mended. In the course of four or five days or in a week at the farthest, the original pain ceases, the swelling subsides and the patient is able to walk. Naught remains but the hardened protruding flesh, which falls away about a month after the application of the sesquichloride of iron. These are the results yielded by this method in four soldiers suffering from the growth of the nail into the flesh."

HOW A RIFLED MUSKET IS MADE AT THE PROVIDENCE TOOL COMPANY'S ARMORY.

When the war for the preservation of the Union first broke out, there were not wanting stout hearts and willing hands to defend our imperilled liberty. So well had the measures of the arch traitors who inaugurated the strife been taken, that when our armies were to enter the field, it was found that hardly a tithe of the required number of muskets were to be had, our usual quotas having been transported South many months previously. In this dilemma the only resource was to look abroad, and large quantities of arms were imported from Belgium, and other countries.

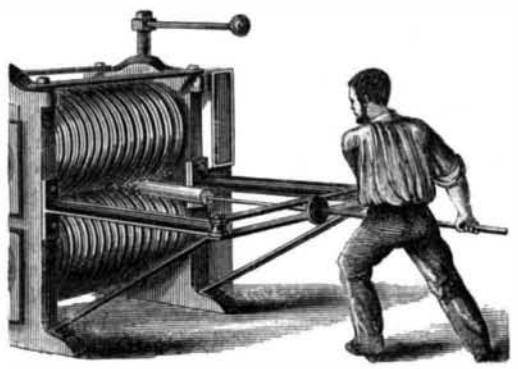
In the meantime the United States Armory, at Springfield, Mass., was urged to its utmost capacity, but in spite of all the strenuous efforts made, the number of guns delivered fell far short of what was required. Here was an emergency wholly unlooked for, but one which the enemy had largely counted on as a means of enforcing his demands. Reduced to one armory, the splendid one at Harper's Ferry with all its costly machinery having been destroyed early in the struggle by our own officers, the only alternative was to call on the mechanical talent of the North to come to the country's rescue. The appeal was not ineffectual, and the results have been an immense number of muskets produced by machines similar to those used by Government with such improvements added as the skill and cunning of the contracting parties could devise. Let us call attention to the above fact and the suggestion it contains. The tools for making guns, or Springfield muskets, are justly celebrated as being the finest and most elaborate of their class; yet important modifications have been made in fabricating delicate parts of the weapon, and the processes themselves greatly expedited by allowing intelligent and skillful men to exercise their ingenuity upon the subject. There are at the present time a large number of private armories engaged on the Springfield arm, under Government contract. We recently visited one of them —the Providence Tool Company's Armory—in Providence, R. I. This company manufactures more of the several parts of the weapon than any other private firm in the country. Other establishments turn out finished guns complete, and up to the Government standard, but they procure, some one part and some another, from different shops and combine the whole in the musket at their particular works. The company that we have individualized makes every part of the Springfield rifled musket except the rear sight; this being a small item is not undertaken, as it can be bought ready-made from manufacturers engaged in its production. The quality of the work done in the Providence Armory is unequalled any where, and we have taken some pains to satisfy ourselves on this point—even rival firms according all praise in this respect with a candor which is highly creditable.

No person, except one who has fully and thoroughly investigated the subject, can have the slightest conception of the character and quality of the work demanded by the Government from parties making the Springfield musket. The most severe and apparently unreasonable tests are exacted, and the finished weapon will bear comparison for accuracy and general beauty of workmanship *with any mathematical instrument ever made.* This is a strong expression, but it is fully borne out by the facts, as the reader can see by reading our description of the Armory.

Let us premise by saying that the Providence Tool Company, like most others who embarked in the business, were entire novices in the art, and when they undertook their first contract were in a state of complete ignorance concerning the character of the work and the requirements of the Government. This no longer exists, owing to the energy and genius given to the task by the superintendent and workmen employed there. As was remarked by a gentleman connected with the armory who kindly showed us through the establishment, "when we came to make the gages we were almost discouraged; the standards are kept at the Springfield Armory, and three separate sets were made to match them; each set being pronounced perfect at the time, but they were afterward sent back to Providence to be reconstructed." When we inform our readers that there are no less than seventy-five different gages, and from two to ten apertures in each gage, the nature of the alteration will be apparent, without further explanation. Three model muskets, or those which are considered to be perfect, and of the exact pattern required, cost the Government $2,500, or over $800 each, to make. From this illustration some conception can be formed of the unapproachable excellence of the Springfield musket as a weapon of war. Some economist with false ideas may here exclaim, "what folly!" and begin at once to elaborate a series of articles on waste, useless expenditure of time, &c., which we herewith affectionately advise him to restrain and listen a moment to our explanation. The excellent quality of the work demanded by the Government has this redeeming feature (if it had no other it would be defensible as authorizing the system pursued), it secures *perfection* so far as human skill is able to attain it. Perfect weapons conduce largely to make efficient soldiers, and lead to victories; when a soldier knows that the gun he carries will never fail him in time of need, that it will not miss fire, but will shoot with unerring precision, and not become disabled with fair usage, then he fights with a determination and energy which he would not manifest with an inferior arm. The mechanical efficiency of infantry depends almost wholly upon their guns; for the bravest men without good weapons or short of ammunition, are no better than a mob before well-armed inferiors. Not only are these moral points secured by the possession of a good arm, but the true principles of economy are embraced in the manufacture of a good weapon of any kind; not only are armies saved from panic or rout caused by worthless weapons, but the arsenals are not full of them requiring repair, and thousands, yea millions, of dollars are annually saved by producing a weapon which is the best that can possibly be made. The people will therefore understand that the Springfield musket is not "a pretty good gun;" but is, both as a weapon of war, and an article of manufacture, wholly unapproachable by any similar musket made elsewhere; not even the Enfield rifle—which is made as near like the Springfield arm as Englishmen can make it, with Yankee machinery and men to instruct them—equals it. There may be some persons ignorant of the fact that in 1855, Jefferson Davis, being the Secretary of War, gave full permission to the English Government to witness all parts of the manufacture, and to construct sets of machinery in all respects similar to our own. This machinery is now in operation at Enfield, England.

While, as has been stated previously, great improvements have been made in musket machinery, we do not desire to be understood as saying that the art has been revolutionized, but that in the essential points of expediting and cheapening the work, a great deal has been done, and much still remains to do. In the construction of a standard piece of work, such as a musket, a sewing machine, watch, &c., a complete and simple order must be observed, so that while the work goes forward with dispatch, there will be no confusion, error, or delay; the latter it is particularly necessary to avoid in making muskets, since the failure to produce certain portions in a specified time precludes the possibility of a weekly delivery. The system observed in the Providence Tool Company's Armory is a most excellent one, mutually advantageous to all concerned, the jobbers, workmen, and the company. Where all parties are pleased it is useless to comment, and we turn without further preliminaries to descend the stairs to the rolling shop, where the first operation of making a musket is going forward. With one hand upon the door knob we must premise by saying that we are indebted to many obliging and ingenious men, foremen and others, throughout the works, for personal attention, explanations, and practical illustration of the several processes. These gentlemen voluntarily left their work (every one works by the piece, be it understood), and courteously pointed out objects of interest. Nothing would afford us more pleasure than to allude to individuals by name, but we beg they will consider the difficulties and embarrassments likely to arise from such a course, and be satisfied with this general recognition of their politeness.

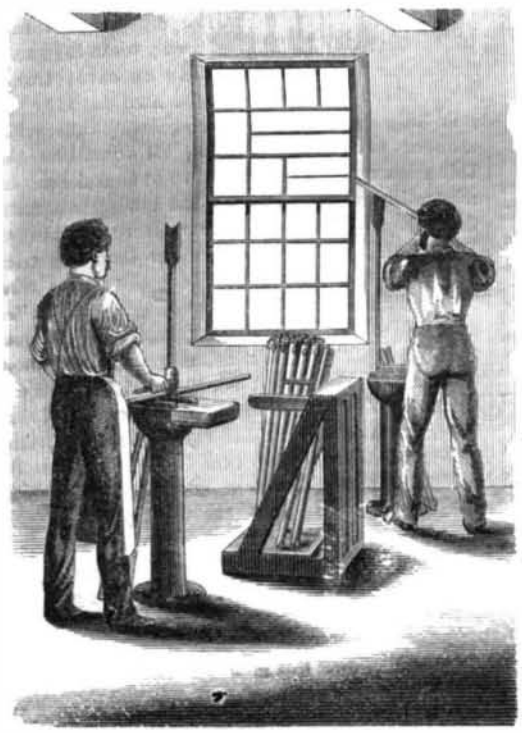
IN THE ROLLING MILL.—



We have the first step toward producing that essential part of the musket—the barrel. In an adjoining storeroom there are huge piles of flat iron continually on hand; these pieces are incipient barrels, and are 12½ inches long, by 5½ wide, and ½-inch thick; they weigh ten pounds. They are the best English iron, imported especially for the work. The plate is formed up by successive operations; at first it is run through what are called the crimping rolls. These are merely cast-iron rollers, with grooves in them of a constantly increasing depth; the first groove being merely a shallow depression, through which the red hot plate is drawn; when it issues on the further side it is curved like an eaves trough; these curves are gradually augmented until the plate is no longer such, but is an irregular cylinder with a seam, or two unlapped edges, all down one side. This seam must now be closed so as to make the barrel continuous and of a solid and homogenous nature throughout. Here the true rolls come into use. These latter are larger in diameter than the crimping rolls, and are arranged one above the other. Now the gun barrel is not straight, but tapers from one end to the other, consequently the grooves in the rolls must be of a constantly increasing depth, so that the barrel will be of the right taper when finished. Very little metal is left on, barely sufficient to turn and grind to a smooth surface; therefore it will be apparent that if the workman does not always insert the barrel at the proper time and always in the same place, the thick part of the butt might be inserted in the narrow end of the groove and the work be spoiled. When the rollers once get hold of the barrel they never relax their grasp, but put the work through to the other side most speedily; there is no alteration or re-adjustment possible. To insure against loss in this respect the rollers are provided with a square jog. The barrel being heated to a white heat in the furnace behind the workman, is then thrust on a steel mandrel, and watching his chance, he pushes the butt of the barrel against the shoulder on the roll. Here is a starting point to work from, for as the barrel is drawn in, it is always in the same relative position, and consequently cannot be wrong. The operation of rolling is repeated many times by running the barrels through constantly decreasing grooves until they have attained the proper dimensions. This duty is excessively severe upon the workman. The barrel weighs ten pounds when it enters the first roll, and when it issues completed it weighs rather less than seven; the roller, therefore, handles eight and a half pounds of iron on an average all day long, as fast as he can pick it up and present it to the rolls. In the course of the day this amounts to thousands of pounds. The man at the rollers is assisted in all these labors by one helper and a fireman, and all hands have their energies tasked to the utmost. This method of producing a musket barrel is comparatively new; the old plan being to forge or weld the sheets under trip hammers. The rolling process is far superior, in

that it is unattended by noise and confusion (trip hammers make a horrible din), and results in better work in all respects. The plan is English, and was brought to this country by an individual who enjoyed a monopoly of his art for a long time, until it was at length discovered by others. Even now it takes a great while to "get the knack" of doing good work. The Providence Armory was the first to use barrel rolls in this country, outside of the Government works. When the barrels are completely finished at the rolls, they are taken to the cone-seater, who welds a rough lump of iron on one side, very much as one would stick a lump of clay the size of a hickory nut on the side of a walking stick. He then makes his mark and that of the rollers on the barrel, and it is ready for the finishing-rooms.

We have now seen the initial step toward making the musket. From this apartment we must follow our guide into another shop, where the barrels are bored out true internally; for as yet they are only rude iron tubes almost without shape or form. The barrels are laid in a lathe and "nut bored," as it is called, which consists in running a drill or cutter through from end to end. Now the barrel is very small inside--58 100ths in the bore—therefore the rod attached to the cutter would double up on the slightest pressure, and be useless if fed in the regular way. To avoid this, the cutting tool is *drawn* through, and the operation proceeds with despatch. The barrels are nut bored, and are then "quick reamed;" which reaming is merely running a fluted steel bar through from end to end. This reamer runs with great rapidity and makes a squeaking noise, which suggested that a little oil or water would not be unacceptable to it. We expressed surprise that the edge was not destroyed, but were told that no difficulty was experienced on this score: this is done several times; the barrel is bored out and ready for the straightener and turner.



The barrel is straightened after nearly every operation performed upon it, and the peculiar nature of the process excites the liveliest curiosity of the uninitiated. The observer secs a number of men behaving in the most singular manner—taking up the barrels, holding them to their eyes for a minute, and then laying them over a block, they give a slight tap on one side and the thing is done. But how, asks the reader, do the men know where to strike? For further information on this point we must refer the interrogator to the workman; all that we can say is that a piece of ground glass is fixed in a frame hung across the window; on this glass there is drawn a parallel line; this line is the only guide to correctness. The operator raises the barrel and gazes through it at the lines; these are reflected on the inside of the barrel bore, and being perfectly true, any deviation in the barrel, be it ever so little, is seen and rectified by the hammer. The engraving of the two processes, rolling and straightening, were drawn on the spot.

SHAPING THE BARREL.

The rough exterior of the tube must now be removed and rendered more sightly and also lighter by going through the finishing processes. The first step is to turn it in a lathe; this is done quite rapidly, being of a regular taper from end to end. Whoever takes a modern Springfield rifle in hand will see that there is an octagon formed at the lower end near the breech. It is done in this wise—when the tool runs up near where the octagon should commence, a certain arrangement strikes against the carriage and throws an eight sided "former" against the tool; this has a yielding motion, governed by the "former," and thrusts in and out as the angles and sides push the tool in, thus a perfect octagon is made by a revolving motion. This was thought to be impossible at one time, but the Providence mechanics seem to think with Napoleon (or Joe Miller, we forget which) that nothing is impossible to him who wills. These lathes are nearly automatic, for the speed decreases as the work gets heavier, and the tool stops altogether when the task is done; so that there is no danger of spoiling the "job." One man is able to tend six of them, and when they stop the belt shipper flies back very quickly. This feature was unlooked for by us, and as we watched the operation the shipper bar came whizzing by the editorial nose and threatened to annihilate it; to the no small delight of a grimy-looking boy in attendance.

(To be concluded next week.)

One Effect of the High Price of Sugar.

Nothing is more characteristic of our people than fertility of resource, and the readiness they display in adapting themselves to circumstances, favorable or adverse, is remarkable. This trait has recently been brought to our notice with great force, by reason of the immense numbers of *bee hives* inventors have forwarded to us, with the commendable design of stimulating, through better habitations and economical arrangements generally, the art of bee culture. In this, the shrewd observer will see a loop-hole of escape from the high prices for all sorts of "sweetening" which now prevail, and which are not so much due to the taxes imposed by Government as to the combination of unscrupulous speculators. Sorghum mills were at one time all the rage and also other apparatus for defecating, and granulating the sap of all sugar-bearing plants and trees; but we think nothing is more noteworthy in connection with this subject than the efforts of our inventors to provide comfortable and profitable bee houses, whereby the crop of honey—a delicious substitute for molasses—will be largely increased during the coming year. If it tends to lower the price of the article, now far beyond its intrinsic value, the exertions of the inventors will not have been put forth in vain.

Practice with Lyman's "Accelerator."

Some time ago Mr. A. S. Lyman, of this city, constructed a gun at the Novelty Works on a peculiar principle: one previously embodied, however, in a small arm, from which he had fired a half-inch pointed steel bolt, eight inches long, through a block of iron six inches thick. The block was on exhibition at this office for some time. The gun alluded to was fired at Washington a short time ago, with the following result. The target was a 5 inch iron plate backed with 18 inches of live oak; at 204 yards, the longest range that could be obtained, the projectile passed completely through all obstructions, including a mass of rubbish behind the target, and struck the water 100 yards in the rear. This is "good shooting." On the occasion referred to practice had been had with an English Blakeley gun, the projectiles from which stuck in but did not penetrate the iron. Admiral Milne, Lord Lyons, Secretary Seward, and others were present, unknown to the inventor. This notice is also contraband, so far as Mr. Lyman is concerned, he having a reluctance to publish facts at present.

A London professor lectured recently on adulterations of food. He handed round coffee, which was pronounced excellent, then told the audience that they had been regaled with a mixture of bullock's blood, chicory, sheep's liver, dried and old coffee grouts. He gave them capital porter too, made of spirits of wine, gum arabic and burnt sugar.

Correspondence

Abuse of Exhilarating Gas in Surgery.

Messrs. Editors:—During the past year public attention has been frequently called to the properties of the protoxide of nitrogen or "laughing gas," and many persons have been subjected to its influence, without being aware of its dangerous properties. Scientific men have been silent all this time, as its uses were chiefly confined to persons for public amusement. But it is time to interfere, when it is recommended for and used in surgical operations. The properties of this gas have been known since 1776, and those who now proclaim it to be a new anesthetic agent, capable of taking the place of ether, impose upon the public, as a work was written upon this very subject in 1847. It is known that atmospheric air supports animal life from the oxygen contained in it, and the essential functions of respiration can be carried on in an atmosphere of protoxide of nitrogen, but a prolonged use of this gas will give rise to disturbances of the system sufficient to produce death. Plants introduced into vessels filled with this gas faded in about three days, and they soon afterwards died. Its effects upon insects, annelides, mollusca, amphibiads, birds and mammals, were examined by Sir Humphrey Davy, and on all of these it acts as a positive poison. It produces peculiar changes in their blood and organs, terminating in death; and when forced into the veins of animals it disorganizes the nervous system, according to Nystem. Dr. Paveira says respecting it—"I have administered this gas to more than one hundred persons, and have observed that after the respiration of it for a few seconds, it causes frequent and deep respirations, the color of the lips and whole face become blue, temporary delirium is produced and an indisposition to part with the inhaling tube. The sensations are pleasing; the delirium manifests itself differently in different persons: I have known it to produce stupor, singing in the ears, giddiness, tingling sensations in the hands and feet, &c." Professor Silliman mentions a case in which the effects of this gas produced a complete perversion of the sense of taste for eight weeks; and A. S. Taylor states that some serious after effects upon the brain have been produced by its inhalation. I could cite the opinions and experience of many other authorities upon this subject, all coming to the same conclusion, that the effects of this gas are dangerous. It was known in 1847 that it produced insensibility to pain when used as an anesthetic agent. It appears unsafe to employ it in surgery even for such small operations on teeth. It cannot, therefore, be recommended as a substitute for ether or an anesthetic agent, although a new agent, as harmless and as effective as ether, without possessing its strong odor, is very desirable.

Prof. H. Dussauce.

New Lebanon, N. Y. Oct. 23, 1863.

The Parrott Gun.

Messrs. Editors:—In the Scientific American, of Oct. 24th, a correspondent points out what he considers the defects in the manufacture of the Parrott gun; he suggests that the muzzle and chase should be made according to Dahlgren's pattern, and but a thin skin of iron turned off, in order to preserve the strong external surface of the casting. Your correspondent does not seem to be aware that there is greater difference between the rough and finished Dahlgren gun than in any other, owing to the great thickness of metal cut away from the muzzle. The Rodman core could not be introduced with advantage, save in a gun of the present Columbiad model.

Fisp.

Pittsburgh, Pa., Oct. 19, 1863.

Specie in the United States Treasury.—Gold is accumulating fast in the Treasury, and will be kept there until specie payments are resumed, except at the recurring periods of the payment of interest on the public debts.

Those who would like early salad next spring would do well to plant a bed of lettuce this fall.