PRIVATEERS IN HATTERAS INLET.

Among the papers taken at the capture of Fort Hatteras were copies of letters by Major Andrews, at one time in command of the place. The following is so instructive that we give it in full :—

HEADQUARTERS CAMP HATTERAS, }
August 2, 1861. }

His Excellency Henry F. Clark :—

GOVERNOR :—Since my last the privateer steamer *Mariner* has brought into this port as a prize the schooner *Pricilla*, of Baltimore, from Curacoa, with six hundred bushels of salt. I had some doubt as to the legality of the prize, but having seen that Baltimore vessels, laden with coffee, had been seized in the mouth of the Chesapeake and sent to New York as prizes, I ordered her up to Newbern to-day. The *Winslow* has a large brig at the bar laden with sugar and molasses, and the *Gordon* has two schooners coming over the bar now. The *Mariner* has taken a schooner into Ocracook, and is now in pursuit of another. These will all be fully reported to as soon as the captains report to me. I am doing all I can to prevent the news of captures spreading, but so long as the crews are sent up to Newbern immediately, it cannot be prevented. Your despatch through the Adjutant-General's office of the 27th instant, is received.

The directions of Captain Barron, with regard to Hatteras Light-House, will be followed. You did not direct me what to do in regard to the coffee. I am trying to save the copper on the bark *Linwood*, and will await your order how to dispose of it. I suppose it is needed to make percussion caps. Yours, very respectfully,

W. S. G. ANDREWS,
Major Commanding Fort Hatteras and Dependencies.

A SKIRMISH IN WESTERN VIRGINIA.

Our account left General Cox pursuing General Wise up the valley of the Kanawha, which runs northwardly through the western part of Virginia. On the 26th of August, General Cox had reached Gauley Bridge, some 40 miles above Charleston, and had sent one regiment, the Ohio Seventh, to Summersville, a few miles up the Gauley River, a stream that enters the Kanawha from the east.

As Col. Tyler's men were taking their breakfast on the morning of the 26th, they were suddenly surrounded by three regiments of Secessionists, who hoped to take them prisoners. But they fought their way through the enemy's lines, and most of them reached the main body at Gauley Bridge in safety.

WRECK OF THE PRIVATEER "JEFFERSON DAVIS."

The privateer *Jefferson Davis* was wrecked at 6½ o'clock on Sunday morning, August 12th, while trying to enter the harbor of St. Augustine, Fla. The vessel struck on the bar, and became a total wreck. The crew were all saved.

OBSEQUIES OF GENERAL LYON.

On Saturday, August 31st, the remains of General Lyon reached this city on their way to their last resting place in his native town, Eastford, Conn. In all the principal cities on the route—St. Louis, Cincinnati, Pittsburgh, Philadelphia and New York—the citizens testified their respect for the departed hero by celebrating the passage of his remains with imposing funeral ceremonies. Along the route it was remarked that there was a peculiar depth and earnestness in the grief of the people for the death of this brave soldier. In all the numerous histories that will be written of this war, his name will stand out with remarkable prominence, for his career was remarkably heroic. He never shrunk from battle, whatever the odds, and as long as he lived he was never defeated. Contending against greatly superior numbers, he finally sacrificed his life in a desperate attempt to save the city of St. Louis from the clutches of the secessionists, and with it, the State of Missouri from the crushing military despotism that reigns in the seceded States. There is great satisfaction in reflecting that the effort was successful. The people have appreciated his sublime devotion, and the hushed breaths and bended heads which accompanied the passage of his coffin mark the beginning of a fame that will grow brighter with the lapse of time.

Parr's American Camp Chest.

This excellent article, which was illustrated in No. 5, present volume of the SCIENTIFIC AMERICAN, is on exhibition at Messrs. Ball, Black & Co.'s, on Broadway, and is attracting unusual attention from army officers and others interested in the comforts of camp life. The demand for these chests has exceeded the ability of the inventor to supply, and we learn that Messrs. Gray & Potter, of 202 Broadway, who are making "army supplies" a specialty, have become the proprietors of the patent, and will very soon be able to fill any and all orders. Messrs. Ball, Black & Co. will, we learn, continue to have the agency for this city. We understand that this useful invention is meeting with the success it deserves.

Correspondence.

From a Washington Correspondent of the "Scientific American."

WASHINGTON, D. C., August 29, 1861.

MESSRS. EDITORS:—Since my last communication to your highly-prized journal, there has been great activity in the military department under Gen. McClellan, and all fear of danger from a surprise has vanished and given place to a feeling of perfect security. It is not a little amusing to see the great anxiety expressed sometimes by persons living at a distance for the safety of this city, when we who live here, and who would probably be the greatest sufferers in case the city should fall into the hands of the enemy, feel perfectly at ease, and have full confidence in the preparations and ability of Gen. McClellan. The reason of this fear, however, is but natural, when we consider the fact that all knowledge of military movements on our side is suppressed, while we read accounts daily of the activity and the near approach of the enemy to our lines; thus leading many to suppose that our preparations for offence and defence are not as certain as those of the enemy, which is very far from being the case.

The business of the Patent Office has fallen off some since our troubles commenced; and, in consequence thereof, some changes have been made in this department, only, however, as regards the force employed and the compensation of those who are retained. I notice that a great many improvements have been made in military accouterments, the better to provide for the comfort and convenience of our soldiers during the present struggle. Inventors will find a broad field open for them here to display their ingenuity, as there are hundreds of little wants which could be readily supplied by the inventor, and those who, through disabilities, cannot enter our regiments, might contribute their share in this way.

We have a Provost Guard in this city, whose especial duty it is to arrest drunken and disorderly soldiers, and to arrest and fine persons for selling or giving liquors to soldiers. All soldiers are required to have a pass from one of the officers of their respective regiment, with which pass they can attend to their private business about the city; without a pass, the soldier is liable to be arrested. We therefore have very little disturbance in our streets, night or day.

Army wagons and horses continue to arrive every day in large numbers; and I notice that many of the wagons are dragged through our streets with the *wheels locked!* This is an injury both to the horses and wagons, and attention should be called to it immediately.

The Washington Navy Yard has become quite a lively place, and many hundred workmen are employed day and night in and about the various shops, turning out cannon, making shot and shell, gun carriages, &c., &c. This yard is now a very convenient place for keeping in good repair the gunboats used on the Potomac, some of which visit the yard every day or two.

Steamers run between this city and Alexandria, Va., every hour, but all persons leaving the wharf for the latter place are required to show a pass. These passes are only obtained upon the representation of some well-known Union citizen, and much inconvenience has been felt by certain person whose opinions are somewhat tainted with secession because of this pass system. This channel to Virginia has been blockaded effectually, and as every floating craft on the river, from a "dug-out" to a long boat, has been taken possession of by our river guard, those whose character deprives them of the privileges of a pass must be content to live among us until they show, by their good works, that they are indeed Union-loving citizens.

The system of oath-taking at first adopted by our government has ceased to exist, and those who prove disloyal and treacherous to the confidence reposed in them are sent where they will neither be harmed themselves nor harm others. Thus has the Mayor of our city been arrested and imprisoned "for cause;" many ladies of this city having taken advantage of the privileges accorded to their sex to aid the enemy, have been arrested and held, so far, only, as to prevent the recurrence of such things.

Rumors say that we are to have a battle on the other side of the river soon; the circumstances on which they are based amount to little more than the gradual advance of the scouting outposts of Beauregard's army to points almost within range of the guns of our fortifications. These scouting parties, however, remain only a sufficient time to make reconnoissances, shoot down our pickets, and then retire; but Gen. McClellan will soon put a stop to these movements of the enemy, and if persisted in, we may expect to hear at any moment of a considerable affair between the outposts of the two armies at some place not more than three ar four miles from this city.

Finally, I will add that, as all of our military affairs have been confided to men of military knowledge and experience, everything goes on smoothly and harmoniously, leading us to believe with great confidence that all will end well, and to the glory and honor of our Republic. R. T. C.

MESSRS. EDITORS :— Will you have the kindness to inform me, through your popular scientific journal, the title, price and where I can purchase the best scientific work on mechanical engineering published in this country, and much oblige an attentive reader? Yours, truly,

JAMES DEVINE.

Frankford, Pa., August 27, 1861.

Similar letters of inquiry to the above come daily to this office, and it would relieve us of answering a great many letters of no profit to us, if dealers in scientific and mechanical books would advertise their works in our columns. At the same time, they would find it a profitable business transaction.

MESSRS. EDITORS :—At the request of one of your patrons who receives your paper at the news depot here, I write for advice upon the subject of steam engineering, he desiring to purchase one of about twenty horse-power; he wishes "all the modern improvements." Whose engine do you consider the best? Your reply will be conferring a great favor. Respectfully yours,

A. D. McDONALD.

Hamilton, C. W., August 26, 1861.

The same editorial advice as rendered to booksellers in the above is applicable to manufacturers of steam engines and all kinds of machinery, inquiries about which are being constantly made at this office.

The secret of success in all kinds of business is advertising; and the duller the times, the more should manufacturers or others having anything to sell avail themselves by advertising in papers of large circulation, and especially in such papers as are circulated among the class of persons likely to patronize their wares.

The New Postage Stamps.

The new postage stamps have made their appearance. There are eight classes—one, three, five, ten, twelve, twenty-four, thirty, and ninety-cent stamps, embracing line-engraving heads of Washington, Franklin, and Jefferson, from portraits painted by Stuart, Trumbull, and Houden.

The one cent stamp is green with a profile bust of Franklin. The three cent is a delicate carmine with a portrait of Washington. The five cent is brown with a likeness of Jefferson. The ten cent is green with a head of Washington. The twelve cent is black also with a head of Washington. The twenty-four cent is purple—same likeness. The thirty cent has a bust of Franklin and is printed in orange. The ninety cent is dark ultra-marine, and concludes the list with a portrait of the father of his country.

PROGRESS OF THE WORK ON THE FORTRESS AT SANDY HOOK.—The fortifications at Sandy Hook are progressing very rapidly under the superintendence of Capt. J. G. Foster, U. S. Engineer corps.

Twenty-seven casemates are completed, and the guns will be mounted in a few days. This part of the work will command the entrance of the main and Swash channels. Thirty-seven guns have been ordered down immediately. A large portion of them will be rifled, and of a new and improved pattern; 8-inch columbiads will make up the complement to be used at present.

A magazine is nearly completed, and as soon as entirely finished a large quantity of shot and shell will be sent down.

AT a recent exhibition in England, a couple of bullets were shown which were picked up on the field of Inkerman. A French and a Russian bullet had met in mid air and were flattened against each other. So says the London *Mechanics' Magazine*.

Bessemer's Paper on his Process of Making Steel.

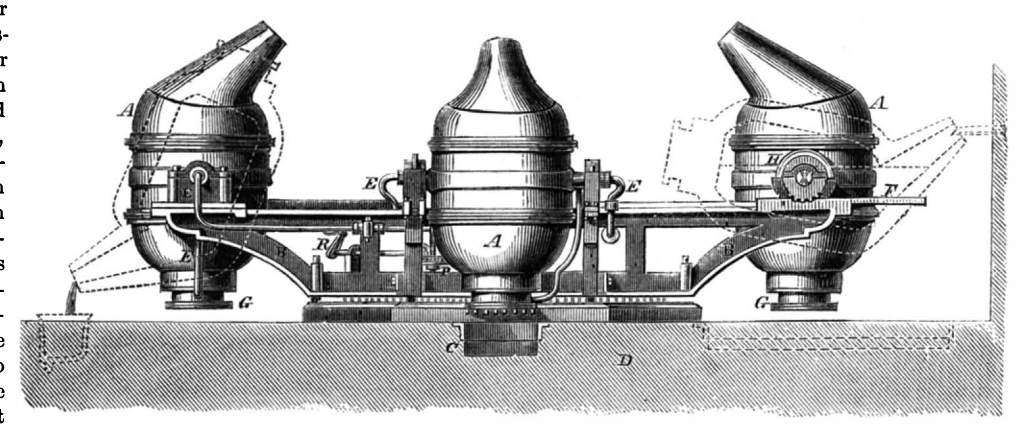
We published last week some extracts from this valuable paper, and now, in view of the great importance of the subject and the wide interest that it has excited, we give the remainder. In order to make it more intelligible, we accompany it with an illustration of Bessemer's apparatus which is reproduced from page 373, Vol. III (new series). It will be understood that the vessels A A, are the pots in which the refining is effected; these vessels being supported in a frame which revolves so as to bring them to the furnace of melted iron on one side and carry them to the mold on the other. They are hung on trunnions so as to be turned down to receive the iron, keeping the airholes in their bottoms above the liquid metal until the charge is received.

THE ORDINARY MODE OF MAKING CAST STEEL.

The mode of manufacturing cast steel, which now forms so important a branch of the Sheffield trade, was discovered in the year 1740 by Mr. Benj. Huntsman, of Handsworth, near Sheffield. This gentleman subsequently established steel works at Attercliffe, where his most valuable invention has ever since been successfully carried on. In the early stages of this invention many difficulties had, doubtless, to be overcome, materials for the lining of furnaces, and for the making of crucibles, had to be sought for and tested, the peculiar marks of iron most suitable for melting had to be determined on by numerous experimental trials, and such was the difficulty at that time of making crucibles that would stand the excessive heat of molten steel, and only very highly carbonized or "double converted" steel, could, for a long period, be successfully melted.

The first products of a new manufacture, even while the invention still remains in a partially developed state, but too frequently stamp its subsequent character; thus Huntsman's cast steel, although it was acknowledged to be a pure, homogeneous metal of great value for certain purposes, was still looked upon as a hard and brittle material of very limited use, not bearing a high temperature without tumbling to pieces, and quite incapable of being welded. Even within our own time this has been the popular idea of cast steel. Improvements in its manufacture have, however, from time to time been introduced, and steel of a milder and less brittle character has long been made capable of welding with facility, and working at a high temperature without falling to pieces. Its uses have, in consequence, been greatly extended, and the employment of cast steel for the best cutlery and edge tools has now become universal; indeed, the excellent quality of the cast steel at present made in Sheffield for these purposes is scarcely to be surpassed. Of late years several of our most enterprising manufacturers have sought to introduce cast steel for a variety of purposes other than those for which it was originally employed, hence we now find it used in some form or other, in almost every first-class machine. Its employment as a material for founding bells and various other articles in clay molds has been successfully carried out by Messrs. Naylor, Vickers & Co., while the introduction of a most valuable material by Messrs Howel & Shorbridge, under the name of homogeneous iron, are prominent examples of the successful adaptation of cast steel to engineering purposes. The manufacture of cast steel by Huntsman's process is so extensively practiced, and is so well known, that it will not be necessary here to go into any lengthened detail, but it may be as well to remind those who have not paid special attention to the subject, that crude pig iron has first to go through all the stages of melting, refining, puddling, hammering and rolling, in order to produce a bar of malleable iron as nearly pure as the most careful manipulation in charcoal fires can make it.

Bar iron, on which so much labor, fuel, and engine power has been expended, thus becomes the raw material of this most expensive manufacture. In order to convert these iron bars into blister steel they are packed with powdered charcoal in large chests, and are exposed to a white heat for several days; the time required for heating and cooling them extending over a period of twenty days. The iron bars, when thus converted into blister steel, are broken into small pieces, and are sorted for quality, which sometimes differs even in the same bar. For melting this material powerful air furnaces are employed containing two crucibles, into each of which are put about 40 lbs. of the broken blistered steel; in about three hours the pots are removed from the furnace, and the molten steel is poured into iron molds, and is thus formed into ingots of cast steel, from three and a half to four tuns of hard coke being consumed for each tun of metal so melted. When large masses of steel are required a great many crucibles must be all got ready at the same moment, and a continuous stream of the molten metal from the various crucibles must be kept up until the ingot is completed, as any cessation of the pouring would entirely spoil it. Hence, in proportion to the size of the ingot, so is the cost and risk of its production increased.



BESSEMER'S PROCESS OF MAKING STEEL.

DISADVANTAGES OF THIS PROCESS.

From the foregoing remarks it will be obvious that the cast-steel manufacturer is working at an immense disadvantage. If he desires to supersede the use of wrought iron for engineering purposes, he must cease to employ wrought iron as a raw material for his otherwise most expensive mode of manufacture. The extremely high temperature requisite to maintain malleable iron in a state of fusion has, from the earliest period of the history of iron up to almost the present day, rendered its purification in a fluid state practically and commercially impossible; hence arise all those imperfections to which bar iron is subject, every small piece of this material consisting of numerous granules partially separated from each other by scoria, and every large mass of it resulting only from the piling together of small bars, with the inevitable result of increasing the former imperfections; for no two pieces of iron can be brought to a welding heat without becoming perfectly coated with oxyd, and when this coating is rendered fluid by welding sand, a fluid silicate of the oxyd of iron is formed covering the entire surface to be united; the heavy blows of the hammer, or the pressure of the rolls, may and does extrude the greater portion of this fluid, extraneous matter, but it is never wholly removed from between the welded surfaces, and hence a portion of the cohesive force of the metal is lost at every such junction. When a bar of iron is nicked on one side and bent, the rending open of the pile clearly shows this want of perfect cohesion, nor is this the only difficulty to be encountered, for, in the production of large masses of wrought iron, it is necessary to raise the temperature nearly to the fusing point of the metal, in order to render each additional piece sufficiently soft and plastic to become united to the bloom. This softening of the iron induces a molecular change in the structure of the metal; its natural tendency to crystallize is so powerfully assisted by the long continuance of this high temperature that its whole structure undergoes a change. Large and well-defined crystals are formed, almost independent of each other and cohering so feebly to the planes of other contiguous crystals, as, in some cases, to separate with as little force as would overcome the cohesion of ordinary cast iron.

ADVANTAGES OF CAST STEEL.

In the substitution of cast steel for malleable iron we escape both these sources of difficulty, for the mass, whether it be of 1 ton or of 20 tons in weight, may be formed in a fluid state into a single block wholly free from an admixture with scoria, while it is perfectly and equally coherent at every part. The forging into form of such a solid block of metal is only the work of a few hours, and, as there is no welding of separate pieces, it may be worked under the hammer at a temperature at which no molecular disturbance will take place, the metal being far below its fusing point, and much too solid to undergo that destructive crystallization so common in large masses of iron. Thus it will be perceived that the difficulties and uncertainty which attend the production of all large masses of wrought iron are wholly avoided in the production of equally large masses of cast steel. But, however desirable in the abstract it may be to employ cast steel as a substitute for malleable iron for engineering purposes, it must not be forgotten that there are several important conditions indispensable to its general use. Firstly, the steel must be able to bear a good white heat without falling to pieces under the hammer, or otherwise the shaping of it will not only be expensive, but the partly finished forging may be spoiled at any moment by being overheated. Secondly, the steel should be of that tough character as to admit of being twisted or bent almost into any form in its cold state before fracture takes place, whether the force be applied as a gradual strain or by sudden impact. Thirdly, it should have a tensile strength of, at least, 50 per cent over the marks of English iron. Fourthly, and especially, it must be soft enough to turn well in the lathe, to bore easily, and yield readily to the file and the chisel, so as not to enhance its original cost by the difficulty of working it into the requisite forms. This is both commercially and practically an important question, and one which will in future greatly determine the extent of its use. Steel to the engineer, has hitherto stood in much the same relation as granite to the builder. All acknowledge the superior hardness, beauty of polish, and durability of that material, as compared with other building stone. Nature has given it to us in great profusion; we have only to lift it from the earth and use it. But the practical man has found that to drill a hole in granite for blasting takes days of labor to accomplish, blunts all his chisels, defies the saw, and is only faced at a great cost; hence the builder goes on using his inferior soft stone, over which his tools have perfect command.

BESSEMER'S PROCESS.

The problem we have before us is, how to produce cast steel that will take any form in the mold, or under the hammer; that will yield quickly and readily to all our present cutting and shaping machines; will retain all the toughness of the best iron with a much greater tensile strength; and all the clearness of surface, beauty of finish, and the durability, that so eminently distinguish the harder and more refractory qualities of the steel in common use. It is believed by the author that these desirable objects are fully accomplished by his process of converting rude molten iron into cast steel at a single operation, which process has now been in daily operation in this town for the last two years. For this purpose the hematite pig iron, smelted with coke and hot-blast, has chiefly been used. The metal is melted in a reverberatory furnace, and is then run into a founder's ladle, and from thence it is transferred to the vessel in which its conversion into steel is to be effected. It is made of stout plate iron, and lined with a powdered argillaceous stone found in this neighborhood below the coal, and known as ganister. Its value in the powdered state is about 11s. per ton. The rapid destruction of the lining of the converting vessel was one of the great difficulties met with in the early stages of the invention; the excessive temperature generated in the vessel, together with the solvent action of the fluid slags, were found to dissolve the best fire-brick so rapidly that sometimes as much as 2 inches in thickness would be lost from the lining of the vessel during the thirty minutes required to convert a single charge of iron into steel. The material used at present is not only much cheaper than fire-bricks, but is also very durable. A portion of the old lining of the vessel is also shown. It has stood ninety-six consecutive conversions before its removal. The converting vessel is mounted on axes, which rest on stout iron standards, and by means of a wheel and handle it may be turned into any required position. There is an opening at the top for the inlet and pouring out of the metal, and at the lowest part are inserted seven fire-clay tuyeres, each having five openings in them; these openings communicate at one end with the interior of the vessel, and at the other end with a box called the tuyere box, into which a current of air, from a suitable blast engine, is conveyed under a pressure of about 14 lbs. to a square inch, a pressure more than sufficient to prevent the fluid metal from entering the tuyeres.

Before commencing the first operation, the interior of the vessel is heated by coke, a blast through the tuyeres being used to urge the fire. When sufficiently heated, the vessel is turned upside down, and all the unburned coke is shaken out. The molten pig iron is then run in from the ladle before referred to; the vessel, during the pouring in of the iron, is kept in such a position that the orifices of the tuyeres are at a higher level than the surface of the metal. When all the iron has run in the blast is turned on, and the vessel quickly moved round. The air then rushes upward into fluid metal from each of the thirty-five small orifices of the tuyeres, producing a most violent agitation of the whole mass. The silicum, always present in greater or less quantities in pig iron, is first attacked. It unites readily with the oxygen of the air producing silicic acid, at the same time a small portion of the iron undergoes oxydation, hence a fluid silicate of the oxyd of iron is formed, a little carbon being simultaneously eliminated. The heat is thus gradually increased until nearly the whole of the silicum is oxydized; this generally takes place in about twelve minutes from the commencement of the process. The carbon now begins to unite more freely with the oxygen of the air, producing at first a small flame, which rapidly increases, and in about three more minutes from its first appearance we have a most intense combustion going on; the metal rises higher and higher in the vessel, sometimes occupying more than double its former space. The frothy fluid now presents an enormous surface to the action of the oxygen of the air, which unites rapidly with the carbon contained in the crude iron, and produces a most intense combustion, the whole, in fact, being a perfect mixture of metal and fire. The carbon is now eliminated so rapidly as to produce a series of harmless explosions, throwing out the fluid slags in great quantities, while the union of the gases is so perfect that a voluminous white flame rushes from the mouth of the vessel, illuminating the whole building, and indicating to the practiced eye the precise condition of the metal inside. The workman may thus leave off whenever the number of minutes he has been blowing and the appearance of the flame indicate the required quality of the metal. This is the mode preferred in working the process in Sweden. But here we prefer to blow the metal until the flame suddenly drops, which it does just on the approach of the metal to the condition of malleable iron; a small quantity of charcoal pig iron, containing a known quantity of carbon, is then added, and steel is produced of any desired degree of carburation, the process having occupied about twenty-eight minutes from the commencement. The vessel is then turned, and the fluid steel is run into the casting ladle, which is provided with a plug rod covered with loam; the rod passes over the top of the ladle, and works in guides on the outside of it, so that, by means of a lever handle, the workman may move it up and down as desired. The lower part of the plug, which occupies the interior of the ladle, has fitted to its lower end a fire-clay cone, which rests in a seating of the same material let into the bottom of the ladle, thus forming a cone valve, by means of which the fluid steel is run into different sized molds, as may be required, the stream of fluid steel being prevented by the valve plug from flowing during the movement of the casting ladle from one mold to another. By tapping the metal from below no scoria or other extraneous floating matters are allowed to pass into the mold.

By this process from one to ten tons of crude iron may be converted into cast steel in thirty minutes without employing any fuel except that required for melting the pig iron, and for the preliminary heating of the vessel, the process being effected entirely without manipulation. The loss in the weight of crude iron being from 14 to 18 per cent on English iron worked in small quantities. The result of working on a purer iron in Sweden has been carefully noted for two consecutive weeks, when the loss on the weight of fluid iron tapped from the blast furnace was ascertained to be 8¾ per cent. The largest sized apparatus at present erected is that in use at the Atlas Steel works, the vessel being capable of operating on four tuns at a time, which it converts into cast steel in twenty-five minutes. In consequence of the increased size of the vessel no metal is thrown out during the converting process, and the loss of weight has fallen as low as 10 per cent, including the loss in melting the pig iron in the reverberatory furnace.

SAMPLES OF THE STEEL.

We have on the table before us some examples of this manufacture, as carried on by Messrs. Henry Bessemer & Co., of Carlisle street. The first sample is a piece of the pig iron employed, viz: hot-blast coke made hematite No. 1. Secondly, a portion of an ingot of very mild cast steel, broken under the hammer, to show the purity and soundness of the metal in its cast unhammered state. Perfectly sound ingots of such mild steel are extremely rare, if ever, produced by the old process.

The third example is an ingot partly forged to show how little work with the hammer will produce a forging from these solid blooms of steel.

There are also two pieces of steel of the quality employed for making piston rods. These samples were bent cold under a heavy steam hammer. To show the toughness of the metal it requires very much more force to bend it than would be required to bend wrought iron, but notwithstanding this additional rigidity, it gives to any extent without snapping. The tensile strength of this soft and easily wrought metal is from 41 to 43 tons per square inch, or from 15 to 18 tons greater than Lowmoor or Bowling iron. In turning, planing, boring and tapping this metal, it will be found that the uniformity of its quality will be less trying to the cutting tools than the hardness and sunk cracks found in the common qualities of malleable iron.

It must, however, be borne in mind that the tensile strength of the piston rod steel just quoted is by no means the maximum, but, on the contrary, it is nearly the minimum strength of such converted metal; but, at the same time, it possesses nearly a maximum degree of toughness, every additional ton in tensile strength given to it, by the addition of carbon, hardens it for working, renders it more difficult to forge and brings it nearer to that undesirable state when a sudden blow snaps it like a piece of cast iron.

The extreme limits of tensile strength of the converted metal are exhibited in a tabular form on the wall above. They are the result of many trials made at different times at the Royal Arsenal, at Woolwich, under the superintendence of Colonel Eardley Wilmot, and are copied from his reports. The highly carbonated samples exhibit a mean tensile strength of 152,000 lbs., and are, from their hardness and unyielding nature, totally unfit for many purposes, while the entirely decarbonized metal is so soft and copper-like in its texture as to yield to a mean strain of 72,000 lbs., a point unnecessarily low, except in such cases where a metal approaching copper in softness is required. The author, therefore, is strongly impressed with the belief that the soft, easy-working, tough metal, of the quality used for piston rods, is the most appropriate material for general purposes, and that the hard steels, that range up to a tensile strain of 50 or 60 tons per square inch, should be avoided as altogether too expensive to work, and too dangerous to be employed in any case where sudden strains may be brought upon them.

A kettle for boiling tallow, weighing 9,114 lbs., and capable of containing 1,316 gallons, was lately cast at Donohue's foundry, in San Francisco. California papers assert that it is the largest cast iron kettle ever made in America.

Revolution in Photography.

The Paris correspondent of the London *Photographic News* says:—"Another revolution in photography! The honor of achieving this result is due to Sig. Joseph Eugéne Balsamo, Professor of Natural Philosophy at Lucca, in Italy, who has found a substitute for nitrate of silver in positive printing, which is hydrochloric acid saturated with phosphorus, and diluted with acetate of copper. Paper imbued with this compound is exposed to the action of light under a negative, and when it has acquired a gray color, it is removed from the pressure-frame and exposed for five minutes to the vapors of sulphureted hydrogen, which acts upon those parts of the paper which have become altered by the action of light. The picture is afterward toned and fixed in a solution of nitrate of bismuth. A decomposition of the salt of copper takes place, and the image, which is permanent is formed of oxyd of bismuth. The professor, with that true liberality which characterizes men of science, has given his discovery to the world. His researches in heliography have opened a new path to the photographer, and he promises another communication on this subject ere long.

Fire-Proof Buildings.

An article in the London *Review* maintains that the late gigantic fire at London bridge tested and found wanting the present system of fire-proofing warehouses. The conflagration made its meal of no mere piles of wooden houses, but of piles of buildings in which science had exhausted her resources in attempting to fortify them against fire. Party walls of immense thickness, stone staircases, iron beams and pillars were of no avail against the spontaneous combustion of a little heap of hemp. Poor Braidwood, who lost his life at this great fire, always protested against the use of cast iron for warehouses; pillars made of it become red hot, the water contracts and snaps them, and away go the floors at once. Then there is another danger outside—the girders supporting the flooring expand, no walls can resist their lateral thrust, and down they fall, to the destruction of those near at hand. Braidwood's death was caused by such an effect. It was proved at the inquest held upon his body that the iron girders heated to a white heat, as they were elongated nearly half a foot, pressing before them the solid wall which proved his tomb.

Industrial and Agricultural Fairs.

The following is a list of Fairs to be held this year in various States and in Canada:—

California........................Sacramento, Sept. 16, 21.
Canada, Upper..............London, C. W. Sept. 24, 27.
Connecticut..............................No exhibition.
Ilinois...........................Chicago, Sept. 9, 14.
Indiana...................................Indianapolis.
Iowa.........................Iowa City, Sept. 24, 27.
Kentucky.....................Louisville, Sept. 17, 21.
Maine...Portland.
Michigan........................Detroit, Sept. 24, 27
Minnesota..................St. Anthony, Sept. 27.
New Brunswick..................Sussex, Oct. 1, 4.
New Hampshire............................Manchester.
New Jersey.
New York...................Watertown, Sept. 17, 20.
Ohio............................Dayton, Sept. 10, 13.
Oregon....................Oregon City, Oct. 1, 5.
Pennsylvania.
St. Louis......Ag. and Mechanical Association St. Louis.
Vermont ....Rutland, Sept. 10, 13.
Wisconsin....................Madison, Sept. 23, 27.
Wisconsin, Ag. and Mech..........Milwaukee, Sept. 2, 6.
Rhode Island Industrial, Providence, Sept. 11. Show of Flax Cotton.

TO CLEAN PRINTED PAPER AND PICTURE PRINTS.—Fasten the paper to a board with button drawing pins, then wash it with water, in which is dissolved an ounce of carbonate of ammonia to every pint of water. This do with care, employing a camel's hair brush for the purpose. Then rinse the paper well with plenty of fresh water. When dry, repeat the same process for the reverse side of the paper. Now wet the paper with water made sour with white vinegar. Finally, wet the paper with water containing a little bleaching powder, and again rinse with clean water; then dry it by exposure to air and sunshine. It will become white, excepting where printed. To stiffen the print give it a coat of parchment size. Most valuable prints have been thus "restored."—*Septimus Piesse.*

THE Harrisburgh (Pa.) *Telegraph* states the potato crop in that vicinity is good, and unaffected by the rot.

Discovery of New Basaltic Columns—A New Giant's Causeway.

The Tuolumne (California) *Courier* thus describes a natural curiosity, lately discovered in its neighborhood :—

A very great excitement among our miners has been caused by a singular discovery made by Messrs. Cochrane, Russell and Lambert, on their claim at Dry Arroya, about a quarter of a mile from Sonora. The gentlemen while "hydraulicing" a stream bank about seventy feet in hight, were suddenly surprised by the caving down of an immense amount of gravel, limestone, boulders and lava, which revealed beyond, in the heart of a high hill, some hundreds of basaltic columns of a dull brown color, pentagonal in shape, and standing perpendicular, from 10 to 21 feet high. The open space between these pillars no where exceeds four or five inches, and rows of them run into the hill from 40 to 50 feet, closely packed together.

In some places, at certain angles, it is possible to see beyond this singular colonnade into an opening formed apparently of quartz rock, which is certainly exceedingly rich in gold; for, even at this distance from the observer, in a kind of dim twilight, strong indications of the metal are distinctly visible. Rays of light seem to penetrate into this opening through fissures in the roof, sides or from the rear, although the most diligent search of hundreds has not as yet led to the discovery of any of them, or of any other avenue through which the light could enter.

The hill is thickly covered with chapparel, which makes the search difficult and unsatisfactory. The well-known geologist of Columbia has been to the spot and examined the place with great attention. He reports that the columns are exceedingly hard, unusually regular in shape, and closely packed together ; that their igneous origin is very apparent, and that on examination he found augite, feldspar, titanic iron and olivin in their composition. He is certain that this is the only instance that so perfect a basaltic development of rock has been found in California—although he has seen as good a development in the West Indies—and he considers it, among all the geological discoveries in this country, as by far the greatest and most worthy of scientific observation. These wonderful natural pillars, interspersed here and there with immense stalactites, indicate a calcareous formation.

THE NEW SPANISH RIFLED ARTILLERY.

[From the London Mechanics' Magazine.]

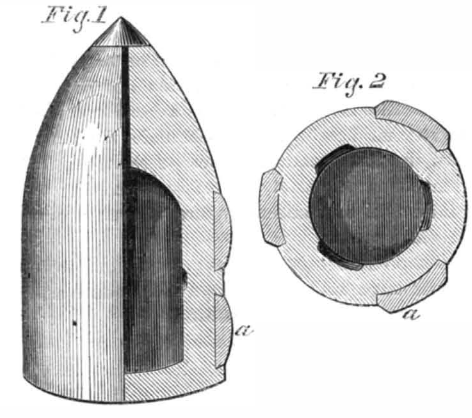
The Spanish government has set an example well worthy of imitation, by publishing the report of the experiments made by the Artillery Committee before deciding on the new system of ordnance, and the reasons given by it for its decision. From these documents it appears that after trying various kinds of breech-loading guns with lead-covered shot like those now in use in England (the Armstong system), a muzzle-loading projectile on very nearly the same plan as the French was found to give better results. A range of 6,600 yards was obtained at 17° of elevation with a 56-pound hollow shell constructed on this system, the extreme simplicity of which the accompanying drawings will render apparent.

The shell is entirely of cast iron, except six buttons of zinc *a a*, which enter the grooves of the gun and give rotation to the shell. As may be supposed, the exact angle for the grooves, the exact length of the shot and position of the buttons best adapted for service, were not ascertained without many trials. At last, however, great certainty of aim seems to have been attained, to judge by the published tables of firing. As to range with practicable angles of elevation, nothing comes up to the reported 6,600 yards with 17°. The nearest approach is by Lancaster, whose 100-pound shell ranged within 1,000 yards as far. Whitworth and Blakely and Armstrong may be able to do more, but we are not aware of their having done it yet.

Captain Blakely, indeed, may claim a great part of the credit of the success of the Spanish artillery, for though the projectile is not his, no guns could be found to fire it with safety but such as are built on his system. The committee reports the trial of many service cast-iron guns rifled, but although the Spanish cast iron is celebrated for its excellence, none stood the great strain produced by firing elongated shot. On the danger of rifling the present stock of cast-iron guns, the committee insists formally in more than one report.

On the 2d January, 1860, it writes:—"Cast iron by itself, as is clearly proved to us by the bursting of the guns we have tried, is not strong enough to resolve the question of rifled cannon of large caliber, unless the charge of gunpowder be much reduced, and even then the gunners would not feel confidence in their guns."

Large iron guns forged in one mass the committee condemns also, and judging by the bursting of the 6-inch forged gun at St. Petersburg a few months ago, and of the 7-inch forged gun at Shoeburyness more recently, we feel inclined to agree in this decision. We hope, however, that wrought iron will not be found as the committee reports it, "without the hardness and other qualities *necessary* to the bore of a gun." If it be really true that guns built up on Captain Blakely's plan, over a central tube of cast iron, are not only cheaper but really better than if the whole mass is of wrought iron, what a mistake England has committed !



The Spanish Artillery Committee asserts that the cast iron center is best, and gives detailed reports of the resistance of several cannon so constucted. We have space for but a few extracts. On the 9th of March, 1859, a comparative trial of a cast iron 32-pounder and a Blakely 32-pounder is thus reported :—

"The results of the proof are the following:—

	No. of rounds with			
	3 ks. powder.	3½ ks.	4 ks.	Total.
Hooped gun ...	600	200	400	1,200
Gun without hoops --		153	—	152

"The hooped gun is not at all injured. The firing was in the same place, and equal in all circumstances. Seeing this, and taking into consideration the premature bursting of the unhooped guns at Gijon, the committee connot do less than acknowledge the great increase of strength which the hoops supply, and declare themselves convinced that from guns cast of iron, in a single piece, the advantages of the system of rifling cannot be obtained." On the 13th of November, 1859 a Blakely gun, of 16 centimetres bore (6⅜ inches), is reported to have "been fired 900 rounds without suffering even the slightest alteration." On the 4th of September, 1860, another of the same bore, and weighing only 2,835 kilogrammes (about 57 cwt.), is reported as bearing no less than 1,366 rounds, with $28\frac{2}{10}$ kils. (about 60 pound) shells, and charges of 3 and 3½ kils. of powder. "During the first days of proof 100 rounds were fired, with intervals of only from 1 to 1¼ minutes. On the following days 50 rounds were fired with the same rapidity every morning, and 50 more every evening. The gun could not be touched with the hand on account of the heat." No wonder the committee thinks that this proof "renders apparent the excellence of the gun, and consequently that of the hooping system."

The final decision of the committee, which has been acted on by the government to the extent of ordering 600 sixty-pounder cannon, we cannot give better than in its own words;—

The path we must follow is clearly indicated : cast-iron cylinders hooped, a most simple manufacture, which, once established, only requires great care in securing the proper diameter to the bore of the hoops. The difference between the diameters of the hoops and of the cast-iron part must be determined by experiment, aided by calculation."

Besides the sixteen-centimeter gun, the Spaniards have rifled guns 4 8-10ths. inches diameter, for siege purposes, and reserve batteries throwing shells of about twenty-four pounds weight. The rifling is very similar to that of their larger guns, with six grooves, however, instead of three. The shells are of cast iron—strong enough to breach masonry—and have each six zinc buttons to take the rifling. The loading is by the muzzle. The reports from which we derive our information contain detailed accounts of experiments with breech-loading cannon, but of none which gave satisfaction to the artillery committee. The lead-coated shot they declare to be uncertain in aim, in consequence of the difficulty of always securing exactly the same difference between its diameter and that of the bore of the gun. Hence, the friction varying ; so does the range.

For field artillery the Spaniards have adopted a caliber of 3 4-10ths. inches, and a shell of about nine pounds. This enables them to use their stock of 4-pounder brass guns. These weigh about 6½ cwt. For mountain service they use the same shells and guns, weighing only 2 cwt.

An exceedingly interesting experiment is reported to test the powers of the new rifled field and siege guns. The fortress of Molina de Aragon was breached in three places by an old smooth-bored 24-pounder, by a 4 8-10ths. inch rifled gun, and by a 3 4-10ths. inch rifled gun. The former opened a breach eleven yards wide, in the ten feet thick wall, in 107 rounds, requiring ten hours. The second made a similar breach in 222 rounds, in fifteen hours ; and the third in 800 rounds, in forty hours.

Taking into consideration the much greater facility of moving the lighter rifled guns than the heavy smooth-bore 24-pounder, the commission unanimously recommend the use of the medium rifled gun for siege purposes. One observation made during this experiment we were not prepared for ; this was the less liability to rupture of the elongated shells than of the round solid shot but of 107 of the latter fired all but five were broken. Out of forty-one unloaded shells only three broke ! Does not this bear on the question of iron-plated ships ?

The Spaniards are now making further experiments, with a view of replacing brass for siege guns, with iron, built upon Captain Blakely's plan. This they are desirous of doing, on account of the destruction of brass when heated by rapid firing. They are also trying steel. We strongly recommend to our readers interested in gunnery to study for themselves the reports we have only had space thus briefly to notice.

English Patents.

The London *Times* gives the following statement concerning the condition and transaction of the English Patent Office :—

In the year 1860 there were 3,196 applications for provisional protection of inventions, and the number of patents actually passed was 2,061 ; in the other 1,135 cases the applicants did not proceed for their patents within the six months. The number of patents that prove useless is very great. The first 4,000 under the new system were granted in 1852-54, all for fourteen years, but liable to become void unless a stamp duty of £50 were paid at the end of three years, and another of £100 at the end of seven years, and of the whole 4,000 only 1,186 paid the £50 duty at the end of the third year, and only 390 the £100 duty at the end of the seventh year ; so that nearly 90 per cent were allowed to become void by the end of the seventh year. Still, the stamp duties received last year amounted to £108,000. The fees paid to the Attorney and Solicitor-General and their clerks amounted to no less than $9,621. Abstracts or abridgements of specifications of patents continue to be published, and sold at the cost of printing and paper ; the subjects now in the press are, shipbuilding, preparation of fuel and apparatus for its combustion, steam-engines, weaving, photography, bricks and tiles, and spinning. The Patent Office labors under the prevalent complaint—it has no room, it has books for which there are no shelves, and models which it has no opportunity to exhibit. But the fees have annually produced a surplus, which has now accumulated to the extent of £92,000, so that there is a building fund to begin with.

Bright Lights.—The Drummond light consists of a stream of oxyhydrogen gas burned upon a piece of chalk (carbonate of lime). It has also been called the "oxyhydrogen" and the "calcium light ;" but it is most generally known by the first name, because Lieut. Drummond first applied it practically and publicly in 1826, while conducting the ordnance survey of Scotland and Ireland. The light is very white, and it has been seen at a distance of 90 miles on a dark night. It has often times been proposed for lighthouses, but the electric light is more promising for this purpose, because more simple.