# Correspondence.

*The Editors are not responsible for the opinions expressed by their Correspondents.*

### Changing Pay Day.

*To the Editor of the Scientific American:*

By almost universal consent and usage, Saturday or Saturday night is the time when the great majority of working people are paid off. The custom, we believe, was imported from the European countries, where it has existed for an indefinite period. Lately, in certain sections of the Queen's dominions, the propriety of changing pay day from Saturday to Monday has been seriously discussed, and so far put to test as to conclusively prove the wisdom of the change.

The reasons specified were principally in the interest of the employed, who were habitually given to squandering on Sunday the wages in hand at the recurrence of the weekly holyday, thus perverting it into a mischievous holiday; but the result has also proved advantageous to the employers and to the community beyond, as will be shown.

First, as to the benefits to the employed: When they receive payment on Monday or Monday night, they have literally no time for carousal and debauching indulgences that would unfit them for the next day's work. Those with more self respect are not generally left with sufficient means, after providing for family expenses, to indulge in the numerous costly pleasures prepared in numberless blazing shop windows on Saturday nights, or which beckon in all directions on Sundays, in the form of excursions, sights, etc., which nearly always emptied the laborer's pocket of the small surplus that, if he were paid on Monday, would be more likely to get into savings bank, or, in some other form, provide for future comfort.

The good sense of reflecting people will approve this system and see, doubtless, what encouragement the change will indirectly be giving to the weak and wavering among our own population, that now find it so hard to deny themselves stimulants, finery, or foolish outlays by the score, when Sunday, with its leisure and opportunities for idleness, indulgence, and display is just at hand, and when the price of all they covet is just paid to them. The diversion of a large percentage of wages, now absolutely squandered on Sunday, might, by changing pay day, be at once secured to its proper and rightful appropriation, namely, the comfort of families that, under the present system, sooner or later come to want and beggary. I believe, further, that it would operate directly and disastrously upon liquor establishments and drinking places of every grade, for credit is not popular in such houses; the laborer is welcome there only when his money keeps him company.

Beyond these mere glances at the physical benefit to the employed and their now cheated families, and passing by the yet mightier moral effects herein involved, let us see what the employer and capitalist would gain by the change.

If labor is capital to a considerable extent, then a simple gain of reliable capital, in the shape of sober, rested workers, instead of sleepy, half drunk, enervated make believes, would be an item worth considering. The peace of mind following established confidence in the general sobriety and faithful appearance of the hands is an appreciable consideration, appealing to individual employers to try the change of pay day. The loss of time and the failure to meet contracts on account of the delinquencies of working men who despoil themselves over the Sabbath appeal to the credit of manufacturers, head mechanics, and all grades of employers to devise a new system alike beneficial to themselves, their patrons, and their employees.

I have the utmost faith that a simple measure that will "stand to reason," as this does, and that has been proved a success when tried, will arouse discussion in our own community, as well as elsewhere, and receive the practical approval of the parties most directly to be benefited.

Kingston, N. Y. M. M. S. F.

### Japan as a Field for Employment.

*To the Editor of the Scientific American:*

Several letters from America and Europe have been directed to me by parties in search of employment. I can only say, very briefly, that this country is already overstocked with foreigners out of employment. I should advise no American to come to Japan, unless he has a position secured before he comes. A man can do well here if he comes to Japan having been appointed in America. It gives him *prestige* over those who are trying to get employment here. As you see by the appended note [printed elsewhere.—ED.]. the English have the lion's share in the railroad undertakings, the Mint, the Lighthouse Department, the Navy, and in many other branches of enterprise. Yet the large majority of the unemployed foreigners here are English. In educational and agricultural matters the Americans take the lead, in military, the French, in medicine, hospitals, etc., the German.

In regard to men appointed to offices with high sounding names and large salaries, I am afraid many people will be disappointed concerning Japan. The Japanese simply want helpers and advisers. They propose to keep the "bossing," officering, and the power all in their own hands. Some disappointment and a little profanity has been indulged in by certain people who deceived themselves by supposing the flattering Japanese to mean all that their polite words said in America. All this "taking charge of," "being at the head of," "organizing," etc., is shear day dreaming. People from America and Europe must remember that "there were brave men before Hector;" and a few foreigners have been laboring in Japan for years, and with knowledge of the language, etc, have helped the Japanese to help themselves. Many who come here to "organize," etc., find that things are already organized as much as they can be under the circumstances, and that all that new comers can do is to wait quietly until perchance they gain the confidence of the Japanese, and even then all they advise is by no means adopted. Nearly every appointee comes here to "revolutionize" his department, but the Japanese don't want that. They want the foreigners to get into the traces, and pull just so fast as, and no faster than, their mighty enterprises can bear. Let it not be forgotten that this country is an emphatically poor country now, and that millions of its people are very ignorant, and that it has just emerged from feudalism; and that therefore the rulers of Japan must go slowly and cautiously. Above everything else, it is not wise to put their soil or their enterprises too much into foreign hands, and to prove that Japanese nature is human nature, they like to do it themselves, to play with their own toys, and to run their own machines. Therefore, if a man means real hard work, that takes off its coat, and is willing to run the risk of going hungry occasionally, and if he has patience enough to wait until an experience-taught people can trust him, and if he isn't a born brigadier general, and is willing to help without "taking charge" of everything, let him try Japan. If he expects that the Japanese people wish to make him a Secretary of State, or Minister of Education, or Postmaster General, etc., he had better stay at home, because the Japanese people like to be officers themselves, and are neither children nor weak minded. Neither exaggerating nor discouraging, I remain, Mr. Editor,

Yours very truly, W. E. G.

Yedo, July 19, 1872.

### Ball Lightning.

*To the Editor of the Scientific American:*

In reference to J. H. P.'s letter upon lightnings, on page 148, let me say that in midsummer, several years since, there was an exhibition of this kind of lightning. I was at a farm house in northern Ohio; a black cloud hung over a wood, perhaps a hundred rods away and directly across the road in front of the house. Another cloud hung directly over or a little back of the house; both clouds appeared to be unusually near the earth. My position was on the "horse block" between the two clouds. Suddenly a ball of light, dazzlingly brilliant, rushed from the cloud over the wood, passing directly over my head, and disappeared with a loud report in the cloud over the house.

Under the impulse of the moment I ran into the road to get a better view of the destination of the ball; while others present ran into the house and locked the doors, so violent and so very near seemed the noise. J. H. P. may depend (and it can be proved satisfactorily) that the above is "testimony worthy of credit," as far as dazzled eyesight, backed by a cool head, can determine. C.

Cleveland, O.

### The Remarkable Gas Well at Painesville, Ohio.

*To the Editor of the Scientific American:*

Having recently spent a few days at Painesville, Ohio, I visited the celebrated gas well of General J. S. Casement, located on the farm of the Hon. C. C. Jennings, about one mile from the city.

Our party, in charge of Mr. Daniel Casement, brother of the General, arrived at the place just as the lamps were being lighted, and were most cordially received by Mr. Jennings, to whom we made known the object of our visit. We were shown into the sitting room, and were soon seated around one of the fireplaces common to many primitive western homes. Before us was, to all appearances, a small wood fire. Upon inspection, however, our wood proved to be imitation logs, made of metal, and the fuel, gas. By the turning of a small stop cock at the side of the fireplace, our genial fire became a roaring flame, making it almost uncomfortable for us in the farthest part of the room. We next proceeded to the kitchen, where we found that all the cooking was done by the same agency, the gas being introduced into the range, and consumed through peculiarly constructed burners. These burners are arranged in six parallel lines, about one inch apart, and cover about two thirds of the fire plate. The form of the burners resembles the argand in construction. Passing from the old to the new house (which, by the way, though unfinished, is considered to be one of the most complete structures of the kind in the State and, we doubt not, in the West), we here found nearly all of the rooms arranged to be heated by steam and containing also fire places and firelogs. We now descended to the basement to inspect the furnace. The burners used here are the same as in the range, but greatly multiplied. The roaring of the flames under a full head of gas was awfully grand. After the fire was extinguished, the gas was again turned on, to show us the nature of the article. The smell resembles that of the most refined kerosene oil, yet it is not at all offensive. It has not yet been analyzed, therefore I am unable to state its constituent parts.

As to the origin of the well, Mr. Jennings informs us that he had long been convinced that gas was to be found, and that some two years since operations were commenced, but were abandoned on account of the flow of water. Soon after, the second attempt was made, upon higher ground, which proved successful. The first fifty feet were through light sand and gravelly soil, and at this depth the soapstone rock was reached. An eight inch pipe was then sunk, and boring through the rock commenced. At a further depth of six hundred and fifty feet, the vein was reached and the gas has continued to flow to the present time. No receiver or gasometer is used, but the gas is carried through a three inch pipe immediately to the house, some two hundred feet distant.

To give you some slight idea of the supply furnished, I will mention one fact. During the past winter, it was found necessary to keep large fires in the new house. There were thirteen of these, each consuming about the amount required for 150 of our common burners, and were continually burning night and day, without any apparent diminution.

A recent scientific test has shown that the pressure of the gas is 40 pounds to the square inch, and it is further estimated that there is a sufficient quantity to light the whole city of Cleveland.

There is one remarkable feature in connection with this, well deserving more than passing mention. While all the wells discovered have been more or less troubled with a flow of water, thus requiring pumping, Mr. Jennings states that, from the commencement to the close of the work, there has never been a drop of water in the well, and the engine used in drilling, and also designed for the purpose of pumping if required, has never been in operation since the well was completed.

I can assure your readers, if any of them find it convenient to visit the well, of a most hearty reception from Messrs. Jennings and Casement. They will find ample compensation for the trouble of a journey thither. M.

### Sheet Lightning.

*To the Editor of the Scientific American:*

After carefully watching, for many years, what is called sheet lightning, I have never been able to make any distinction between it and so-called zigzag lightning. Sheet lightning is simply lightning at such great distance from us that we neither see its zigzag movements nor hear its thunders rolling. After sunset, should a thunder gust be on its march toward us, the first indications of it we see are its sheet lightning flashes and flickerings among the distant clouds. Bye and bye the blackening smoky looking clouds begin to loom up and travel toward us; then, shortly after, we hear the rolling sounds of distant but approaching thunder; and finally we hear the sharp alarming peals, and often see the zigzag movements of the fiery bolts, or electric charges, of the warring elements, flying from cloud to cloud.

Gloucester, N. J. JOHN HEPBURN.

[For the Scientific American.]

## PORTABLE MEDICAL BATTERIES.

BY PROFESSOR GEORGE W. RAINS, OF THE MEDICAL COLLEGE OF GEORGIA.

The want of a small sized galvanic battery which can be easily carried about in the hand, and which at the same time is of sufficient power to fulfil all the requirements of the general practitioner, has long been felt; and it is continually growing more urgent, as the medical application of electricity becomes more extended. The apparatus now employed, whether it be that of Grove, Bunsen, Daniell, Smee, Siemens, Stöhrer or others, or their modifications as constructed in this country by Kidder, Drescher, Chester or the Galvano-Faradic Manufacturing Company of New York, has always the same inherent difficulty, when of sufficient power, of being too weighty and bulky to answer the requirements of easy portability, however excellent each may be for office use or laboratory purposes.

The Faradic instruments, for giving induced shocks by helices, have arrived at a high degree of excellence within the past few years, and may be considered as sufficiently answering all the requirements of portability and service, whether of the specialist or the general practitioner.

The principal difficulty heretofore existing in the construction of a small and sufficiently powerful galvanic battery has been in the well known law that quantity is proportional to the extent of active surface of each element, while intensity, energy, or power of penetrating and overcoming resistances is proportional to the number of elements employed. Thus it would appear that a battery of sufficient intensity to effectively pass its current through the human body must have many elements; and these must be of considerable size to give out the necessary quantity for all purposes of medical treatment.

So we have Siemens' modification of Daniell's battery for office and hospital use, composed of 60 glass jars from 5 to 6 inches in diameter by 7 or 8 inches high, containing the zinc and copper elements. Hence, from the apparent nature of the case, it has been assumed impracticable to construct a small battery, for portable use, having at the same time sufficient quantity and intensity.

This has been greatly to the detriment of the employment of the galvanic current, continuous or interrupted; for the larger number of cases for electric treatment require necessarily to be acted upon at the residences of the patients, and not at the office of the physician, where the necessary batteries are available. The high value of the galvanic current and its superiority to the Faradic in many cases are now well established, to say nothing of those instances where it is indispensable.

Such being the condition of things, the question arises as to the possibility of overcoming the apparent difficulties in the construction of a small, simple, readily portable battery for general medical use. Towards the solution of this problem I have devoted much time during the past year, and I will here state the principles which appear to evolve from my experiments.

First—That the electricity given out by any single element is composed of a number of rays or currents of different intensities.

Second—That a single element, even if of large size and in energetic action, has but a very small number of such rays or currents of the comparatively higher intensity.

Third—That only the rays or currents having the higher intensities pass through resistances.

Fourth—That an equal number of rays, or an equal amount of electricity, of sufficiently high intensity to be able to overcome a certain resistance, can be generated either by a large battery or by a smaller one having a greater number of elements.

Thus let it be assumed that, in a certain galvanic series, there are 100 rays or currents of different intensities given out by each element, of which only the ray of highest intensity, A, is able to pass through or overcome a given resistance; then only $\frac{1}{100}$ part of the total amount of electricity is available for such purpose. Let it also be assumed that there is another similar series composed of elements of one quarter the size of the former. Then, instead of the full amount, A, only one fourth of A, supplied by this new series, will be able to overcome the given resistance; but the series may be increased by such an addition of new elements that the next lower rays, B, C, and D, may be raised to a sufficient intensity to be able also to pass through the given resistance. Now each ray is assumed to be equal in quantity with any other ray, hence $\frac{1}{4}$ (A+B+C+D)=A. Then the new series of smaller elements supplies exactly the same amount of electricity as the series of larger elements after passing through the resistance. The intensities, however, of A, B, and C, in the new series, have each been raised evidently above that of A in the first series; so the series of small elements has not only supplied an equal quantity of electricity under the conditions, but also electricity of higher tension than that of the series of larger elements.

It is known to physicists that the exact measure for the quantity (motive force) of galvanic electricity generated in any case is the amount of chemical action which takes place; and this may be represented by several methods, by the total amount of zinc dissolved, by the amount of water decomposed by the current, by the amounts of metals deposited from solutions, or by the deflection of the needle of the galvanometer, etc. Let us now apply this to the construction of a small galvanic battery, having a considerable number of small elements which shall give out, after passing the currents through a great resistance like that of the human body, the same amount or quantity of electricity as that supplied by a much larger battery having a less number of large elements.

Thus, for example, take 20 cells or elements of a medium sized Grove's battery in fair action, and pass as much of the general current through the body as can be endured without too much discomfort, by holding wetted metal electrodes in the hands and interposing the resistance of a short column or stratum of water in the circuit; interpose also a delicate galvanometer, and mark the number of degrees of permanent deflection of the needle, which will settle, we will suppose, at 40°. Repeat the experiment, retaining the same conditions carefully, with the 32 cells of a modified Stöhrer's battery supplied by the Galvano-Faradic Manufacturing Company; the needle will settle also at about 40°. Perform the same experiment under the same conditions with the small portable battery presently to be described; the needle will again be deflected permanently to 40°. In each one of the foregoing cases, after passing the constant current through the body, cause it to pass into water slightly acidulated, by means of two platinum wires (electrodes) passed through a cork and immersed to the same extent in each trial; collect the evolved gases in a quill glass tube drawn out to a capillarily closed extremity; the volume of the gases will be found the same in each experiment. Perform similar experiments with the three batteries by passing the respective currents through about one half inch stratum of rain water without passing through the body; the comparative results will remain substantially the same. If, in the above cases, the currents be passed through albumen (white of egg) or freshly drawn blood, the amount of coagulation will be found about the same for each battery.

From the above experiments, it may be fairly inferred that the three batteries evolved the same amount of galvanic motive force; hence either might be substituted for the other in medical use, since in all such applications of electricity the current must pass through some portion of the human body, thus encountering great resistance.

The total amount of zinc surfaces (both surfaces included) exposed to the action of the exciting liquids in each of the three batteries may be approximatively stated to be 1,000 square inches in the Grove, 200 square inches in the Stöhrer, and 49 square inches in the small battery, the number of cells being 20, 31, and 49, respectively.

Thus it would appear that a small portable battery has been constructed just as effective for all medical purposes as those of the largest size usually employed, indeed one which not only gives out an electro-motive force of equal quantity but of superior intensity.

I am convinced that the large Siemens battery of 60 glass jars is no exception to the above conclusion, although I have only been partially able to make a comparison for the want of a proper battery. In this, the action of the exciting liquid is comparatively feeble, the distance between the zinc and copper plates being some three, four, or more inches; while in the portable battery in question, the exciting liquid acts energetically, and the distance between the opposed zinc and platinum plates is but 3-16 of an inch. The electromotive force of any galvanic arrangement is a function, not only of the size and number of the plates, of the kinds of metal opposed and of their distances apart, but also of the energy of action of the exciting liquid.

The office and hospital batteries, however, will probably never be replaced by any portable apparatus, however equal or even superior it may be in power, for the simple reason that the zincs and liquid will require much more frequent renewal in the latter; for equal amounts of motive force, equal amounts of zinc must be dissolved and liquid consumed.

The specialist and general practitioner will necessarily require both kinds of batteries; but in any case where but a single battery is employed by a physician, the portable one would appear to have much the advantage. This one, having 49 elements actively excited, has such high intensity that it answers admirably for giving the interrupted current, which hence is able to penetrate to the deepest muscles and tissues; and the battery is, moreover, useful to supply the constant current.

A more particular description of this battery, as constructed by myself and used daily for the past ten months, will now be given. The metal strips used are zinc and platinum as before stated; but carbon could be employed in place of the latter, if the cells be made somewhat larger. The zincs are 2½ inches long, ½ inch broad and ⅛ inch thick; the platinum strips are 2 inches long, ¾ inch broad (crimped to one half inch) and of thin foil; both metals are immersed to a depth of 1¼ to 1½ inches when in full action, which is rarely required, generally from ¼ to ½ inch immersion being all that is necessary.

The strips of zinc and platinum are united by copper strips in the shape of the letter U inverted, the platinum being soldered to one extremity, and the other being so made as to lap partially around the end of the zinc which is retained in place by the spring in the copper laps. These copper strips are ½ inch broad, and 1⅝ inches long, made in the form of the letter T before being bent, the top of the T forming the laps to retain the zinc. The zinc and platinum strips, being thus united, are respectively passed through corresponding rectangular holes made in a square piece of hard rubber (wood might answer), 6½ inches in dimensions by ⅜ inch thick; this plate has a rod in its center by which the whole is readily raised or lowered, so as to give the proper immersion, into a square trough of hard rubber forming 49 separate cells; these cells are ¾ inch square inside, and 2¼ inches deep. Thus the battery, with the metal strips immersed, occupies a space only 6½ inches square by 2¾ inches deep. For service, however, the whole is enclosed in a thin box 6½ inches square inside by the same hight, open at both ends and slipping easily down over and enclosing the trough, to which it is attached by pins. There is a stiff strip of hard rubber (or metal) loosely placed across the upper part of the box, having a hole in its center; through this, the rod sustaining the hard rubber plate with the attached metals passes, moving freely up and down, and held by a set screw at any required depth of immersion of the zinc and platinum couples. The zinc strips are readily replaced from the top of the rubber plate by simply pushing out, downwards, the worn out one by means of the new one which takes its place; the zincs, being well amalgamated, form a perfect connection with the copper strips without the aid of a screw. The platinum strips of course never require renewal, and are never disturbed after once being placed in position. The exciting liquid is the same as that used in Stöhrer's battery, being a solution of bichromate of potash in dilute sulphuric acid. To fill the trough with liquid, the pins are removed and the box lifted clear from it; then, the trough being placed in a dish, the liquid is poured over it in a large stream, filling all the cells at once, the excess passing over into the dish. The trough is then raised up on one side to a considerable angle to permit a portion of the liquid to flow out from the cells; and being wiped with a cloth, it is placed on a table and the box containing the metal strips is slipped over it, and the battery is ready for use; no more time is taken than would be required to fill a single large cell. This facility in replacing the worn out zincs and renewing the excited liquid is indispensable for the practical working of small batteries; otherwise they are soon thrown aside, from giving too much trouble when frequently used. In a daily use of this battery for one half hour for interrupted current, the zincs have lasted two months and the liquid over two weeks without renewal. It is important that the liquid should not fill the cells, so as to wet their top surfaces when the couples are fully immersed, and that there should be no cracks in the cell partitions; otherwise the high intensity will establish currents along such conducting channels to the great loss of power and waste of materials; for the same reason, the hard rubber plate must not be wetted, which can only happen from carelessness.

By a simple arrangement, any number of cells from 1 to 49 can be brought into action; a pole changer and current interrupter being added makes the battery complete. The entire weight of the battery is about the same as that of a good Faradic instrument, such for example as No. 4 of the Galvano-Faradic Company's manufacture; and it is equally as portable.

In case zinc of the required thickness cannot be had for the strips, they are readily made from the common thin sheet zinc, by cutting slips ½ an inch broad and 12 inches long and doubling up the two ends compactly so as to form a total of six thicknesses; such strips when amalgamated become a solid mass. The trough might be made of vulcanized rubber, gutta percha, or even, for a temporary purpose, of thin wood or pasteboard dipped into melted paraffin, getting a coating of the latter of about 1-16 of an inch around the walls of each cell.

Grove's battery of 20 cells is referred to as a unit of comparison on account of its well known power, being sufficient probably for all medical purposes; Stöhrer's modified battery of 32 cells, as perhaps the best, taken all in all, for office use that has ever been constructed.

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ON the morning of the 12th June, a large aerolite fell in the province of Musashi, during a violent storm. The stone sunk some five feet into a paddy field; where it fell, it has the appearance of having been red hot. It is to be removed, says the Yedo *Herald* to one of the Yedo exhibitions.

### A New Telegraph Line between England and New York.

The success attending Atlantic telegraphy has made people express wishes for more cables and reduced tariffs—the latter being so high as to be somewhat exclusive,—and to enable the public to send messages at a less rate, the Great Western Telegraph Company was projected for the purpose of laying, during the course of next year, a cable from England to New York *viâ* Bermuda. This endeavor so far succeeded that the public took the matter up, and a contract was signed with Hooper's Telegraph Works for the manufacture and the laying of the cables, which are now in course of construction.

The following particulars are given in *Engineering:* The proposed route for the cable is entirely new. The cable will start from a convenient point at the Land's End to the island of Bermuda, and from thence to New York. From Bermuda, a cable will in the course of time be laid to St. Thomas to connect with the network of West Indian cables, and there are subsequent intentions of connecting Bermuda with the coast of South America, which route is stated to possess the great advantages of connecting Brazil both with England and with New York by direct lines. The distances are as follows: Land's End to Bermuda, 3,225 knots; Bermuda to New York, 762; total, 4,953.

In the existing Atlantic cables, the insulating medium is that of the well known and generally used material, gutta-percha. In the present instance, however, the directors have decided to employ india rubber in that form known as Hooper's material, as the insulator for their cable. Hooper's core has of late years been largely adopted, as for instance, for the Persian Gulf cable, the various English cables belonging to the Great Northern company, and more recently the China and Japan extensions. The success of the present cable, being the longest stretch of cable yet attempted, will prove of material moment in the great question of gutta percha *versus* india rubber.

Conductor.—The conductor consists of a strand of seven tinned wires of annealed copper of the best quality and manufacture, and the resistance of a nautical mile will not exceed 4·3 ohms at the standard temperature of 75° Fahr.; this represents a conductivity of 92½ per cent of pure copper. The copper strand will weigh for this section 300 lbs. per knot.

Dielectric.—The conductor will be insulated with Hooper's material to the weight 250 lbs. per knot. This may be briefly stated to be pure rubber next the wire, a separating medium then coatings of vulcanized rubber, and finally a jacket, the whole process being peculiar, but representing finally a compact insulated core.

The insulated conductor, or core, is protected with a serving of india rubber felt, and subsequently with a serving of jute yarn, in quantity according to the requirement of the various types of cable.

The manufacture of this cable progresses steadily. Sir William Thompson and Professor Fleeming Jenkin are electricians and engineers to the company.

### Statistics of the Iron Industry.

The ninth census gives the following information relative to the iron industry of the United States, for the year ending June, 1870:

Pig iron, 386 establishments, 574 blast furnaces (with a daily capacity of 8,357 tuns melted metal) employing 27,554 hands, producing 2,052,821 tuns of pig, of the value of $69,640,498.

Bloomary forges, 82, employing 2,902 hands, producing 110,808 tuns of blooms, of the value of $2,765,623.

Founderies, 2,653, employing 51,297 hands, and producing to the value of $99,837,218.

Forges, 103, employing 3,561 hands, and producing to the value of $8,147,669.

Establishments producing bar, rod and railroad iron, nail, plate, etc., 309, employing 44,643 hands, and producing to the value of $120,301,158.

### Condensing Liquid Steel.

At the Austrian Steel Works, of Neuburg, Styria, Chevalier Stummer, of Trauenfels, has carried out a large series of experiments in order to weld the interior particles of cast steel to each other as strongly as possible, and to prevent the honeycomb, which is an accumulation of fine pores, filled with elastic gases which are inclosed in the cooling metal. The principal result of these experiments is that it is quite possible, by exposing the semi-fluid metal to great pressure, to unite all the pores within a very limited space in the center of the steel block. This fact is of the utmost importance in the manufacture of heavy steel ordnance, which is intended to bear the strain of very great charges, as in that case it is just the central part of the barrel which is bored out and the perfectly sound part of it left to form the wall of the gun. Thus a pressure of from 6 to 9 tuns on the square inch will be sufficient to compress a red hot steel ingot before its solidification, and give it an even structure throughout the whole mass, while the impact even of a very heavy steam hammer, like Krupp's 50 tun hammer, is principally spent on the outer part of the block, and the result will be the absorption of the power before it reaches the center, and the exterior of the mass will be elongated and cause the tearing asunder of the central part. Only very heavy hammers or rams will effectually overcome the *vis inertiæ* which a very heavy casting opposes to them.

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MESSRS. J. A. SAKES & CO., of New York city, have made a contract to furnish to the United States Navy two hundred thousand pounds of pickles for seventeen thousand five hundred dollars.