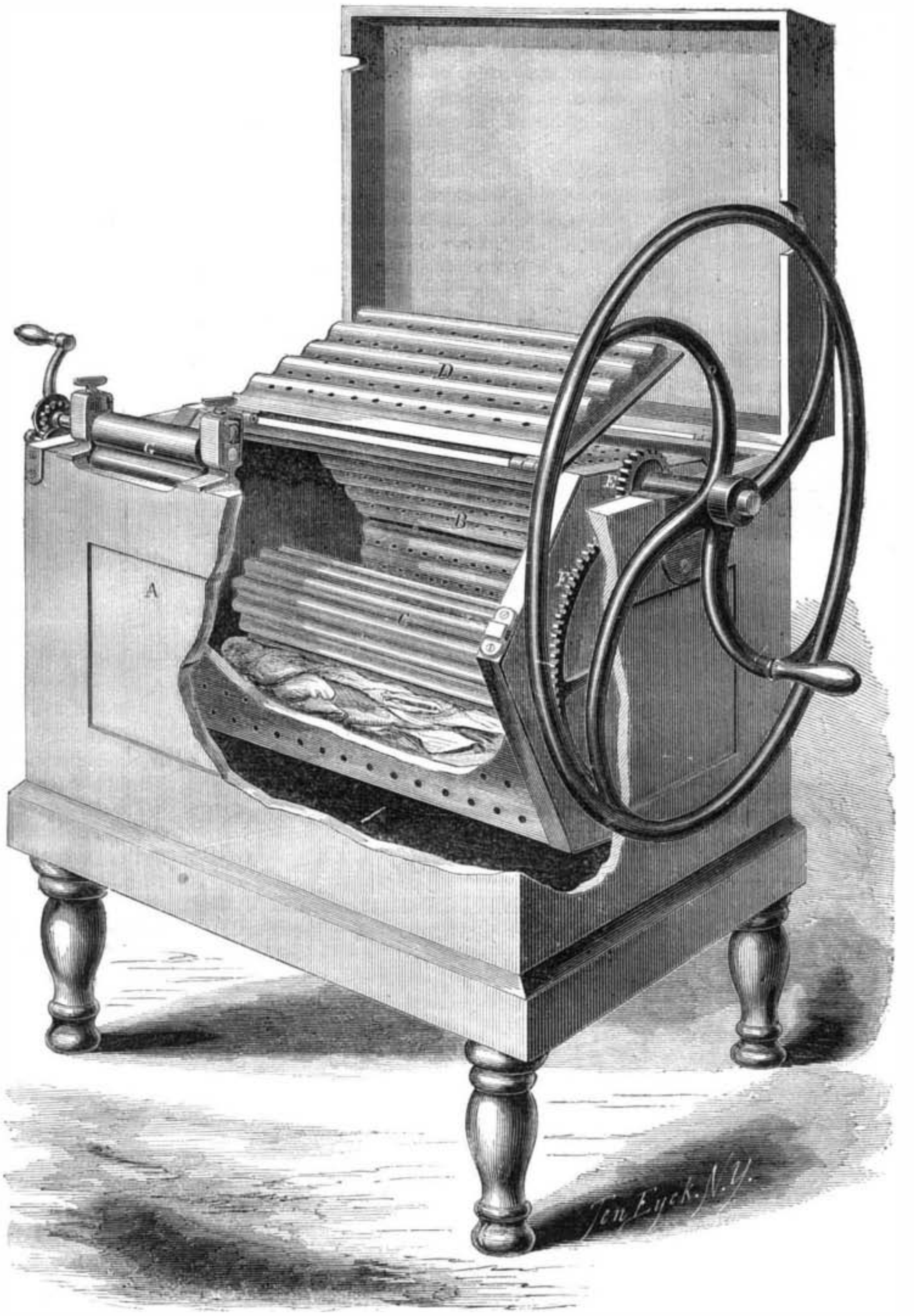
Clean clothing is almost as essential to the health of man as fresh air, good food and water. The sanitary condition of our soldiers is justly occupying a great deal of public attention, and we have heard it asserted on several occasions by persons who had recently visited the camps on the Potomac, that efficient, simple and durable washing machines would be among the most beneficial appliances that could be supplied to our armies. We have no doubt of the correctness of such statements, because all history is conclusive respecting the evils resulting from unclean clothing in hospitals and among soldiers on "the tented field." In the early part of the Crimean war the English hospitals became pest-houses of disease.—Simple wounds festered and became fatal, and one of the great sources of this arose from filthy garments and bed-clothing, owing to the inefficient facilities for washing them. It was the same in the hospitals at St. Louis until recently, as we have been assured by a resident of that city. It is also well known that soldiers in camp are very much subject to cutaneous diseases which are in a great measure thus causedf

The common mode o. washing clothes in the army by rubbing and scrubbing is a clumsy, tedious and expensive operation; therefore good washing machines for army purposes must be beneficial agencies. The accompanying engraving illustrates a simple, strong and durable machine for this purpose, as well as for the common purposes for which such machines are required. It is represented open to show the interior, and it consists of an outer box, A, resembling a common family refrigerator. It is lined inside with zinc and is water-tight. B represents a hexagonal hollow box perforated with holes and fluted inside, as shown by its lid, D. This box holds the clothes, it is hung on journals, has a loose fluted roller, C, rolling with the clothes inside, and it is rotated by the crank handle of the fly-wheel through the gear wheels, E F, so as to dash among the suds that are placed in the outer box. G is a clothes wringer composed of two accommodating pressure rollers covered with india rubber. When the clothes are washed in the hollow hexagonal box, B, they are placed, piece after piece, between these rollers, and by turning the handle, the clothes are carried through, the water pressed out of them, and they drop into a basket situated underneath.

A certain quantity of hot suds is poured into the outer box, then some of the batch of clothes to be washed are placed in the box, B; then the loose fluted roller, C, is put in, and afterward the rest of the clothes, leaving the roller in the middle of them. The lid of the hexagonal box is then shut down and fastened with a bolt, and also the lid of the outer box, which has a deep rim upon it. The box inside is then rotated by the fly-wheel handle for about from fifteen to twenty minutes, which is about a sufficient length of time for washing a batch of colored clothes requiring only one course of suds. The form of the box makes the clothes roll over and drop down from one side to another, as it rotates, similar in its action to the old dash wheel, while the roller exerts a gentle padding action, squeezing the dirt through the perforations of the box.

Such is a description of the construction, arrangement and operations of this washing machine. We have examined several in operation at No. 111 East Houston street, this city, where they are made of various sizes. A No. 4 machine, which is about 3½ feet long and 2 feet deep, is capable of washing 47 soldiers' shirts in fifteen minutes, and 76 white cotton or linen shirts in twenty minutes. White linen articles require two waters in order to cleanse them thoroughly. After passing through the suds they are rinsed with cold water, in the same way they have been dashed in the suds. In hospitals, regiments, or any institution where a great many clothes have to be washed, one machine should be used for washing and another for rinsing. Blankets and pantaloons should be washed nearly as often as shirts. These machines may be heated with steam, or when this cannot be obtained, hot suds boiled in a kettle and poured in will answer just as well. The price of these machines complete, with wringer, ranges from $20 to $100, according to size and style of finish. They can be driven by hand, or by horse, water or steam power.

The patentee is H. E. Smith, from whom further information may be obtained at 111 East Houston street, New York, or by mail.



SMITH'S WASHING MACHINE AND WRINGER.

Rolling Gun Barrels.

On page 372 of our last volume (V. new series) we illustrated the method of rolling gun barrels for which a patent had been granted to W. H. Burton, formerly of Harper's Ferry. We have received two communications claiming the invention as English. One says it was invented by Henry Osborn, of Bordsley, near Birmingham, in 1817, and the other that it was invented by a Mr. Russel, of the same place. Probably they are right.

Another correspondent—Mr. William S. Hudson—says "the rollers used at the Springfield Armory are of English manufacture. They have two sets, and one of these was recently imported from England. I do not know why they were imported, as I have no doubt they could be made here." —Our correspondent is right; such rollers can be made here, we believe, as well as in Europe.

LARGE PROFITS ON SMALL PATENTS.—A VALUABLE SPRING.—In 1858, E. F. Jones (colonel of the renowned Massachusetts Sixth Regiment which was assailed by the mob while passing through Baltimore last April) obtained a patent for securing the glass chimneys of coal-oil and other lamps by a small bent flat spring, as a substitute for the old screw fastener, and since then the little spring has been pouring forth a perfect stream of gold to the inventor. Mr. Edward Miller, manufacturer of lamps, burners, &c., Meriden, Conn., has informed us that he alone pays the patentee $300 per month for the license to apply this simple spring fastener to the lamp burners which he makes, and there is another firm in Boston that pays an equal sum for a similar privilege. Mr. Miller makes about 200 dozen burners per day; there are other manufacturers who make upon a smaller scale, and pay proportionally for their licenses.

THE LONDON UNDERGROUND RAILWAY.—The London *Engineer* says:—From Paddington to Victoria street station the line is 3½ miles long, having stations at Paddington, Edgware road, Baker street, Portland road, Euston square, King's cross and Victoria street. From west to east the average slope downward of the whole line is about 1 foot in 300 feet, though, after entering the city, it again rises, but there is no steeper gradient than 1 in 100. Its greatest curve is of 200 yards radius, and its greatest depth from the ground above to the rails is 54 feet; and there are not more than 1,200 yards of straight line throughout. The span of the arch of the tunnel is 28½ feet, its form is elliptical, and its hight 17 feet, except in the parts where there is great superincumbent pressure, when the form of the arch is altered to give it greater strength, and to take the crown to a hight of 19 feet.

CARBONATE of lead (a poison) is, it is now asserted, efficacious in cases of consumption. Workers in lead, we are told, are never consumptive.