Correspondence

Our Steam Navy—Mr. Dickerson's Reply.

MESSRS. EDITORS :—In your paper of the 24th inst., I find three columns under the title of "Our Steam Navy," in which you devote a small space to the task of vindicating the Navy Department from the charge of ignorance and fraud which I have made against it, and a large space to the easier task of proving that I am not infallible as an engineer, but "have my little errors in common with the rest of humanity." As an American citizen, contemplating the possibility that our country may be precipitated into a foreign war, I sincerely regret that you have not been able to do more for the Navy Department than you have accomplished; my qualifications as an engineer are of no importance to the country. But as a scientific editor you have been exceedingly unfortunate in selecting your facts and your arguments (although no doubt they are the best the case admits of) to sustain you in either branch of your undertaking. It is a very important question—the *future* of our navy—Mr. Editor, which ought not to be mixed up with any such unimportant one as the skill of some private person who is not engaged in building our ships; and that question, permit me to say, you do not state fairly.

You say "Mr. Isherwood has designed some engines for the United States Navy *which work steam expansively*, but not at as high rates as Mr. Dickerson thinks economical and proper," and you would have your readers suppose that it is a mere question of *degree* and not of *principle*. But this is not the case. The real question is whether the engines of the navy shall be worked by *an independent cut-off*, or whether they shall have only a single slide, *without any independent cut-off*; which is a very different question from the one you think it best to do now, in order to confuse the matter you propose. The whole question is fixed in records, and unfortunately for the country, in iron and steel; and it cannot be evaded by any pretence that we differ only in degree and not in principle. Mr. Isherwood thus states the point in his report to the department signed by himself, Zeller, Long and Stimers (p. 37), "cutting off steam at $\frac{7}{10}$ths of the stroke of the piston is *scarcely recognized as working it expansively*;" and all his engines are made without the means of working it *expansively*, as that term is "recognized" among engineers, that is, *without any independent cut-off*. All the old navy ships have that appendage; all merchant ships have it; all the navies of Europe have it; and no engines, except locomotives, which are the most costly in fuel of any engines, are without it, and except in some small boats made for some cheap and temporary purpose, where power, speed, or fuel, are of no consequence. Now Mr. Editor, will you tell your readers that its anything less than *gross ignorance* to put such a thing as a common locomotive engine, made large, into a steamship? Will you tell them that such a machine, compared with one which *has an independent cut-off*, and is proportioned to work expansively, is anything but a perfect failure? I think not, sir! You perhaps can do some good now by speaking out the truth; will you not do it? I notice that you don't once say that these engines of Isherwood are right in your whole three columns. If you think so, you ought to say it; if you don't, you ought not to assail me for agreeing with you and endeavoring to arrest the mischief.

Your first statement to help Isherwood is that numerous vessels of all classes, from the *Persia* down, use slide valves successfully. How does that help the Navy Department? It is true, just as you state it; and in proportion to the certainty and universality of the truth, is the failure of Isherwood to make his *slide valves work successfully* disgraceful to him and to the country. If there were any difficulty about it, of course I should not assail a man who did no better than others; but when it is so simple a problem, as that no one but him fails to work it out successfully, how can you and I hold our peace when we see our navy ships tied fast to the dock, because their slide valves *won't* work successfully? You propose to state the other side of the question, which is that *some* of these ships have not cut their valves; but you do not deny that many and the most important ones have. Is this a justification of Isherwood—that he has not ruined all the ships, but only some of them? It is bad enough to put locomotive engines into a steamship; but when they are so made that they won't work without destroying their valves, it is too much to bear patiently.

You next state that the *Bienville* can go *three hundred and fifty knots a day*, which is faster than ships I have built can go. Well, sir, suppose this was so, how does that help the navy ships, which cannot go within two knots an hour as fast? You are only proving my case stronger than I made it. The *Bienville* has *an independent adjustable cut-off*, and works steam expansively. If she did not, she would be no faster than Isherwood's boats. It is of no consequence who made her—the *fact of her existence* is a reproach to the navy. If her plans are the best, use them; but in the name of common sense do not attempt to vindicate the Navy Department for *not using an independent cut-off* by citing the case of one ship which has an independent cut-off of one sort, going faster than some other ship which has an independent cut-off of another sort.

As you seem to think it important to assail me, I will answer for myself a few words. The *Hu-Quang*, which is in China, you complain of as not a fair specimen of American engineering skill. Why not? She went there in about twelve days *less* running time than *any other American steamer ever did*; she carried English news *via* New York to the South Pacific, in advance of *the English steamer direct*; she ran across the ocean, from New York to Cape de Verde, which is 2,900 miles (only 125 less than Liverpool), in ten days and seventeen hours, which was three days less than any other American steamboat ever did it; she ran as fast as any other American steamer *of her class* with about *half* the fuel; and she is the *fastest boat in the world of her class*. Her fuel was 23 tuns per day, as you state, but with it she made 900-horse power, which is only $2\frac{3}{10}$ lbs. of coal an hour per horse-power.

Then your information about the *Keang-Tsi* is equally unlucky for you. How my valve-gear worked on that ship in comparison with the other (*both* having *independent cut-offs*, however), you can see by looking at your own report of a trial, published in the SCIENTIFIC AMERICAN of the 15th of March last. My plans were put on in opposition to the wish of the engineer driver, and of all the subordinates of the owner, Mr. Forbes. They were used all the way to China, and the ship went *three days* quicker than ever had been done at that time, with less than half the fuel (the *Po-Yang—a smaller section boat* with a fixed cut-off—being the next fastest, but using *double* the coal), and as soon as she arrived, the man you mention, without ever having tried the other and without trying mine in the river, took it off on his own responsibility, and supposing that he could have his own way. The first thing that happened to his boat after he made the change, was that the engine knocked out her cylinder-head, by working water, which the other valve would not allow to escape, but which mine would. The next thing was to increase his coal consumption 38½ per cent. in a fresh water river. That he made no *experiment*, either in crossing the ocean or in China, *as you state*, I propose to prove by the following extract from his letter to his owners :—"I *intended* to make a trip to Hankow and back with Dickerson's, and then make one with Winter's, but having worked Dickerson's *all the way from New York*, I came to the conclusion that we had given it a good trial;" and he took it off then and there. His owners have sent out orders to have it replaced.

Your little anecdote about me is peculiarly unfortunate for you, whether it is to be considered either in a truthful or scientific point of view. No such fact as you state ever occurred. I may be ignorant enough to make such a boat as the *Hu Quang*, which I acknowledge even at the risk of your displeasure; but I am not such a fool as to assert that a *closed valve* of any kind, would leak steam to the amount *of the boiler pressure* so as to fill the cylinder in 30 seconds or in any other time. When the valves are wide open, *boiler pressure* is never got in the cylinder. But you have stated a case and I propose to submit to you to decide who is the ignorant person, on your own showing. Your statement is that the steam in the cylinder was *two pounds* below the atmosphere—that is it was 13 lbs. of steam. You have not stated the other facts, which are, that the boiler pressure was 10 lbs., above the atmosphere, and the condenser vacuum was 27 inches of mercury, or 13½ lbs., below the atmosphere. The pressure of steam therefore, which tended to leak through the steam valves into the cylinder, was 12 lbs., to the inch, while at the same time the pressure of steam in the cylinder, which tended to leak through the exhaust valves into condensers, was 10½ lbs., to the inch. If the steam and exhaust valves were equally leaky, then the steam would leak *out of the cylinder* into the condenser about as fast as it would *leak into the cylinder* from the boiler—the difference of pressure between the two operations being only *one and a half pounds* in favor of the steam valve leak. Under these circumstances you state the fact to be that in 4 minutes the cylinder was filled with steam of three-quarters of a pound pressure; and that difference of leak must have also supplied the condensation, which, in *an unjacketed cylinder* standing still, is a very large amount. Is it not certain, Mr. Editor, therefore, that these valves must have been *very leaky*? If under the very feeble pressure of a pound and a half, which is no more than our atmosphere sometimes changes, the valves leaked so much, how much do you think they would have leaked, if the pressure in the cylinder had been down to *two pounds* instead of *thirteen*, and the pressure of steam had been up to *thirty* above the atmosphere, instead of *ten*, which would be the case in use? In this case the leak would have been under a pressure of 42 lbs., instead of one and a half, and its amount would be quite as much as I said it would.

As to my use of terms, I am also correct. The boilers are "*Montgomery Boilers.*" The general plan on which they are made, he patented Dec. 26th 1845, and at the time filed in the Patent Office his drawings of the various shapes in which he would make them, and, among others, the *exact shape* now called Martin's boilers—although he had not at that time taken a patent for that *shape*, as he had covered by his patent all shapes in which his new mode of construction could be used. Afterwards Martin got a patent for the *shape* of a Montgomery boiler; which, if he had been the first contriver of, would have been proper—although he could not have used the boiler without Montgomery's license. When Mr. Montgomery found that he was about to be deprived of the exclusive use of one of his own shapes by this patent, he brought the question before the Patent Office, and his old drawings being produced (which had been accidentally overlooked), a patent for this shape was issued to him on the 4th day of May, 1858, over the head of Martin's; and now he stands *on record* not only the legal patentee of this vertical tubular boiler in all shapes, but also of this particular shape now improperly called Martin's boiler. Why am I not right in calling it Montgomery's?

You say that whether the condenser is an infringement has nothing to do with the question. I think it has. Mr. Pirsson has a patent for the condenser used by Government; but he does not pack the ends of the tubes with india-rubber. Mr. Sewell has a patent for packing the ends of the tubes of *any condenser* with india-rubber. Mr. Isherwood adopts Pirsson's patented *plan of condenser*, and also Sewell's *patented plan* of packing the tubes of that condenser. The Government is bound to pay both these patentees; but instead of that, Mr. Isherwood requires the contractors to pay Sewell before they can get their money, while he takes Pirsson's property without recognition or pay. Is that just? So Isherwood compels the builder to pay Martin for Montgomery's boilers. Is that anything less than a fraud?

Examine the records, sir, and if they prove the facts as I state them, speak out. The country needs all our help now, and you ought not, from any motive, to assist in concealing such transactions as these.

EDWARD N. DICKERSON.

New York, Jan. 26, 1863.

[Some time since a pamphlet was sent to this office entitled "Our Steam Navy—a Letter from E. N. Dickerson to Gideon Welles," which contained some most extraordinary statements; these were, in effect, that we had no navy at all, and that, in short, we were almost helpless on the sea. As these statements seemed to us exceedingly incredible, we took some steps to ascertain how far they were correct, and did consequently ascertain that beyond some ordinary engineering mishaps to four or five gunboats or sloops, out of thirty or forty of the same vessels, they performed very well. The economy with which the new vessels used coal, compared with other ships, had nothing to do with the subject as we discussed it. The whole and sole issue turns upon the worth or worthlessness of the new engines in the navy. As they are *not* worthless, but, on the contrary, are doing the country service every day, it will be seen that what we quoted in reference to some of them, applies to the ships as a class. Mr. Dickerson, however, strives to turn the point of our assertion by bringing up the old question of the utility of cut-offs; this is an altogether unnecessary diversion, and one which we cannot now consider. Mr. Dickerson does not state the case fairly, but evades the question in its main features in nearly every particular. His assertions respecting the performances of the *Lackawanna* or one of the new sloop engines are garbled, and do not do common justice to the naval engines. "*Audi alteram partem*" is a good motto, and one we strive to observe. As, for example, the *Lackawanna* was quoted by Mr. Dickerson as having been disabled alongside of the dock, and the cause was attributed to the plan of the engines, and the unmanageable slide valves upon them. The facts are, briefly, that the vacuum ring which is let into the backs of these valves was fitted too tightly, became immovable, and caused thereby (it being in contact with the inside of the steam-chest bonnet) a tremendous artificial pressure, which it was supposed *did* result in disabling the valves. It appears, however, that the valves were not cut at all. Mr. Zeller, a chief engineer in the navy, states that when he examined them after a trip down the coast, the surfaces were remarkably smooth and bright, and it seems to us that these facts ought to have been presented in company with the contrary assertions. We may also state in this connection that we do not defend or impeach the engineering character of Mr. Isherwood, or that of any other engineer, nor is it a part of our argument to assail the professional character of any one; we prefer to let events speak for themselves, as they do, generally.

Further on in our correspondent's communication we have another reference to the *Hu Quang*; and it is asserted that our conclusions in reference to the utility of a certain plan of valve are incorrect; that by the aid of these valves, Mr. Dickerson's invention, or adoption of, as he acknowledges old-fashioned plans, the vessel in question accomplished more than any other steamer ever did, and performed, in short, prodigious feats of speed and economy. This statement may be correct, but we must be permitted to say, so far as the speed goes, that it is stoutly disputed by those who dispatched the *Fire-cracker*. We would ask permission to call the attention of the engineering community to the fact that poppet valves do not permit the escape of water; if the boiler should unfortunately foam, the cylinder head, according to Mr. Dickerson's theory, must come out. What this has to do with the question at issue is not obvious. We accept as a fact the statement that Mr. Dickerson's improved cut-off has been ordered to be replaced on the engine of the *Hu Quang* again.

We cannot, however, follow this gentleman through all his intricacies and "arguments" for the reason before stated that they do not affect in any degree, as our readers will discover for themselves, the justice of our criticism. In regard, however, to the test of poppet valves as compared with single disk valves in the Morgan Iron Works, Mr. Dickerson distinctly disavows ever having made any such experiment; further down the same paragraph he admits having made some such experiment, and takes direct issue with us upon the accuracy of our information. "If," says the gentleman in question, "the exhaust valve leaked, the case would have been thus and so." The reply to all this is the fact that if the engine in question had lost steam as fast as it entered the cylinder, the condenser would soon have got hot and consequently destroyed the vacuum in the same. Unfortunately for the deductions of Mr. Dickerson, the vacuum gage indicated 3½ pounds for two hours after this experiment, consequently we stand just where we did upon our first assertion. We do not understand what point is to be gained by accusing intelligent practical engineers, of long standing in their profession, of ignorance. They are certainly ignorant of any knowledge of the art of subterfuge, and stand up to their assertions manfully.

We cannot, however, encumber our columns with this subject again. We desire to say most distinctly that we reserve to ourselves the right to criticize any public matter of importance that may come under our notice. If Mr. Dickerson takes exception to the tone of our article we cannot help it. "Those who live in glass-houses should not throw stones." Mr. Dickerson is an enthusiast on the subject of cut-offs, and goes as far in one direction as Mr. Isherwood does in another, and as the former gentleman sees fit to question our impartiality and disinterestedness on this subject, we will add that we never received a word, or a line, from Mr. Isherwood, or his friends, on this or any other subject that we are aware of.

We may also be pardoned if we cannot see how it is that Mr. Dickerson should combine all the engineering knowledge of the period; not that we are prejudiced in any way, but that it seems to us barely possible that views entertained by other members of the engineering community are so essentially different from his that they are certainly entitled to some consideration and respect. We also made some allusion to the personal motives which our correspondent had in writing the pamphlet, and so far from having changed our views, we are rather strengthened in them than otherwise. It is very difficult to see what consistency there is in condemning the whole body of our naval engineers, from first to last, as a set of ignoramuses, and then quoting, as our correspondent does, *their* opinions to sustain his own case. We have given much more time to this matter than we can spare from our other engagements, and shall not be able to refer to it again.—Eds.

The Calorific Effect of Silicious Sand in the Boiling of Water and Generation of Steam.

(Concluded from page 84.)

Quartz rock or silica is composed of 22 parts, by weight, of the metal silicon and 24 of oxygen. It is the most abundant mineral upon the globe, constituting 50 per cent. of the earth's crust, and is the principal constituent of granite. Quartz rock breaks down or crumbles into grains called silicious sand, the most abundant of all the sands. Crystallized quartz, like all crystallized minerals, preserves its crystalline form in the finest grain, each grain remaining a perfect crystal, however broken up, with focus and angles best adapted for the reflection and transmission of heat, and when in mass, however compact, preserving innumerable interstices or capillary tubes; and hence silicious sand—unlike the other earths—is always hard and sharp, and angular to the touch, and always porous to water and permeable by air, gas or steam. Silex, in its pure state, has neither taste nor smell, and, therefore, no odors can arise from its use, nor can it give unpleasant taste to drinks or viands. Silicious sand is in itself infusible by any temperature, however intense. It is not soluble, and hence never becomes plastic, as clay or mud. For heating purposes sand seems to improve by use. It is so porous, and, at the same time, so searching, that air, gas, steam and water readily rise and pass through it; and it is unequaled for purifying water from its impurities, even of organic matter in solution, and entirely excluding solid impurities or depositions into its mass, when once made clean. Depositions from water, as of lime or calcareous deposit and other impurities, will always lodge upon the surface of the sand without penetrating its substance; and what is of very great importance to steam boilers, it will not encrust, harden or adhere to the sand as to metal, but lying loosely upon the surface can be readily washed or flooded off, or removed without changing the sand.

A simple gas burner connected with a gas pipe and introduced into a body of sand, and so as just to enter it, will diffuse the gas from very trifling pressure through the entire mass of sand, so that the gas will burn upon its surface from center to circumference, and the gas is forced downward through the sand apparently with as much facility as it is upward. The vapor of alcohol or other burning fluid, not viscid, will also diffuse itself from its own elasticity through the sand, when once introduced or generated into its substance, and burn upon the entire surface until all consumed, like gas. Steam also, introduced or generated in the sand, and also water, before its final escape, will diffuse itself or spread through the entire mass. When heat is applied to the bottom of a vessel containing water and sand, the conversion of the water into steam, and its escape, will go on unceasingly until the sand becomes perfectly dry through its entire substance; the drying process commencing from the upper surface of the sand, and so readily does the sand transmit the steam that the steam will penetrate almost any depth of sand above it, wet or dry, when it will be effectually confined or prevented from rising by a small strata of cold water or not yet heated to 212° by circulation. So rapid is the heating of water and the generation of steam in sand that the water can be heard, and in glass vessels seen, to boil in it with violent ebullition, some time before the water above it becomes heated to the boiling point, or even warm. As sand first claims the heat even from the water until it reaches a certain temperature, when it begins to impart it or give it off, its first effect upon the water above it is to retard, somewhat, the warming, but in all vessels of any considerable extent of sand surface—even with the water entering down through the sand from above only, and in every case where the water is forced upward by hydrostatic pressure—the entire mass of water reaches the boiling point sooner with the sand than without it. Water introduced into the bottom of a vessel containing sand, or below the sand, so as to produce hydrostatic pressure upwards, will always rise in the vessel as high as the water source of supply, and so as to completely saturate the sand and keep it wet, and protect from the fire the metal in contact with it, no matter how quick or intense the fire of the furnace or narrow and deep the vessel containing the sand. The sand will measurably, in itself, and without water, protect the metal with which it is in contact, upon the same principle that water protects it, that is, by absorbing the heat that would otherwise accumulate in the metal; and were the contact as complete in the one case as in the other, which is impossible, sand would give more perfect protection to the metal than water, for it absorbs heat much more readily, and does not (like water) boil away or evaporate. The sand will hold, without increase of bulk, more than half its volume of water, and may itself be considered a reservoir of water. Its specific gravity or weight being more than three times that of water, it lies at the bottom of the vessel in a mass, without floating in grains through the water, however violent the ebullition, the force of steam acting upon the water and not upon the sand, but if the water and steam be confined without sufficient room for spread or expansion, the force of the steam will move both water and sand.

Sand contains no inert or latent heat that has been communicated to it as sensible heat, and its specific caloric, so-called, or susceptibility to heat, is such that, from this cause as well as from its superior absorbing powers, it is much more economically raised to a given temperature than an equal weight of metal or water. Sand, from its comparatively slow conduction of heat as compared with metal, much longer retains its radiating temperature of sensible heat, and then, again, the radiating power of the sand, or its equivalent power of imparting heat to water by contact, being in direct proportion to its absorbing and not its conducting power, it possesses unequaled power of heating the water, not only from its own inherent properties of imparting heat, but also from the greatly-increased and extended heating surface of the grains of sand, in which the water in almost infinite division in its circulation necessarily comes in contact. Water in the remote parts of the boiler where there is no sand, will circulate through the sand nearest the fire or wherever is the greatest heat, giving place again to water of less temperature, until the whole is converted into steam. So readily may heating surface to water, and its increase or diminution at pleasure, be obtained by this simple and beautiful application of sand, that we ever have it in *maximum*, or in exact adjustment and proportion to the intensity of the fire, capacity of the furnace or heat required, without regard or reference to the metallic surface or size of the boiler, provided that it be large enough to contain the water and sand and for steam expansion. CALVIN PEPPER.

Albany, Feb. 3, 1863.

Manufacture of Glass---Implements Wanted.

MESSRS. EDITORS :—After reading the interesting article on "Flint Glass" recently published in the SCIENTIFIC AMERICAN, I thought a few additional suggestions might be acceptable to your readers.

Glass-making is one of the few branches of industry in this country which have comparatively remained behindhand in the employment of machinery, for which as a people we are so justly celebrated. Outside of the iron molds used in casting hollow-ware very few mechanical tools are used, and there is probably no other business in which so much depends on the skill of the workmen. The French have been using for years, with great success, wooden molds for shaping all objects made of a cylindrical form, and have thereby been enabled to produce more regular and cheaper wares. I am not aware of any manufactory in the United States using the same means, although efforts have been repeatedly made to introduce it by Frenchmen acquainted with the business. It seems as if, strange to say, our glass manufacturers were behind their brother manufacturers in wishing to introduce labor-saving machinery. Any one visiting glass-works will notice how impossible it seems to be for a workman to shape two articles alike with the scanty tools at their command. It is in fact an impossibility, as can be ascertained by comparing and measuring any two of them together. It certainly is not more impossible to attain perfection in that business than in any other.

If from glass-blowing we pass to the cutting we will find the same difficulties, if not greater, for how can a man produce regular and similar patterns with a simple grindstone, as it were, having nothing to guide him but his steadiness of nerve and intelligence? The same defects exist in cut-ware as in blown-ware as regards regularity; moreover, it is a well-known fact that glass-cutters as a class suffer from diseases of the chest, occasioned by the constant strain thrown to that part of the body in holding objects to the grinding-wheel. In glass-making we cannot, like in other branches, produce articles beyond a very limited size, machinery not being used, human strength cannot go beyond a certain limit, this tends to restrain the use of glass, whereas, if large pieces could be manufactured, glass could be applied to many purposes unthought of; in fact, almost anything made in other wares could be manufactured in glass with much more beauty. Our places of amusement, our private residences could be fitted with mammoth gas fixtures, legs of pianos could be made, vases and urns of colossal dimensions, &c. We could ornament those objects with beautiful cut designs, in a word, glass-making would be on a par with other manufactures.

The inventive genius of this country however, has not altogether been as dormant as would be supposed from the above. A machine was patented some years ago, and was put on trial in your city by the inventor, a practical man in the business, then residing there. It cut several decanters and goblets with perfect regularity, unaided by the skill of the workman; the only attendance required was simply to push the machine backward and forward, it would then perform its duty with unerring precision. This, although a rough trial, proved that objects of any dimensions could be cut with perfect ease to the workman and mathematical regularity. Want of means, as in many other cases, prevented the inventor ever since from introducing the machine into our glass manufactories. The same inventor also devised a mechanical tube for blowing glass without the aid of the workman's lungs, an advantage that no doubt would be highly appreciated by many workmen.

I am not aware of any manufactures in the United States, besides the Boston Glass Works, making colored glass—an art in which the French are so renowned. We have often noticed the beautiful cut-glass bottles made of one, two and sometimes three different kinds of colored glass, the cutting showing the different coats, as it were, one above the other. It is true our Boston works produced a few good colors but we are still sadly behindhand with Europe. Our flint glass, however, has a very good reputation in Europe, thanks to the pure materials this country affords, for we have no need to go abroad for anything used in the manufacture of glass, if we are willing to open the natural resources it has spread in every direction. Why then should we not be able to reach the perfection of European manufacturers when we have everything we need? Let our manufacturers open their doors freely to improvements and encourage inventors and we will soon be able to rival Europe in every respect.

It also seems strange that, so far, we have not manufactured our own looking-glass plates. Is the French monopoly so very rich as to prevent it or have we not the requisite talents and energy to do it? Capital ought not to be wanting for such an enterprise, for it is a well-known fact that the business is immensely profitable. C. C.

Washington, D. C., Feb. 2, 1863.

More about Milling.

MESSRS. EDITORS :—I noticed in the SCIENTIFIC AMERICAN of the 17th ult. an article entitled "Questions for Millers," and having had considerable experience in that business, I will give what information I can on that subject.

The process of grinding is by passing the grain between two planes and crushing it on the feather edges of the furrows in the stone, and rubbing it over the lands or smooth planes by cracking or creasing, similar to the action of a file, for the purpose of rubbing the inside of the grain from the bran or outside. Now, if a file be dull everybody knows that you have to press harder upon it to make it cut, and just so with a millstone that has become smooth in the face. You have to use more pressure upon the grain, thus causing a large amount of unnecessary friction and loss of power, and injuring the flour by making it more subject to become sour. It also impairs its rising qualities, giving it a watery appearance when made into bread.

In regard to bolting, flour that is bolted when warm is certainly a little fairer, but the reason is that the meal is more adhesive and closes up the meshes of the cloth; but at the same time a less quantity of flour is thus made, for a portion of it goes in with the offal and yields "shorts." I cannot see why cool meal should be more liable to burst the cloth. It does not increase its weight, for if you grind twelve bushels per hour, 720 lbs. of meal go through the bolts in the same time, hot or cold. All that is necessary for cool meal is to have a finer cloth, and keep the feather edges of the stone furrows smooth, with a fine edge, and the face should not be cracked too much. If it is desired to have the meal warm it may be heated by conveying it over hot pipes, which would be a better mode than to heat by friction. SAMUEL GOODLAD.

Prairie du Sac, Wis., Feb. 3, 1863.

Proposed Modes of Canceling Postage-stamps.

The following is interesting information respecting proposed methods for cancelling postage-stamps, being a correspondence with the Post Office Department at Washington, on the subject.

MESSRS. EDITORS :—I herewith send you a copy of a correspondence, regarding the gumming of one-half the stamps, leaving the other to be torn off; which I think might prove of some value to you. Would not an electric battery answer the purpose of perforating the stamp, for a medium battery would be sufficient to cancel two or three letters at a time; though it might be too costly, and not do the work accurately. LEWIS LAESCH,

Philadelphia, Jan. 26, 1863.

POST OFFICE DEPARTMENT,
Washington, Jan. 23, 1863.

SIR :—The plan for canceling postage-stamps proposed in your letter of the 19th inst., had previously been submitted to this office by some half dozen persons in various parts of the State, and was patented some time since by Marcus P. Norton, Esq., of Troy, N. Y. The objection to this mode of cancelation is the time required to effect it, as the operation of detaching the free portion of the stamp would manifestly be much slower, than the present mode of stamping by hand, while even the latter is not sufficiently rapid to meet the requirements of the larger post-offices, and an effort has been made to obtain a stamping machine to supply this deficiency. In the case of internal revenue stamps, the above objections would not of course hold good. A. N. ZEVALY,
Third Assistant Postmaster General.

GAS is now employed for lighting carriages on the Lancashire and Yorkshire, London and North-Western, and Great Northern railways.

Wells in the Deserts.

The French are acquiring great influence among the desert tribes of Algeria, by the introduction of useful European arts, especially that of boring for water. Beneath certain sections of the Great Desert there is either a subterranean lake or river; and this has been long known to the native Arabs, among whom there are professional well-sinkers, who form a numerous body, enjoying much consideration; their work being of a very dangerous character. They excavate in the ground, and when they reach a certain depth they know by the color of the soil if water is below. A thin crust covers the subterranean stream, and when it is broken the water in it rushes up with the velocity of petroleum in American oil-wells. In the south of Algeria, the well-sinkers endeavor to find a subterranean stream, which is sometimes tapped at the depth of about 550 feet. Colonel Dumas, of the French army, thus describes the mode of excavating them :—

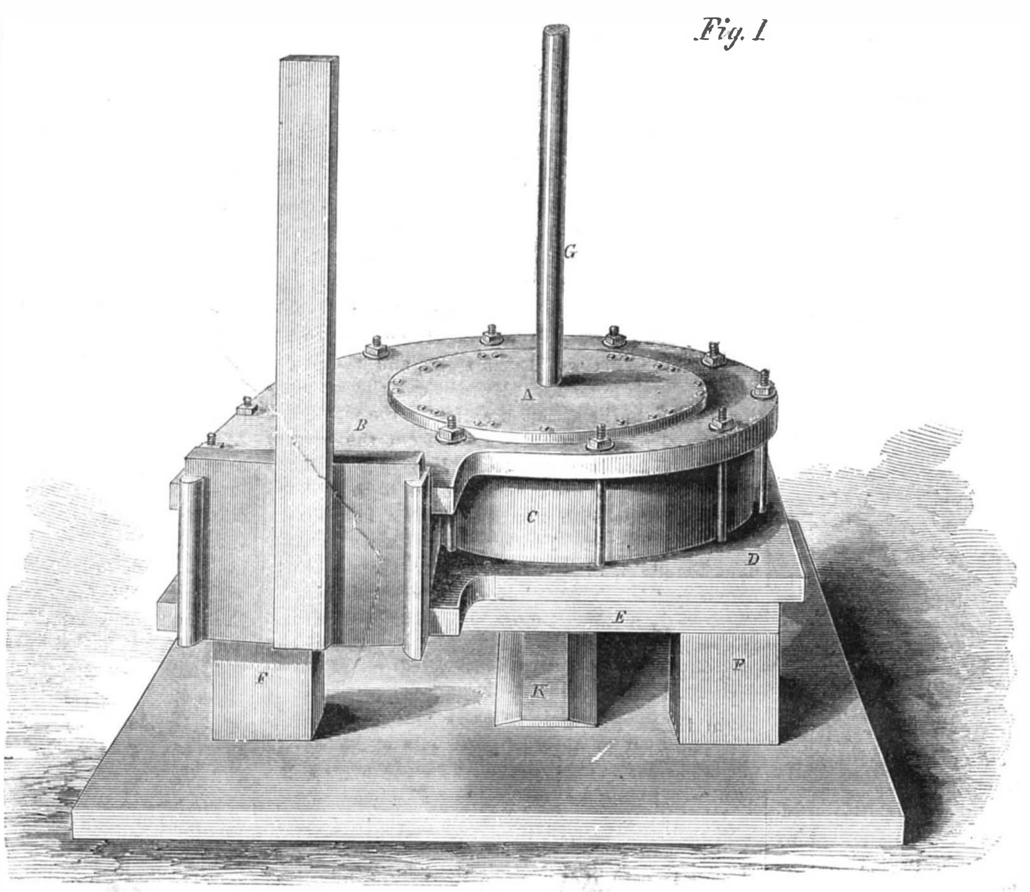
"The section is in a square form. One workman alone works at it; and, as he advances, he supports the sides with four planks of palm-tree. By certain infallible signs—for instance, when the soil becomes black and moist—he knows that he is near the spring. He then fills his ears and nostrils with wax, that he may not be suffocated by the uprising deluge of water, and fastens a rope under his arms, having previously arranged to be drawn up on a given signal. At the last stroke of the pick, the water often rises so rapidly, that the unhappy well-sinker is drawn up insensible. These inexhaustible springs are the common property of the village which has discovered them, and are conveyed to the gardens in conduits of hollowed palm-tree trunks. It is these springs which are the foundation of the greater number of the oases of Sahara." In 1853, when French conquests had extended to the vast and mysterious solitude called the Great Desert, well-boring and sinking apparatus were introduced, and astonished the Arabs by their simplicity and effectiveness. In the five years ending 1859-60, fifty wells have been opened; 30,000 palms and 1,000 fruit trees have been planted; many oases have revived from the ruin caused by a failure of springs; and two villages have been created in the Desert; the total expense not having been much more than £20,000 sterling, which has been repaid by taxes and voluntary contributions from the Arabs. Colonel Dumas observes: "Such works give us ten times more influence than our military victories. The waters bubbling up from these borings are generally charged with sulphate of soda, magnesia, and lime, either as a chloride or a sulphate, which makes them bitter and salt; but the Arabs are only too glad to have any kind of water, and the palms and other vegetable products of the Desert thrive on it." The borings of Sidi-Sliman and K'Sour present the curious phenomenon of live fish. A parallel to this case was reported by M. Aymé, governor of the oases of Egypt, to a scientific society in France. In clearing a well 325 feet deep, he said "he had found fish fit for cooking." The French propose to extend these wells into the Desert, so as to unite the rich oases of Touat (on the route to Timbuctoo) with Algeria, and thus direct the stream of overland commerce into its ancient channel by Algeria.

PRINTING PAPER.—The *Boston Journal* says that the consumption of paper in this country equals that of Great Britain and France together. In 1854 it was estimated that 250,000,000 pounds were made here, valued at $25,000,000. About 405,000,000 pounds of rags were used, at an average cost of four cents per pound. In New England, the Middle and Western States, the value of book, job and newspaper printing was returned by the last census (1860) as $39,428,843, of which eleven millions worth consisted of books, the value of the latter being nearly equal to the whole product of the same branch in 1850, which was returned at $11,586,549. The manufacture of paper has increased in an equal ratio, the State of Massachusetts alone producing paper of the value of $5,968,469, being over 58 per cent of the product of the Union in 1850.

A TUBE, furnished with a circular cutter made of rough diamonds, is now said to be employed in France, for the purpose of boring into hard rock.

Improved Water Wheel.

The importance of a cheap and easily managed motive power cannot be exaggerated. Especially is this the case in rural districts, and in parts of the country remote from towns or villages. Here we will illustrate a simple but effectual water wheel, which is highly spoken of by those who have used it. A reference to the several views of this wheel will render our description plain. Fig. 1, represents the wheel and its case in perspective. The cover of the case, A, is made of two-inch oak plank, the top of the chute, B, is also of oak, two and a half inches thick, C, is the circumference of the chute and D the bottom of the same. The square wooden frame, E, is two inches larger than the diameter of the wheel, and is supported by four posts, F, one of them is placed under each corner of the frame. The shaft, G, of the wheel, seen in Fig. 2, rests on the hard wood step, H, this step is boiled in tallow, and is received by the casting, I. There is further, a ring, J, cast on the saddle provided with four set-screws, by which the step can be set properly. The timber, K, supports the whole fabric, step and wheel, and the buckets, L, are curved to suit the velocity of the current under which the wheel is to be run. Provision is made for replacing them when broken. The concave hub, M, is turned off on its periphery so that it fits closely to the top of the chute. The ring, *o*, is adjustable, being laid loosely on the bottom of the chute, so that it prevents the water from leaking out; this, it is stated, has never been obviated before by an iron wheel working in a



BURNHAM'S PATENT CENTRAL-DISCHARGE WATER WHEEL.

Fig. 2.

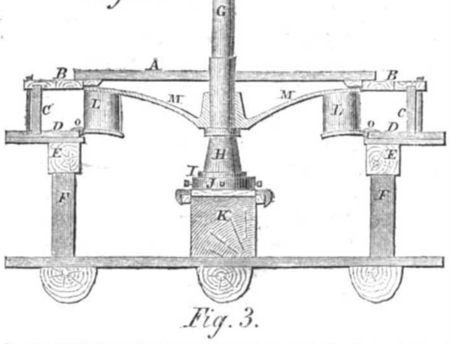
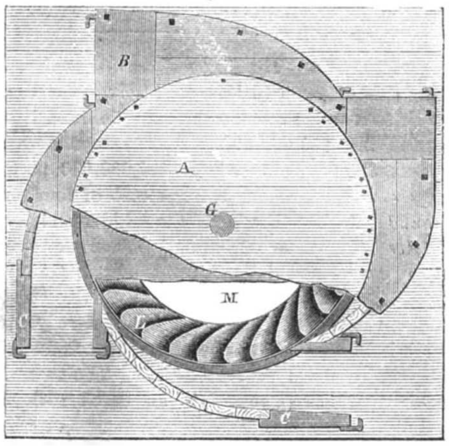


Fig. 3.



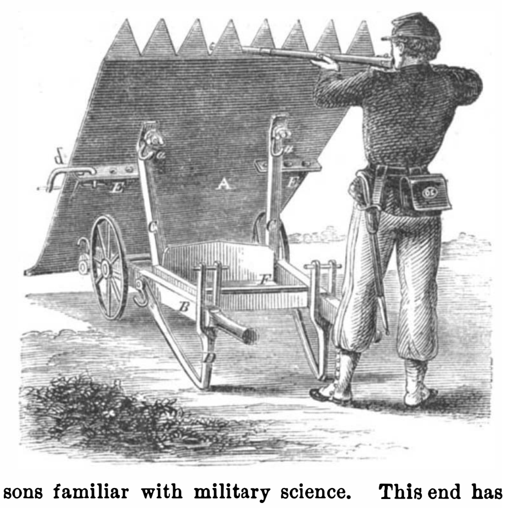
wooden curb. Fig. 3, represents the same wheel with four chutes; it can be made with either one or four, as parties may desire. This water wheel is the invention of N. F. Burnham, Variety Iron Works, York, Pa. A patent has been ordered to issue through the Scientific American Patent Agency. Further information can be had by addressing the inventor at York, Pa.

Repairing the "Great Eastern."

We notice a communication in the London *Engineer* of Jan. 16th, from a Mr. Young, C. E., in which he quotes the "Transactions of the Society of Arts for 1823," to prove that the device adopted by Renwick Bros., of this city, was identical with the one there described. This point being granted, how does that affect the question of the difficulties which were overcome and surmounted by the contractors here, the credit for which they are just as much entitled to as if the apparatus were novel or as if it were a thousand years old?

SHERMAN'S PORTABLE BREASTWORK.

The importance of protecting infantry in the field from the attacks of sharp-shooters or other soldiers detailed for special duty is acknowledged by all per-



sons familiar with military science. This end has been the study of many inventors. We illustrate a plan designed to afford such protection, which will be readily understood by referring to our description. It consists of an iron breastwork, A, mounted upon a truck, B. The top of the iron plate has a serrated edge, which is intended not only to prevent the breastwork from being scaled by the enemy, but also to furnish a protection for the head, and loopholes for the musket of the soldier or sharp-shooter behind the barricade. There are two upright braces, C C attached to the truck, which strengthen the iron plate and render it more stable. The slotted legs, D, at the end of the truck, allow the handles of the same to be raised or lowered, as may be desired, thus varying the natural angle of the breastwork's inclination 45°, at the will of the soldier. The upright braces have thumb-screws, provided with long hooked ends, *a*, on which the sharp-shooter can place his weapon; the screws also fasten the ends of the braces to the plate. The appendages, E E, are supplied for the purpose of securing two or more sections of these defenses together; they have staples, *b*, which engage with similar fixtures upon the other plates, and prevent them from being forced apart from the outside. There is also a box, F, formed in the truck, which furnishes a convenient receptacle for hand grenades or other missiles thrown when in close action. These details comprise the main features of the portable breastwork.

Our artist has so fully depicted the uses to which this invention can be applied, that further comment is unnecessary. It may be well to add, however, that the breastwork is light, easily wheeled from place to place, and affords a shelter from inimical bullets; this will, we think, be highly appreciated by soldiers. The picket can thus defend himself from the unscrupulous foe, or infantry moving to attack other infantry can, by the aid of the portable breastwork, deliver their volleys at close range.

This breastwork is the invention of Mr. S. M. Sherman, of Plover, Wis. Further information can be had by addressing him at that place.

HOW FLINTS ARE FORMED.

The rounded nodules called "flints" are usually found in chalk beds, and are supposed to be organic remains transformed into chalcedonic quartz. Flint is nearly pure silicic acid, and at one time it was extensively used in the manufacture of pottery and glass, hence the common term "flint glass," in the production of which white sand has superseded it. It has been a subject of some wonder how flint, which is nearly pure silica, could be formed out of organic remains, such as the eggs of extinct creatures in chalk formations. This subject was lately brought before the London Chemical Society, when Dr. Church stated that the origin of flints could be traced to water holding silica in solution. During the percolation of such water through beds of chalk, the silica became separated and the carbonate of lime took its place in the water thus deprived of its silica. An interesting example of the deposition of silica in the form of chalcedony took place within a comparatively recent date, geologically speaking. About the year 1400 a basket of hen's eggs had been left in a chalk pit at Winchester, England, and this basket was lately found covered up with broken chalk. The organic matter and the shell of the eggs had entirely disappeared and their places occupied with the semi-transparent variety of silica—chalcedony. Silica was also deposited upon the willow twigs composing the basket, forming a crust of silica.

The higher the temperature to which steel to be hardened is raised, and the colder the fluid into which it is plunged, the harder and more brittle it becomes. In India glaziers never use a diamond to cut glass; they use steel points hardened as described.