Scientific American.

MUNN & COMPANY, Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW (PARK BUILDING), NEW YORK.

O. D. MUNN. S. H. WALES. A. E. BEACH.

☞ "The American News Company," Agents, 121 Nassau street, New York

☞ "The New York News Company," 8 Spruce street.

☞ Messrs. Sampson Low, Son & Co., Booksellers, 47 Ludgate Hill, London, England, are the Agents to receive European subscriptions or advertisements for the SCIENTIFIC AMERICAN. Orders sent to them will be promptly attended to.

☞ Messrs. Trubner & Co., 60 Paternoster Row London, are also Agents for the SCIENTIFIC AMERICAN.

VOL. XVII., No. 23....[NEW SERIES.]....*Twenty-first Year.*

NEW YORK, SATURDAY, DECEMBER 7, 1867.

Contents:

(Illustrated articles are marked with an asterisk.)

THE IMPORTANCE AND DIFFICULTY OF THE PUDDLING PROCESS---LATE IMPROVEMENTS IN MECHANICAL PUDDLING.

Of all the processes in the manufacture of malleable iron, from its existence in the ore to its delivery in merchantable shapes, that of puddling is not only the most laborious and difficult, but it is probably the most important. It is in this stage of its manufacture that the quality of the iron is determined to a very great degree; no matter how excellent the pig may be, either unskillfulness or carelessness in this process will spoil the quality of the product. Those who have never seen a puddler at work, standing, as he is frequently compelled to do, from one half to three quarters of an hour before a partly opened furnace door, can scarcely form an idea of the severity of this labor. So onerous is it, that it is with great difficulty that men can be found fit for this duty, both on account of its tax on their powers of endurance and also because of the skill required in the manipulation of the partially molten metal.

The writer has seen many instances in his experience, of puddlers actually dropping down before their furnaces, prostrated and exhausted by the heat, and in one large iron establishment, numbers of these men are continually incapacitated for work by the exhaustive character of their labor. Many of them instead of feeling brisk and in good spirits in the morning before commencing their day's work actually dread returning to the works, knowing very well what suffering they will have to go through before a day of toil is finished. What makes this labor more unbearable than it otherwise might be, is the fact that it is only a part of the puddling process that requires skill, at other times the puddler is merely exhausting himself by performing manual labor.

The object of puddling, it may be well to observe, is to expose the partially liquid iron at a sufficiently high temperature, to the oxygen passing through the furnace, so that it may be deprived of its carbon, and it is in this part of the operation that the mass requires incessant stirring in order to bring every portion of it under the influence of the fire. Thus far but comparatively little skill is necessary, but when at the latter part of the operation the iron acquires a pasty consistency, the skill of the workman is demanded to form the pasty mass into the required number of balls for the rolls, squeezer, or hammer.

One of the results aimed at in the puddling process is to bring the iron up to the "boil," as it is termed, while the furnace is at its greatest temperature, and to accomplish this the most rigorous and incessant stirring is necessary, but during this stage so exhausting is the drain on the powers of endurance of the workman, that the closest oversight will not prevent him from adopting means to lower the heat of the fire, to which he is exposed, by lowering the damper, and to hurry the iron into an improper boil by throwing upon it wet slag or refuse. It is almost unnecessary to say that this treatment, if it does not ruin the product of his labor, so deteriorates it as to make what is termed cold short, a comparatively useless iron. Those who have visited iron works can scarcely fail to notice that the workmen close the dampers, in many instances as soon as the iron is melted, at the very time the highest temperature is required to carry off the superfluous carbon and other impurities. We have thus spoken at length of the puddling process in order to show its great importance and the difficulties attending it when it is carried out as it should be in order that the best quality of iron may be produced; and the reader can now fully appreciate the vast importance of the application of mechanism to this department of iron manufacture, in order not only that the puddler may be relieved of that part of his labor which requires but little skill, and that the iron may be effectually stirred while the furnace is burning its fiercest, but also to enable him to give more attention to the latter part of the operation where his skill is most required.

Several plans have been advanced to accomplish this end, and of those which we have seen, that of Morgan, of England, appears to be the most practical and to have fewer objections than any other. That a description of this apparatus may be clear to those of our readers who have not given attention to iron manufacture, we will state that the process of puddling is carried on in what is known as a reverberatory furnace; that is, one in which the material to be subjected to the heat of the fire is not brought in contact with the fuel, but is placed on a sort of hearth a short distance in front of the furnace grate, between which and the material a bridge wall intervenes. This bridge and the top of the furnace is so curved that the flame of the fire urged by a powerful draft impinges on the substances placed on the hearth. In the present case the iron is placed there and it is through a door opening upon it that the puddler performs his manipulations.

In the apparatus of Morgan a vertical shaft passes through the top of the furnace directly over the center of the hearth where the iron is placed. Fastened to the bottom of this shaft, which is kept revolving by means of bevel gearing driven by steam power is an arm fitted with four fangs or prongs, each one about the size of a puddler's "rabble." These prongs stir the iron by moving at the necessary speed, when it is in a liquid state, and thus purify or refine it much more thoroughly than can be accomplished in the ordinary way by a man poking the mass through a partially opened door. There is no necessity, by this method of closing the dampers, to reduce the draft because no one is annoyed by the unendurable temperature, but the furnaces can be urged to their utmost, and that, too, at that stage of the process which requires the greatest heat. As soon as the iron acquires its pasty consistency the mechanical "rabble" or stirring iron is withdrawn by the assistance of the usual balance weights through a hole in the top of the furnace which is closed by a fire-brick stopper. After it is withdrawn it is immersed in a tub of water which is moved to the proper place by a truck running on a track, and the stirring tool is ready for the next batch of iron. As this mechanical rabble revolves in a circle it will be seen that the hearth of the furnace, where the iron is placed, will require to be changed from the usual oval to a circular shape. This is, however, a change very easily made and one which in new furnaces would not increase the cost of construction.

To recapitulate what we have already partially stated, it will be seen that this contrivance is a step in the right direction, and if practical difficulties are not found to exist to prevent its application, the process of puddling will not only be rendered much more perfect as regards the quality of the product, but the labor of the puddler will be shorn of its horrors, and no doubt the number of heats that he is now able to get out in a given time will be increased to a very considerable extent; and still further, workmen of intelligence who would now shrink from the terrible labor of a puddler, would no doubt gladly take up with this department of iron manufacture. The consequence would certainly be a great increase in the quality of wrought iron and would perhaps enable it to hold its own in some of those branches of the arts where steel is now disputing the supremacy. We are not among those who think that steel is destined to entirely supersede wrought iron; the fibrous and ductile character of superior wrought iron has not yet been reached by the steel makers, except perhaps in rare instances, and then a considerable quantity of a uniform character could not be counted on.

There are several directions in which the successful introduction of mechanical puddling will lessen the expense of iron manufacture, among which is the saving of what is technically termed the fetling lining of the furnace; the longer the iron remains in a liquid state the more will this lining be eaten away and the iron must of course remain longer in the liquid state by the old method than by the proposed mechanical process, for the reason that by the former a very much longer time must be taken to stir it sufficiently to deprive it of its impurities than by the latter, where the stirring may be much more powerful and efficient. Before taking leave of this interesting and important department in this great industry, we must say that we cannot call to mind anything in the mechanical line which demands improvement more than the process of puddling.

A REMARKABLE SUMMER EXCURSION.

One pleasant morning last June, a goodly company of ladies and gentlemen—some 75 in number—embarked from the foot of Wall street, New York, on the fine steamer *Quaker City*, for an excursion to that most attractive of all parts of the world, the Mediterranean. Along its classic shores they coasted during the entire season, visiting every memorable and interesting place. Oftentimes they made diversions to the interior; but they were usually glad to escape from the land heats of the day, to enjoy cool and refreshing sleep on board the ship at night. They first landed at the peninsula of Gibraltar, and some of them journeyed thence through Spain, France, Switzerland, and Italy, joining the ship again at Naples. Thence they passed on to Athens, Constantinople, Sebastopol, and Odessa, at which latter place they visited the Palace of the Emperor of Russia, by whom and his interesting family they were most cordially and splendidly entertained. Returning they visited Smyrna, Beyrout, Jaffa, Damascus, Jerusalem, Sea of Galilee, the Dead Sea, Thebes, Alexandria in Egypt, the Nile, the Pyramids, Algiers, Malta, Cadiz in Spain, Madeira Islands, and the Bermudas, arriving safely home, a few days ago, after an absence of only five and a half months. It is one of the most novel, remarkable, and successful excursions that we remember to have heard of. There were no accidents, no sickness, every place laid down in the programme was faithfully explored, and not a single rainy day interfered with the projects of the party. How much more rational to spend a summer among such interesting and wonderful scenes, filling the mind with useful knowledge, than to be cooped up in a hot hotel at some fashionable watering place. The excursion we have described was projected and commanded by Capt. Duncan, of Brooklyn, N. Y. The complete success of this first enterprise will, we trust, encourage him to a renewal every year. As soon as the Pacific Railroad is completed a pleasant summer excursion may extend from New York to China, Japan, and back.

PATENTS IN CANADA TO AMERICAN CITIZENS.

We are glad to see that the subject of amending their patent laws is about the first thing that engages the attention of the New Canadian Parliament. A telegram from Ottawa dated the 22d says:

In the House last night the following notice of motion was given: Whether it is the intention of the Government to extend to citizens of the United States the same facilities for obtaining patents in Canada that are afforded to citizens of the Dominion, and whether the privileges to order patents now enjoyed by the United States in the Province of New Brunswick are to extend to other parts of the Dominion.

In addition to the above we have private advices from prominent citizens in the Provinces stating that there is but little doubt but that a bill will pass early in the session extending the same rights to citizens in the States to obtain patents as is accorded to residents of Canada.

Mr. Legge has favored us with a copy of his pamphlet showing the importance of a radical amendment in their laws. He says:

Among the British Provinces in America, we find that New Brunswick and Newfoundland have wisely shaken off the shackles of prejudice and exclusiveness, and allow all foreigners to obtain patents on the same terms as are granted to their own citizens. By this arrangement, the inhabitants of these colonies or provinces are permitted to obtain patents in the United States for the reduced fee of $35, in place of the discriminating fee of $500 charged to the inhabitants of Canada, Nova Scotia, and Prince Edward Island, in return for their exclusiveness in not permitting American citizens to obtain Letters Patent on any terms, even by the payment of an equally large fee.

The United States Patent Law is so framed that as soon as we cease to discriminate against their citizens in the granting of patents in the Dominion of Canada, their fee at once drops from $500 to $35, without additional legislation.

The proposed change in our laws, by which this good result would be obtained, will at once open a market of 35,000,000 of enterprising, wealthy, and speculative people to our Canadian inventors, as all wishing to apply could afford to pay the lesser fee of $35, while but few can pay, in the first instance, the larger fee, $500. In return for 35,000,000, given to our inventors, we give theirs but about one-tenth the number, and as our inventors, as a class, will equal, if not excel, those of the United States, in point of ability, we have a large margin in our favor, by the proposed alteration. From this it is evident that if in the new law we adhere to the exploded exclusive principle, it will result, to use a common but forcible expression, in "cutting our own throats," without doing much harm to our neighbors.

Evils of Tight Lacing.

Sometime ago the death of a young lady passenger, Miss Stainsby, in one of the cars of the London underground railway was reported, caused, as then alleged, by suffocation, due to the bad state of the air in the tunnels. A legal investigation ensued from which it now appears that one of the causes of her death was tight lacing.

Prof. Rodgers, lecturer on medical jurisprudence and on chemistry, was the first witness, and at his request the evidence of Dr. Popham as to the appearance of the body was read to him.

Dr. Popham added that he had found the deceased was tightly laced, and that the result would be to compress her chest and impede the free action of her lungs.

Prof. Rodgers said he had examined samples of air taken on four different occasions from the tunnels of the Metropolitan Railway, and also from various other tunnels. The air in its pure condition contained 2,080 volumes of oxygen per 10,000, and from 3·7 to 6·2 of carbonic acid. On the 4th of September he found that in the worst tunnel (*i. e.*, Gower street), there were 1,870 measures of oxygen, and there was but a slight trace of carbonic acid. The highest amount of carbonic acid he had found on any one occasion was 18·7 per 10,000; but the atmosphere of a theater four feet above the stage was 23·7. The slight deficiency of oxygen which he found would not act injuriously, even upon delicate persons, passing as they did, rapidly through the tunnel in trains. Thought that under the circumstances under which the deceased had entered the train—that was to say, considering that she had eaten heartily, was tightly laced. had diseased heart, and was already faint before she entered the tunnel—her death had resulted from natural causes. The jury heard other evidence, and then, without hesitation, brought in a verdict:—"Died from natural causes."

PETROLEUM TRIALS—We trust that soon we shall be favored with exact information respecting the trials under government patronage of petroleum as a fuel for generating steam in marine boilers. The Chief of the Naval Bureau, B. F. Isherwood, will give these results in the Annual report of the Secretary of the Navy, and a more complete technical report, with full details, drawings of the boilers, etc., will be published in a few months afterward.