A RADICAL CHANGE IN SUGAR MAKING.

MESSRS. EDITORS:—Suffer me to lead your attention to the inclosed extracts from *Les Mondes*, of Paris, and the *Diario de la Marina*, of Havana, convinced that their perusal will prove interesting, not only to yourselves but also to the enlightened readers of your ably-conducted journal. Mr. Reynoso's discovery has caused a great sensation in this country.

JORGE CRAVE.

Concepcion, August 29, 1865.

The extract from *Les Mondes* we translate, as follows:—

"LAST SESSION OF THE IMPERIAL AND CENTRAL SOCIETY OF AGRICULTURE.—M. Payen, in consequence of the intimate relations of agriculture with the manfacture of sugar, believed it a duty to call, in a special manner, the attention of the Society to the happy thought of M. Alvaro Reynoso, of Havana, a very distinguished pupil of our national schools, of substituting the action of cold for that of heat in the concentration of sugar sirups—either those of the cane or those of the beet.

"At the present time machines for making ice have become very common and very economical. By the combustion of one pound of coal, twelve pounds of water are frozen; while, with the same pound, only six pounds of water, in the average, can be evaporated. The advantage, then, in favor of congelation, is nearly one-half. It has, furthermore, been applied with success to the concentration of sea water, to extract from it the salts of soda, potassa and magnesia which it contains; to the concentration of mineral waters to reduce them to the smallest volume possible without depriving them of their virtue; and even to the purification of sea water in freeing it from all its saline principles and making it potable. The waters of the sea desalted, the salts extracted from sea water, mineral waters concentrated, are far from having the commercial value of sugar, and of being able to bear the cost of a treatment equally expensive.

"The moment, then, was come to think of treating sugar juice by artificial cooling, in place of submitting it to heat which decomposes it, or augments considerably the proportion of uncrystallizable sugar. M. Payen had seen the results of the first experiments made on a small scale by M. Alvaro Reynoso; he was able to state that the sirups marking five to six degrees on the hydrometer of Beaume were converted by congelation, aided by movement, or by a turn of the hand analogous to that employed in obtaining sorbet ices known under the name of *granit*, into a sirup of twenty-five degrees, and water nearly pure from the melting of the ice after the sugar had been separated by the centrifugal machine, or the press.

"The able Havana chemist, who has made a name in the Spanish colonies by the publication of two highly esteemed works—"Progressive Studies on Divers Scientific Matters, Agricultural and Industrial," "Essay on the Culture of the Sugar Cane" —completes at this moment his practical researches on the best mode of the application of cold. At the same time he is preparing some experiments on a large scale. M. Payen undertakes to follow them closely with his illustrious associates of the Academy of Sciences—MM. Dumas, Pelouze and Peligot, and to present, in relation to them, a detailed report to the Society of Agriculture.

"M. Chevreul, in the name of the assembly over which he presides, thanks M. Alvaro Reynoso, for the communication made through the medium so honorable of M. the Perpetual Secretary, and accepts the promise which has just been made in his name."

[As there is a loss of at least 18 per cent in removing the water of cane juice by evaporation, owing to the conversion of a portion of the sugar into grape sugar by heat, if the separation could be effected without the employment of heat, the yield of sugar would be considerably increased. The freezing of water is an act of crystallization, and crystallization is a separating process. If all the water could be removed from cane juice by this process, or sufficient to induce the sugar to granulate, and if the process were a cheap one, it would indeed work a revolution in sugar making; but if the concentration is only to 25°, requiring evaporation for its completion, it is difficult to imagine that it can be economical. The novelty of the suggestion, however, and the high position of M. Payen, who introduces it, warrant us in laying it before our readers.—EDS. SCI. AM.

NOTES ON THE NEW SLOOPS OF WAR.

[For the Scientific American.]

The contracts for the construction of the machinery for these vessels were issued in the year 1863, the price agreed upon being $400,000 for each pair of engines, with boilers, etc., complete. The hulls are being constructed at the national navy yards throughout the country, none being built by private contract. These steamers are rated at "second-class sloops" in the "Navy Register," and will average 225 ft. between perpendiculars; have a breadth of beam of 41 feet, and a burden of 2,000 tuns; they will have two decks, viz., the spar and main decks—the whole of the machinery being below the latter, and, consequently, below the water line. The propelling force will consist of a pair of back-action condensing engines, having cylinders of a diameter of 60 inches, with a stroke of piston of 36 inches. They were designed by the Chief of the Bureau of Steam Engineering, and are creditable specimens of their class. Steam is supplied by four of "Martin's" upright tubular boilers, and two superheating boilers of one furnace each. Total number of furnaces, 30, each one 3 feet by 6 feet 6 inches; total grate surface, 585 square feet; total heating surface, 16,000 square feet. In reviewing the general design and the elaboration of the details of these engines, it is manifest that they are much less open to criticism than were the earlier attempts of the Bureau of Steam Engineering in designing the machinery for its war vessels. The gunboats built in 1861 and 1862, having engines of 30 by 18-inch cylinders, proved so entirely deficient in speed that new boilers, having increased grate and heating surface, in addition to a superheating apparatus, are being built by them, and for the use of these it is hoped a better rate of speed may be obtained; but there are so many defects in the engines as at present arranged that the performances can never be entirely satisfactory. The sloops of war, having engines of 42 inches cylinder and 30 inches stroke of piston, built soon after the gunboats, although an improvement on the last-named vessels, are yet defective in design and detail. In the engines for the vessels which are the subjects of these notes, the slide valves and their working gear have received some valuable modifications. The valves have been made "double ported," thereby giving a quicker opening, and reducing the size and throw of the eccentrics. Steel rollers have been introduced for carrying the weight of, and pressure on, the valves, and a large proportion of the surfaces of the valves has been balanced by "Waddell's" patent balance plate. By means of this arrangement that portion of the inside surface of the valve within the edges of the "balance plate" is open to the same pressure of steam as the back, and is, therefore, "balanced." This plan of relieving the pressure on large slide valves has, for some years, been in successful operation on the Royal Mail steamer *Persia*, of the Cunard line, as well as in the navy. It might be supposed that the use of rollers under the *face* of a slide valve would not be admissible. The inventor of this arrangement designs that the rollers should barely touch when first fitted in, but, as the face of the valve and its seat wears down, the rollers receive a considerable proportion of the unbalanced pressure on the valve, substituting a rolling for a sliding motion. Rollers under the lower edge of the valve are in daily use in the navy, and give entire satisfaction. The reversing gear for these engines is, in some of its details, light and ill-proportioned for the duty it has to perform. The counterbalance introduced will balance the weight of the links only, leaving the power to move the valve (which, in reversing, with the eccentrics in certain positions, will be moved several inches) and the friction of the various journals to be overcome by a small hand wheel on the engine platform, operating through the agency of a worm and wheel. Much difficulty must be experienced in reversing the engines promptly, as it will require for that purpose more operators at the wheel than can reasonably be expected to be in the engine room at any one time. A very good arrangement—one that has been in use in naval steamers, and is in general use on large screw steamers of the merchant marine—is the combination of a steam cylinder with the reversing shaft and arms, for the purpose of raising or lowering the links. Such an apparatus has, for some reason, been omitted in the design of these engines, although its use would certainly facilitate the maneuvering of the engines. It would be noticed by even a casual observer that the main cross-head slides of these engines have unusually large surfaces. So much trouble has been experienced on board of naval steamers, both screw and paddle wheel, from an insufficiency of surface in this very important part, that the value of this increase will be appreciated. As friction is independent of surface at ordinary speeds, the dimensions so often given to main slides could, where practicable, be increased with great advantage, and with this modification one source of delay to the vessel and annoyance to her engineers would be removed. The air and circulating pumps are entirely separate, and each is double-acting. This is manifestly an advantage, as the former plan of combining the two pumps in one, causing one end of the pump to use fresh water and the other end salt, was productive of much trouble, causing both a loss of fresh water and the introduction of salt water in the hot well. The suction valves are unnecessarily large, and the space between the piston at the end of its stroke and the valves is so great (more than the capacity of the pump) that much trouble may be apprehended from the uncertain action of the valves, caused by the vapor inclosed within this space. It is asserted that the momentum which the water acquires in descending from the condenser of the pump will insure a prompt movement in the valves; but this cannot be relied upon when at sea, and it is more advisable to bring the valves as close to the end of the pump barrel as possible. The pump barrels are lined with brass, and the weight of the pistons is borne as usual by lignum-vitæ rings, which are to be recommended for that purpose. A manifest improvement has been made in the reduction of the capacity of the surface condenser to that actually required (about one-third of the heating surface of the boilers), and in passing the refrigerating water but once through the tubes. In some of the gunboats before referred to, the condensers contained twice the number of tubes required; and the refrigerating water, by being twice passed through them, became, some time before it was discharged, so heated as to be of little avail in condensing the steam. The great pressure brought upon the pumps in forcing the refrigerating water to change in direction so often, caused their pistons to leak badly, their valves to pound and wear out very rapidly, and in some instances bursting the bonnets of either the condenser or pumps. The tubes in the condensers for the vessels which are the subject of these notes, lie in the direction of the length of the ship—the exhaust steam entering the condenser by two nozzles in front, and being distributed around and among the tubes by a channel way having a narrow opening extending the whole length of the condenser. By this arrangement the whole of the tubes are made available, which was not the case in the condensers of the gunboats, where there is a difference of many degrees in different parts of the condenser.

The working parts of these engines are very massive, and their dimensions might be reduced with advantage. The metal of the cylinders, channel plate, etc., is also much heavier than is found in ordinary practice.

The boiler power in these ships is ample, and by means of the superheating apparatus attached, a considerable economy of fuel may be expected, besides a more satisfactory action in the engines. There are no blowers supplied, in which omission the good judgment and the experience of the designer may be seen, as it is well known that the duty of a Martin boiler cannot be greatly augmented by the use of a blower, owing to the contracted calorimeter, while the consumption of coal under those circumstances is greatly increased. A steamjet has, however, been applied in each steam chimney, a moderate use of which jet is often found advisable, as it is the speediest way of bringing the fires, when small, to a full action.

The screw propeller for these vessels is of brass, and has four blades, each 27 inches wide, with a pitch at the forward edge of 26 feet, expanding at the after edge to 30 feet. The mean pitch of 28 feet will require the engines to perform 50 revolutions per minute, in order that the vessel may have—in ordinary weather—a speed of 14 miles per hour. This will allow of a slip of 16 per cent, which is considered ample for vessels having the lines, etc., of those under remark.

The engines, owing to their strength of detail, will be capable of working much beyond the speed mentioned with safety, should the boiler power be sufficient to allow of it. It should not be expected that a man-of war, which is necessarily of a fuller model than a clipper-built merchant steamer, and which, in addition to its large crew, with their provisions, etc., for many months, is obliged to carry a heavy battery, with ammunition, etc, can be propelled with the same economy of fuel as its rival in the merchant marine. But it cannot be denied that the sloops-of-war, which are the subject of these notes, will, when completed, compare favorably with any vessels of their class in the world. ENGINEER.

September 25, 1865.

[These engines are not of the class usually known as "back acting." They are direct acting horizontal engines, precisely similar to those used in factories every day.—EDS.

Correspondence

Steam in Long Pipes.

MESSRS. EDITORS:—In your paper of July 29th, in answer to a question from Mr. John C. Gardiner, in regard to length of steam pipes, you stated the case of the Gould and Curry Mine. Having been at that time the chief engineer and projector of the works in question, I will give you some facts.

The mine was worked through three tunnels—upper, middle and lower—with a respective difference in their levels of about 225 feet each. In consequence of a very heavy winter and the softening of the hanging wall of the mine, it became evident that the mine would cave or fall in; therefore it became necessary to project some other works which would secure the yield of the mine at a lower depth, outside or below the "cave." There was no shaft from the surface, so that there had to be put up temporary works in some secure part of the mine until a shaft could be put down from the surface. I then carefully considered the troubles arising from putting a boiler in the mine; and, on the other hand, the ease with which a steam pipe could be carried there from a boiler on the surface. In fact I had no other recourse as, if I put a boiler in the mine, I would have to use part of the old workings for a smoke-stack, but as that was going to "cave," I would then have had no smoke-stack at all, so I resolved to carry the steam 1,300 feet, which was the shortest available distance to the surface. I had no data to work on other than the knowledge that, in some coal mines in the north of England, they have carried steam six or seven hundred feet for accessory work, from lower levels than the main pumping level. It was "Hobson's choice" with me; but I was fully aware that I staked my reputation in the experiment.

The boiler was of the common Mississippi style—two flues of 42 inches diameter 26 feet long, and two flues 14 inches diameter, having also steam and mud drums. The steam was taken from the steam drum and passed through a superheater under the boiler—the same firing answering for both—and thence through a 4 inch gas pipe down an air shaft to the lower tunnel, where I had fixed an expansion joint and also an accumulator; this was a small boiler, 30 inches diameter and 5 feet long—its object being to catch water in case the boiler should foam, or to drain the pipe beyond. As the pipe raised gradually from this accumulator to the engine, with the grade of the tunnel, it was in just the right place. The length of the steam pipe in the air shaft was 201 feet. From the accumulator the pipe ran alongside of the tunnel, to a branch tunnel, to the engine room—600 feet long—in the branch tunnel—500 feet long—and up a slight incline to engine room, 40 feet more—making, in all, a steam pipe of 1,341 feet in length In the engine room was placed another accumulator, the same as the one at the bottom of the air shaft, but set on its end—the steam going in at its middle and out to the engine at the top. The object of this one was to catch whatever water might be carried with the steam, also scale from the iron pipes, and to form a kind of reservoir for steam; as the engine had a variable cut-off on, it acted as such to a considerable extent. On each of the accumulators, was placed one of Furman's steam and water traps, also a gage to note pressure.

The engine was made at the Vulcan Iron Works in San Francisco, and was a horizontal cylinder of 14 inches bore, 30 inches stroke, and was used cutting off at half stroke. It hoisted a bucket for sinking purposes, holding one tun of rock, in one shaft 200 feet deep; in another shaft a cage, with car and load weighing 3,000 pounds. The speed of hoist was 400 feet per minute; it also worked a pump of 8-inch bore, 4-feet stroke, with its machinery in the third shaft. The amount of water was not much—about half the capacity of pump, as the pump was going sucking about half the time. The trips of hoisting were made about every ten minutes, respectively—sometimes both were hoisting together. The hoisting apparatus was of the friction variety—the same as generally used in these mines; in all I think the engine had to do about 35 horse-power of work.

The steam pipe was 4-inch gas pipe screwed together with flanges at intervals of 100 feet For convenience of repairs, in every 400 feet there was an expansion joint. The pipe was anchored to the side of the tunnel in the middle of that distance, so that it expanded both ways from that point. The casing of the pipe was of wood, made of two by 12-inch plank—making a box of eight inches square inside, in the center of which rested the pipe on saddle pieces, the balance of space being filled with common wood ashes. The expansion of the pipe was very nearly two inches per 100 feet, from 60° to temperature of the steam at 80 pounds pressure. [325°, Eds., SCI AM.] The difference in pressure at the boiler from that at the engine, could not be detected; I changed the gages (Ashcroft's) from the boiler to the engine, but no difference could be found I even made two gages of gas pipe, half-inch, of common siphon shape, and filled them with mercury. I made them long enough to suit our working pressure, and still no difference in pressure between boiler and engine. I also made experiments without the superheater, and found no difference in pressures. The only loss was an increase in the amount of water trapped off from the pipes. The loss would then be one cubic foot per hour trapped off; with the superheater the loss was one third of a cubic foot per hour. The amounts trapped off were accurately kept; these figures are the average, and not the result of any one hour, although it never varied much from what is given. When the flow of steam through the pipes was rapid it was less; when slow, greater.

The fuel was common pine wood, using from three and a half to four cords per twenty-four hours—which will compare with any engine having short steam pipe and doing the same amount of work with the same kind of fuel. The engine ran in the mine over one gear, during which time I made numerous experiments with it. It is now out of the mine, as they have no use for it in there. It was a complete success, as it did more than was ever expected of it, and enabled the company to declare dividends during the "caved" condition of their mine

In conclusion, I would state that, as far as my experiments went, I see no end to the distance to which steam can be carried—it being merely regulated, more by the amount of condensation than by difference of pressure. I would not hesitate to carry it one mile, if I could cover the pipe well—that being the great point to be looked after.

ROBT. G. CARLYLE.

Virginia, Nev. Ter., Sept. 1, 1865.

Galvanizing Cast Iron.

MESSRS. EDITORS:—At some time during the past year I have read a series of interesting articles upon galvanizing iron, in your paper, but I have not seen any method or process which will apply to common cast iron. I find no difficulty with wrought or malleable iron, but the process which succeeds with these fails with common cast iron—the zinc or tin will not adhere. I have used first a bath of dilute sulphuric acid, after cleaning a bath of muriate of zinc; then immersed in the tin or zinc. This process fails, as above stated. Knowing you to be interested in all that pertains to the arts, I take the liberty to inquire what is the common process in use, or best process for galvanizing cast iron. E. D.

South Dedham, Mass, Sept. 18, 1865.

[We have made repeated efforts to obtain this information, but without success; and we print the inquiry in hopes that some of our correspondents may be able to send the directions required.—EDS.

Wire Bolting Cloth.

MESSRS. EDITORS:—For the information of G. W. Waskey and others, I place at your disposal my experience in the use of wire cloth instead of silk for bolting. In 1860 I purchased one of D. C. Anderson's atmospheric wire bolts, and put it in operation immediately, and have been using it constantly up to the present time. Its dimensions are as follows:—Length of cylinder, 6 feet; diameter, 20 inches; one-third is covered with No. 64; one-third, No. 74, and the remaining one third with coarser iron wire. Bolting chest and frame for gearing, all occupy a space 9 feet long, 3 feet wide, and 6 feet high. I bolt 10 to 15 bushels per hour, make a No. 1 article of flour, clean the bran, middlings and shorts in good order, use no cooler or conveyer, and give every man his own grain to within one peck—something that cannot be done where it has to pass through 30 or 40 feet of reel and over the same amount of conveyer. Wire, as a material for separating flour from bran is not known or not appreciated, or I think it would supersede silk cloth altogether. I have been in the milling business for twenty years, and have found nothing to answer the purpose for bolting so well for the same amount of money as the bolt described above.

I first used Nos. 74 and 84, and found them too fine for all kinds of grain; 60 and 70 are fine enough for any cloth for ordinary business.

B. A. HAYCOCK.

Richland, Iowa, Sept. 3, 1865.

Suggestion for a Cast-iron Statue.

MESSRS. EDITORS:—Do you know of any iron foundery where they make a casting to resemble a soldier standing "In place, Rest!" that is, the butt of the gun on the ground, one foot on the alignment, and the hands folded in front? I think such a design would be very appropriate for the top of a soldier's monument. There are founderies which cast figures to resemble animals, and I should think such a design would pay for the trouble. A. R. B.

Cherry Valley, N. Y., Sept. 28, 1865.

Shooting a Candle Through a Board.

MESSRS. EDITORS:—It is a well-known fact that a candle can be shot through a board; now if the board could be impelled against the candle with a velocity equal to that of the candle when shot from a gun, so that the relations of the two should be the same as in the first instance, at the moment of contact, what would be the result? J. W. P.

New York, Oct. 2, 1865.

[Doubtless the candle would be smashed.—EDS.

The Definition of Work.

MESSRS. EDITORS:—Mr. Nystrom seems extremely anxious to convince some one of the correctness of his peculiar definition of the mechanical term "Work." After an unsuccessful attempt against the *savans* of the country in the *Journal of the Franklin Institute*, he now tries, through the columns of the SCIENTIFIC AMERICAN, to urge his confusing ideas upon your readers. Permit me to offer a correction to any who has taken Mr. Nystrom's dose. As the definition is one in mechanical *science*, we will ask it of men of universally acknowledged preeminence in the scientific world. Prof. W. J. M. Rankine, probably, now stands first in his specialty—mechanical science. In his work on "Prime Movers" I find that "the action of a machine is measured, or expressed, as a definite quantity, by multiplying the motion which it produces into the resistance—or force directly opposed to that motion—which it overcomes; the product resulting from this multiplication being called 'work.'"

The high scientific attainments of Dr. J. R. Mayer have won for him the respect and admiration of the first scientific men of our age, and his wonderful success in ascertaining the mechanical equivalent of heat by mathematical investigation has won for him a place in history by the side of Newton and La