perior to cast iron for hydraulic presses and all cylinders subjected to great internal pressure—not excepting cannon.

THE WAR.

THE GRAND ADVANCE.

We briefly mentioned, in our last, that the long-anticipated advance of the grand central army which has been entrenched south of Washington had at last commenced. This column was under the command of Brigadier General Irvine McDowell, of the regular army. The main body of the secessionists is strongly intrenched at Manassas Junction, twenty-seven miles outhwest from Alexandria and about thirty from Washington. A letter from one of the secessionists in the entrenchments, written on the 7th of July, represents the works extending for fourteen miles, and very thoroughly constructed under the direction of the educated engineers who have deserted the United States service to fight against the government. If his statements are correct, these intrenchments are quite as formidable as the famous lines of Torres Vedras, north of Lisbon in Portugal, behind which the Duke of Wellington bade defiance to the ablest of Napoleon's marshals.

Our army consisted of sixty regiments and constituted by far the most formidable military force that has ever been mustered on this continent; unless, indeed, the secession force directly opposed to it may be greater. It was organized in five divisions, arranged in the usual order of right and left wings and the center.

The long-expected order to move forward was telegraphed from Gen. McDowell's headquarters, at Arlington Hights, to all the division and brigade commanders of the grand army, at two o'clock in the afternoon of Tuesday, July 15th, and was communicated to the different corps during the brigade parade held in the course of the evening. The order was received by all the troops with the most enthusiastic demonstrations of satisfaction. The regimental commanders were instructed to hold their commands ready to move at 2 P. M., the next day, provided with cooked rations for three days. Accordingly, the greatest activity prevailed on the morning of the 16th, throughout the encampments, from the northernmost post, near the Chain Bridge, to the southernmost, near Alexandria. Tents were taken down and tied up, wagons loaded, arms put in order, ammunition dealt out, rations cooked, &c.

At noon everything was in readiness, and precisely at two o'clock the fifty thousand men composing the grand army about entering upon the great work of sweeping secession out of the Old Dominion, were moving from their different positions toward their respective destinations.

The army moved southwesterly by four roads, its east and west portions being some eight miles apart at the start, but concentrating towards Centerville, three miles from Manassas Junction. Gen. McDowell went forward at the head of the second division forming the center. This division had in advance one regiment deployed as skirmishers, their lines extending from half a mile to two miles on each side of the road to guard against an ambush. Then followed one regiment of infantry, then a company of flying artillery, consisting of six rifled cannon, each drawn by four horses, and each gun followed by an ammunition wagon, also drawn by four horses. Then came two regiments of infantry, completing this brigade. Another brigade, somewhat similarly organized, followed in this division, with a long line of baggage wagons in the rear. The whole line occupied some miles of the road, and was several hours in passing a given point. As the column moved up and down the hills of the broken country through which the march lay, the rumble of the artillery, the long lines of bayonets glistening in the sun, and the perpetual tramp of the soldiers, are said to have produced a scene singularly impressive. Some of the inhabitants fled on the approach of the army, many gazed on sullenly, and a few continued quietly cultivating their fields as the troops marched by.

The other three divisions moved along their respective roads in about the same order, while one division was left in the rear as a reserve.

As the army moved towards the southwest, the enemy's pickets fell back before them on their main lines. On the 17th our troops entered the village of Fairfax Court House, eighteen miles from Alexandria and nine from Manassas Junction.

THE FIRST FIGHT AT BULL'S RUN.

On the 18th the first division arrived at Bull's Run, a small stream running through a valley three and a half miles from Manassas Junction, and here a brisk skirmish took place.

At eleven o'clock General Tyler proceeded to make a reconnoissance in force with Captain Ayres' (late Sherman's) battery, four companies of cavalry and Col. Richardson's brigade. Advancing up the road to Bull's Run for about two miles, the column came to an opening, after passing through a long stretch of timber, when sight was caught of a strong body of the enemy. General Tyler immediately ordered Captain Ayres' battery to advance and open on them, which they did from a commanding elevation. Eight shells had been thrown, when suddenly a volley was fired upon us from a hidden battery, about a mile down the road. Some of the enemy's grapeshot struck among the cavalry, that had in the meantime been drawn up in a body on a hill, killing two horses and wounding two of the troopers. Two more shots were then fired by the rebels, to which our rifled peices responded with about fifty shot and shell, directed wherever a trace of the enemy was visible. Two of Parrott's rifled twenty pounders then came up, and immediately joined in the action. The Parrott's gun is made of rimmed wrought iron, with rifle bore. With a single pound of powder they throw a shell of twenty pounds two and a half miles. The enemy having retreated into the woods, our batteries stopped firing, and the Second Michigan was ordered to deploy as skirmishers on the left of the road, and advance into the woods. They gallantly moved on, and, having entered the timber, they had hardly been out of sight five minutes when a most lively exchange of musket shots took place for a few minutes. Suddenly a succession of whole volleys, evidently discharged by large bodies of men, were fired. The remainder of Colonel Richardson's brigade was then ordered ahead. The three regiments advanced towards the woods, and drew up in battle array in front and on the right of the timber. Meantime the exchange of musket shots continued in the liveliest style in the woods. Companies G and H, of the First Massachusetts Regiment, and some companies of the Twelfth New York Volunteers, were then also ordered into the timber; and at the same time the cavalry and two howitzers advanced to the edge of the woods, the firing in the timber being kept up in the interval. Our howitzers then threw some grapeshot into the timber, when at once a terrific series of volleys of musketry were poured out from the woods upon the troops outside. At the same time a battery commenced playing upon us from an elevation in the rear. Shot of every description flew about our troops for some minutes like hail; but they being fortunately, nearly all aimed too high, hardly any one was struck outside the woods. A retreat was now ordered, when infantry, cavalry and artillery fell back behind our battery on the hill. The Twelfth New York, and a portion of the First Massachusetts broke ranks, and scattered in different directions, in their hasty retreat for some distance through the woods, in the rear of the battery. The remainder of the brigade formed behind the battery. At this juncture Colonel Sherman's Third Brigade, headed by the Sixty-ninth New York Regiment, appeared. Our battery again opened, and kept up a raking fire for nearly an hour which was vigorously replied to by the enemy. Their balls and shells struck the houses in front of which the battery was stationed several times, and raked the woods in the rear for nearly a mile. Some of their shot were picked up and proved to be from Hotchkiss rifled cannon. After a cannonade of about an hour a retreat was ordered, and our entire forse fell back to Centerville.

THE BATTLE OF BULL'S RUN.

After the skirmish of the 18th, our forces were advanced ready for an attack on the secession batteries at Bull's Run, and this took place on the 21st. All through this beautiful summer Sabbath the hostile thousands of these brave young Americans, scattered over some five miles of one of the loveliest regions in the world, were sending shot, shell, grape, canister, shrapnell and musket bullets into each other's bodies, the fight finally resulting in one of the most disgraceful panics and flights on the part of the Union forces that is recorded in the annals of war.

From the accounts received up to the time of going to press, we are unable to form any clear picture in our minds of the details of the battle, and shall not therefore make the attempt to convey any to our readers. The leading events, however, are known, and can be briefly stated. Our forces started upon their march at 2½ o'clock in the morning, and advanced to the valley of Bull's Run, which they reached at about 6. Across the valley the enemy could be seen drawn up in line of battle. On our side the firing was commenced by a large rifled cannon, and soon became general along the whole line of nearly five miles. The infantry advanced and attacked the enemy's batteries, carrying all but two of them in the course of the day. In the rear of the infantry, the engineers were busy in constructing bridges across the stream for the passage of the artillery, when, near sunset, an order was given to retreat. At this instant a panic arose among the teamsters in the rear, which was soon communicated to a portion of the volunteers.

The contagion spread, and in less than ten minutes a part of our army was flying in the utmost disorder. Everything was abandoned. The wounded were deserted in the hospitals, and the only thought was of individual safety. Guns were thrown aside, and blankets and knapsacks were lost and trampledupon. Some of the artillery shared the panic; the guns were cut loose, and the gunners used the horses to escape the more swiftly. Those on foot begged piteously to be allowed to share the horses of those who rode. Many strove to clamber into wagons, and were pushed back by the bayonets of those who occupied them.

A large portion of the army, however, maintained its order with a heroism and coolness worthy of veterans. The First Ohio regiment, under Col. McCook, recently Teacher of Infantry Tactics at West Point, made the last stand in the field, and the retreat was covered by the Rhode Island troops and Colonel Blenker's German regiment, from New York, in admirable order.

A considerable portion of our artillery was temporarily abandoned, but nearly all was afterward recovered.

During the eleven hours' fighting under the broiling sun, the New York city troops were particularly distinguished, though all our forces fought with a desperate and steady valor that has never been surpassed. Mr. Russell, the correspondent of the London *Times*, says that our infantry charges eclipsed even the famous British charges at the battles of Alma and Inkerman. As nearly as we can make out from the present accounts, the teamsters and straggling skirmishers ran away, spreading frightful stories of defeat, while the great mass of the army fell back in good order upon its positions. All that courage could do to retrieve the blunders of their leaders was per formed by our soldiers.

Our troops fell back to the positions which they occupied before the battle, where they are being rapidly reinforced.

Very false accounts of this battle were telegraphed over the country on Monday and Tuesday, representing it as a complete rout and dispersion of the whole army, causing considerable gloom, but nerving the spirit of the people with additional resolution and firmness. By Tuesday night, 60,000 additional volunteers had been accepted by government among those which had been previously offered and declined. General McClellan has been ordered to Washington, it is supposed to take the command of the army there, while Gen. Banks supersedes Gen. Patterson. The effect of the engagement will be to cause the war to assume larger proportions, and to be more protracted.

RETAKING OF ONE OF THE VESSELS CAPTURED BY THE JEFF. DAVIS.

The schooner *S. J. Waring*, mentioned in our last among the vessels which had been captured by the privateer, *Jeff. Davis*, arrived in this port on Sunday, July 21st, having been retaken by the black steward, with the assistance of one of the seamen.

When the *S. J. Waring* was taken by the *Jeff. Davis*, her captain and mate were taken off, but the colored steward, two of the seamen and a passenger were left on board. The steward having discovered, by a con-

versation which he heard, that it was the intention of the prize master, Capt. Amiel, to sell him into slavery as soon as the schooner arrived in Charleston, determined to make a desperate attempt to retake the vessel. He proposed his plan to the two sailors who belonged to the schooner, but one of them refused to have anything to do with it. The other one, however, a young German by the name of William Stedding, agreed to assist, and these two men undertook the bold task of overcoming the whole prize crew.

The following account of the successful execution of their enterprise is given by the passenger, Bryce Mackinnon. After narrating the events of the capture, substantially the same as already published, he says:—

The schooner was headed for Charleston, or some inlet on the coast near that port. We were not put in irons, but were used with as much kindness as we could expect. The steward continued to cook and provide for us, and our men worked the vessel. I became quite intimate with the officers, and expected soon to be a prisoner of war in Charleston, though we hoped we might fall in with a United States vessel, and be rescued from our captors. Thus we got on quietly on our way southward until Tuesday, the 16th inst., when we were 50 miles south and 100 miles west of port, and thought we might get in the next day.

What followed, I did not anticipate. It is true that now, when I look back, I remember that Amiel had congratulated himself upon the valuable prize he had found in the steward, whom he vowed was worth a cool thousand on Meeting street, Charleston. And I further remarked that, on several occasions, Tillman, the steward, shook his head and muttered, "Dem fo'ks nebber git to Charls'n;" but I supposed then that he was expecting, like the rest of us, to meet with a friend in one of Uncle Sam's cruisers.

It was a bright moonlight night, was that of Tuesday, so pleasant that I remained on deck till 11 P. M., later than I usually did. The steward had turned in at 8, as was his habit. Our trunk cabin projected about three feet above the main deck, and was entered by a companion way in the middle of the forward end. When I went down, the mate was nodding on the cabin roof, just in front of the wheel, in a half recumbent position. Behind him stood Wm. Stedding, one of our old crew, at the wheel. Milnor, the South Carolinian, lay asleep on a pile of sails at the foot of the foremast. McLeod, another of our men, with Dorsey, the Jerseyman, were asleep in the forecastle. The cabin lamp was burning on the table when I went below, and Capt. Amiel lay snoring in his berth in his stateroom, sound asleep. In the stateroom on the other side of the cabin slept the steward and second mate, the former on top, the latter in the second berth, the third and lowest sleeping place being unoccupied.

The weather being sultry, the doors of the staterooms had been taken off, so that not only were the rooms open from the cabin, but my room, in the rear of the captain's opened into his, the door between being also down. I tookmy coat and vest off very leisurely, and swallowed a draught of cherry brandy before getting into bed, so that I should think it was 11:10 when I retired. It could not have been more than 10 minutes later when I was awakened from a light sleep by a peculiar sound in the captain's room, which I knew instinctively could only have been produced by an ax cleaving Amiel's skull. No sooner did the "thush" strike upon my ear than I leaped out of bed, and leaning against the door casing in the partition, saw the steward dart through the twilight—for he had extinguished the light—noiseless as a cat across the cabin toward the second mate's room. I also saw, at the same glance, Capt. Amiel rise from his berth and attempt to follow him; but the blood blinded him, and he fell to the floor, with a horrid gurgling sound in his throat. All this was but the work of a second. The cleaving of the skull, like a flash from a gun preceding the report, was followed by a weak, faint cry, like that of a sick child, and the gurgling in the throat. I knew then that his wound was mortal. Stooping sideways, the steward entered the second mate's cabin, and once more swung his ax, but not so effectively.

The mate started up with a "G—d d—n you, don't strike me again," and clutched at the steward's breast, but eluding the wounded man, he ran on deck, to where the man lay near the wheel-house, and keeping his axe behind him demanded "what all this noise was about?"

The mate who had been aroused by the outcries of the captain and mate, had raised himself up on his elbow, and stared at the steward in a half stupid, half fascinated way, not seeing the pistol which Stedding the man at the helm, had pointed at him for use in case of necessity. As he turned his face toward the steward, the latter drove his weapon home into the base of his skull. Stedding and the steward then tumbled him overboard. He rose on the wave, with a hoarse cry, when about two lengths astern, the water having raised him, but he must have soon gone down to his long account.

Then the steward came down to the cabin, where I still stood, while Stedding remained, pistol in hand, to guard the deck. The captain cried faintly twice to me by name, "Help me—help me," but he was past help. Another swishing blow of the ax, and he did not repeat the cry. Then the steward returned to the second mate's cabin, where, seated on a pile of starch boxes, his legs drawn up, and his head between his knees, was the half-stupified man. Again and again the ax fell, and again and again the cry "Don't do that," fell on my ear, each time fainter than the last. Stedding now came down, and the steward and he took the corpse of the captain by the feet, and dragging it up the companion-way, tossed it overboard. Meantime, I had got some irons out, hoping to intercede to save bloodshed. Stedding and the steward once more came down, and each taking the second mate by the shoulder led him out, from the place where he had crouched on the starch boxes. He seemed to walk, with their assistance, as they went up the companion-way, but his head lay a pulpy mass upon his shoulder, and a moment after a loud splash alongside told the fate of another of the privateers.

There were three persons on board who knew nothing of all this. The two privateer sailors, and Donald McLeod, one of our sailors, whom I subsequently learned would not join the steward and Stedding in the attempt to recapture the vessel. Handing me his pistol, Stedding went forward and roused Milnor, the South Carolinian, a young man of two or three and twenty, from his sleep at the foot of the mainmast, and called him aft. Not seeing his comrades when he came into the cabin, he was much frightened and begged for life. The steward told him he would not kill him, but iron him, and his fate would depend upon his good behavior; he wanted to spill as little blood as possible. He willingly held out his wrists for the irons. They then went forward to the forecastle and called the other privateer, Dorsey. Upon learning the condition of affairs he begged for his life, which they promised to spare if he would assist in working the ship and be true and faithful, to all of which he agreed.

The steward now took command, and the schooner headed for the North, with a fair wind. None of us knew anything of navigation, but we trusted to good fortune and the land to enable us to make out our course. The South Carolinian was released from irons the next morning, and proved a very useful and willing fellow in working the ship.

On Friday, the 19th, at 8 o'clock in the morning, we made the land, which became quite distinct by noon, and we kept on our way with good weather, sounding our way as we went. Of course we had to be vigilant. Two of our hands might turn upon us at any moment, and McLeod was not faithful; for three days before we got in he went forward and slept with them in the forecastle. Stedding, Tillman, and I managed it so that two of us were on deck all the while, and always aft of the other three. The men on watch carried the two pistols, and the one that slept always kept one eye open, lest we might be attacked. On Sunday morning, at 9 o'clock, we got a pilot off Sandy Hook, and soon after hired a tug for $60 to tow us up to New York, where we arrived about 4 P. M., truly thankful for our great deliverance.

The steward's name is William Tillman. He says that he was born of free colored parents in Milford, Delaware, and is 27 years of age. His parents moved to Providence, R. I., when he was 14 years old, and he has since called that place his home. He has followed the sea for ten years, and has been in the employ of Jonas Smith & Co., No. 227 Front street, by whom the schooner was owned, for the last three years. He is of medium hight, rather strongly built, crisp hair, of nearly unmixed negro blood and bears in his countenance an expression of honesty, strong common sense, with some touches of humor.

ANOTHER PRIZE RECAPTURED.

One of the vessels captured by the steamer *Sumter* has also been retaken. This is the brig *Cuba*. She was seized at the south of the island of Cuba, and a prize crew of five men put on board; the captain, J. D. Strout and a few of his crew being left on board to work the vessel. On the 8th of July, while the vessel was off the west end of Cuba, Capt. Strout formed a plan, in connection with his mate and steward to retake her, which succeeded; the mate and steward seizing the arms of the sailors and marines forward, while Capt. S. took care of the officer. They made a desperate resistance, but the plans were too well laid.

They arrived safely in this port on Monday, the 22d of July, with the prize crew as prisoners.

TIRED OF WAITING.—The New Orleans *Delta*, of the 11th inst, says that "the further persistence of the Confederate States in endeavoring to obtain a recognition of our nationality is useless." It also says that the British Ministry has not the courage nor inclination to apply to the Confederate States the rules which it has uniformly applied to other nations. Too much importance has been assigned to the idea that France and England would break the blockade to get Southern products. The editor proposes to recall the Commissioners and to reject the resident Consuls of all powers which will not recognize similar officers of the Confederate States abroad.

MANUFACTURE OF HEAVY ORDNANCE FOR THE GOVERNMENT.—The Boston *Traveler* states that the South Boston Iron Foundry now employs two hundred operatives in the manufacture of heavy ordnance and projectiles for the government. Some of the machinery is kept in motion the whole twenty-four hours, so urgent are the demands. The *Traveler* adds:

At this foundry are now making not only twelve and thirteen-inch shell for mortars, but shell for ten-inch Columbiads, and shot and shell for twelve and six-pounders, with canister and grape. From two to three hundred of shot and shell are made per day, and about twelve guns per week. Many persons suppose that mortars and heavy ordnance are cast hollow ready, after finishing, for use. This is a mistake. The gun is cast solid and then bored.

It is reported that Mr. Burton, formerly of Harper's Ferry Armory, and latterly of the Enfield rifle manufactory in England, is now in Richmond, Va., making rifled muskets for the secession forces.

Chemistry of the Comet.

We take the following from the London *Chemical News*:—Probably few of our readers are ignorant that a most brilliant member of this erratic celestial family is now a conspicuous object in the northern heavens. It first made its appearance on Sunday, June 30th, after sunset, when, as the clouds cleared away, it was suddenly discovered shining as bright as a star of the first magnitude, and almost rivalling the magnificent comet of 1858 in brilliancy and development of tail, while it far surpassed it in the diameter of nucleus.

An opportunity which perhaps may never occur again is thus allowed for physicists to become acquainted with the intimate constitution of these mysterious visitors. On the occasion of the last appearance of so brilliant an object, in 1858 philosophers could do little more than examine it through their telescopes, and wonder, and speculate on its constitution. Since then, however, science has made rapid strides, and we are at the present time in possession of methods of analysis vastly more searching and powerful than any known previously. Chemists can now analyze, in the most rapid and accurate manner, almost everything which is visible to the human eye. It matters not whether the body possesses a tangible substance or not—whether it is close at hand in the test tube, or millions of miles away; if it only fulfills the one condition of emitting light, it is almost certain to reveal the secrets of its composition when submitted to the new development of spectrum anlysis.

The actual metallic constitution of the sun has already been shown by this means; that of the fixed stars is also being ascertained in the same manner, and we really hope that the present opportunity will not be allowed to pass without the beautiful method of spectrum analysis being applied to determine the elementary constitution of cometary bodies. The apparatus required would not be more than is already in the hands of many scientific men. A large telescope, equatorially mounted, would, from some experiments of our own upon this subject, seem to be necessary, in order to obtain sufficient light to illuminate the field of view. The spectrum apparatus being placed in proper adjustment, the luminous image only requires to fall on the slit and along the axis of the collimating tube for the fixed lines in the cometic spectrum to be instantly visible. A small and temporary arrangement, hurriedly fitted up, has been sufficient to satisfy us of the existence of fixed lines in the spectrum of the light emitted from the comet at present visible, but they were too faint to admit of identification. This experiment should at once be repeated with larger and more powerful apparatus. Many important questions would thus be finally settled. If the comet shone merely by reflected light from the sun, the ordinary solar fixed lines would be the only ones visible. If, however, as is most probable, some of its splendor is due to native light, the spectrum would as readily reveal whether the nucleus or the tail were in the solid or vaporous state; if the former, it would give a continuous spectrum, while if it were a vapor, the spectrum would be disconnected, and the new lines in it would at once disclose the elementary bodies to which they were due. It is, however, impossible to foresee all the valuable information on the obscure subject of stellar chemistry which could in this manner be obtained. We trust that, having pointed out this most promising field of observation, the rich harvest of facts with which science can thereby be enriched will not be allowed to escape for want of able observers.

SMALL and irregular castings may be rapidly and effectually cleaned from sand by being placed in a slowly revolving drum. Small bronze statues are cast in this manner: The mold is placed on the mandrel of a lathe, the metal poured in, and the mandrel made to revolve. The centrifugal action of the mandrel throws the metal to the circumference of the mold, and thus very accurate thin hollow castings are produced.

DURING some experiments lately made in Vienna, it was ascertained that the guns used by the Austrian infantry could be discharged fifty-five times in nine minutes and a-half, with gun-cotton. The cartridge was put into the barrel without the use of a ramrod. The results with this class of gun are said to have been highly satisfactory.

Boilers and Boiler-Plates.

The following useful information on this important subject is from a paper read before the Association of Foremen Engineers by Mr. Ramsell, and published in the last number of *Newton's London Journal* :—

Mr. Ramsell stated that twenty years' experience in the construction of steam boilers had given him some practical knowledge of his subject, and that, therefore, he had little diffidence in speaking upon it. He had long ago become convinced of the necessity of adopting a different principle to that usually acted upon in the manufacture of boilers; and a very important point was to do away with "stays," as used for strengthening them. More especially, he referred to marine boilers, and instanced, in the following order, three principal evils attending the employment of stays :—First, the obstruction they offered to the effectually cleaning of the boilers; second, the increased amount of incrustation induced by them; and, third, the water and steam space they occupied. The fracture of the steel boilers of the *John Penn* S. V., which came especially under his notice last year, prompted him to give more consideration to the subject. In those boilers, the number of stays rendered necessary by the thinness of the plates, made it almost impossible to clean them out, while the cracking of the plates at the sides of the fire-boxes completed their ruin. The steel boilers were, eventually, and after a very short trial, removed from the *John Penn*, and their places were supplied by iron ones.

Having witnessed this, and many other instances of the evils of stays, Mr. Ramsell stated that he had come to the conclusion that iron plates, for boilers, might be so prepared as to give them strength, to a great extent, without adding to their thickness, or much to their weight. This object he proposed to effect by producing corrugations or indentations of any shape in the middle of each plate, and leaving plain surfaces on their outer edges, for the purpose of riveting them together. Plain surfaces for manholes, and the attachment of pipes, would also be left where necessary. The corrugations or indentations might be made by rollers or presses, as found most desirable or applicable to the particular size or shape of the boiler to be made. He had provided and used both rollers and presses for the purpose, and had experimented upon the plates produced by them. One series of experiments he would give them the details of, they having been made in the presence of Mr. Miles, of the firm of Humphreys and Tennant :—

Two plates, made from ⅞-inch bowling iron, the center of the plates being only ¼-inch thick. Length and breadth from center to center of rivets, 5 feet by 3 feet 4 inches. Surface exposed to pressure, 6 feet 6 inches by 3 feet 5½ inches—equal to 22 square feet. At a pressure of 20 lbs. per square inch, or equal to 28 tuns 5 cwt. 2 qrs. 24 lbs. on the whole surface, it expands in center of plate, 1-32 inch.

	T.	C.	Q.	LBS.		
At 30 lbs., or =	42	8	2	8	it expanded	1-16 inch.
" 40 "	56	11	1	20	"	3-32 "
" 50 "	70	14	1	1	"	1-8 "
" 60 "	84	17	0	16	"	3-6 "
" 70 "	99	0	0	0	"	1 "
" 75 "	106	1	1	24	"	1 1-4 "

A full ⅞-inch boiler plate, flat, with a surface of 3 feet 4 inches, by 3 feet 2½ inches, from center to center of rivets, expanded in center of plate as follows :—

At a pressure of 5 lbs. per sq. inch.		3-32 inch
" 10 "		1-4 "
" 15 "		5-16 "
" 20 "		3-8 "
" 25 "		7-16 "
" 30 "		1-2 "
" 35 "		9-16 "
" 40 "		5-8 "

These results demonstrated the superiority of plates manufactured on the corrugated or indented plan. The author did not confine himself, in the patent which he had secured, to any particular form of indentation, nor to whether these should project on one or both sides of the plates. He simply maintained that his process imparted additional strength to ordinary plates, while it tested severely the quality of the metal, without waiting for the pressure of steam to do it. In one steel plate of the *John Penn*, 10 feet by 2 feet 6 inches by 3-16-inch thick, 72 stays were employed: in one of his of the same dimensions, 9 such stays only would be necessary. In the back of the boiler of the same vessel, 320 stays had been used, whereas 70 would have given equal stability in the same space in a boiler of his construction.

Other facts of a similar character were mentioned by Mr. Ramsell, who illustrated his paper by drawings and models, which were handed round for the inspection of members. On the conclusion of the paper a discussion arose, Mr. Aydon taking exceptions to some of the statements made, and putting several pertinent and practical questions respecting the originality of the plans propounded. Mr. Stabler, Mr. Owbridge, Mr. Jones, and others joined in remarks favorable or otherwise to Mr. Ramsell's views, while the chairman admitted that much light had been thrown upon a very important, and, indeed, vital matter, in connection with steam boilers, and thought that further experiments should be made as to the strength of the plates. Mr. Ramsell met all the objections, and courted further examination at his works at Deptford.

Fire Shells.

Capt. J. Norton, in a communication to the London *American*, states that shells filled with molten iron, if kept for a few minutes "over time," become cold and perfectly harmless as hot shot. Respecting his own fire shells he describes them as follows :—"I charge my shells with phosphorus dissolved in bisulphide of carbon, which does not become damaged by time, or passing through water. I can make them of type or fusible metal, both of which are brittle, and become fragmented without the aid of a bursting charge. On striking the ground or a plank of timber, the fragments, being coated on the inside with the liquid, burn with intense heat for a long time. The shell may, moreover, be charged with pellets of wool, which, being saturated with the liquid, each will burn till consumed, and its ashes glow with fire for some time after. My light muzzle-loading rifled field-gun is well calculated for throwing these incendiary shells so as to strike the ground a short distance in front of a hostile battery, where on striking the ground they become fragmented, and the blazing segments are thrown forward among the gunners and horses of the battery. They would operate in a similar manner on striking the inside of the embrasures, or the port-holes of a man-of-war."

Corrosion of Lead in Water Pipes.

The Boston *Medical and Surgical Journal* contains the following important information on the above subject, which is of deep interest to almost every person. It says :—

Mr. J. R. Nichols calls attention to a source of danger attending the use of leaden pipes used for the conveyance of drinking water, which seems to have been hitherto disregarded. Even if it be admitted that the water which is supplied to the city of Boston from Lake Cochituate, like that of most New England ponds, be such that it may be safely used after having passed through lead pipe under ordinary circumstances, it would nevertheless be wrong to infer that this water can be employed with entire safety at all points of delivery, without first inquiring whether special conditions may not exist in some localities by which the character of the water may there be changed. Having observed several instances in which the inmates of a single house had suffered from lead disease induced by the use of aqueduct water, while the inhabitants of other parts of the city, supplied with water from the same original source, were unaffected, and having in one instance detected the presence of considerable quantities of lead in one of the cases first mentioned, while no reaction for lead could be obtained from a specimen of the same aqueduct water taken from another locality, the author proceeded to inquire into the cause which produces this lead impregnation in certain houses or districts, while the general waters of a supply remain unaffected. He has noticed in the leaden pipes removed from cess-pools, sinks and wells, that the intensity of corrosive action had been in a great measure confined to the sharpest bends and depressions in the pipe, while in some instances other portions remained intact. "I have in my possesion," he says, "a section of supply pipe, removed from the aqueduct of a neighboring city, in a portion of which corrosive action had proceeded so far as to cause leakage. The part thus acted upon was confined to an acute angle, and there is evidence to show that the plumber, in placing it in position, bent it in the wrong direction, thus creating the necessity for another turn in the opposite. This pipe had doubtless been subjected to two violent turns, which seriously impaired the homogeneity of the metal. An examination of lead pipe removed from buildings will certainly show that where there has been any perceptible amount of decomposition, it has been confined to the angles and depressions in its course. There are three causes or agencies which may perhaps be sufficient to produce these results :—1. The disturbance in the crystalline structure of the metal by bending, whereby its electrical condition is changed and voltaic action promoted, giving rise to chemical decomposition. [Together with the galvanic action which must be induced wherever connections or faucets of copper, or alloy, are fastened to the leaden pipe, or where a crack or fissure in the latter has been filled with solder.] 2. The presence of organic matter, such as fragments of leaves, and impurities pervading all pond waters, and which may be detained in angles and depressions of the pipes. 3. Corrosions may be produced in lead pipes by the accidental presence of pieces of mortar. Where mortar is present, the lime would assist in oxydizing the metal, and also aid in the solution of the oxyd. Considerable portions of fresh mortar are frequently deposited in lead pipes, during the erections of buildings. When the family commence the use of the water, it holds the salts of lead in solution, and its presence may be detected for months. The process of oxydation, which is retarded or prevented altogether by the presence of neutral salts in water, could not be materially interfered with under the conditions considered. It is obvious, if these observations and conclusions are correct, that much care should be exercised in placing pipes in position in buildings. In those leading to the culinary department, angles and depressions should be avoided. Violent twists and turns should not be permitted, and during the erection of houses, the open ends of protruding pipes should be carefully closed. Assuming the general fact that pipes, conveying the waters of our New England ponds, become coated and protected by an insoluable lead salt, the question arises, how long before this protection is secured, or, how soon may a family commence the use of water passing through new pipes, with safety? In view of the manifest danger from local disturbances, the most sensible reply would be, never. A section of new lead pipe, immersed in Cochituate water one hour, at a temperature of 65° Fah., gave a decided lead reaction with sulphydric acid. Removed and placed in six fresh portions of water one hour each, the waters, when tested, give similar results. The experiment continued during two weeks. Varying the time of immersion in fresh portions of water from one to ten hours the lead indications continued, although at last feeble. These results are sufficient to show that individuals or families should not commence the use of water flowing through new pipes, until considerable time has elapsed, and much water contact secured."

THIRTY YEARS' WORK.—Since 1831 the British have laid down, at a cost of £330,000,000 ten thousand miles of railway, along which they now carry 150,000,000 of passengers every year at a distance of 2,000,000,000 miles, besides an incredible amount of minerals and merchandise. During the same period there have been laid 10,000 miles of telegraph with 50,000 miles of communicating wire, by which there has been given to the people of that country something like an earthly omnipresence. In doing this they have been accomplishing a work more stupendons and likely to be more useful, than any works of which there is record in the history of the world—more stupendous than the mightiest industrial achievements of Rome, Greece, or China. During the same interval of time they have increased there navigation fourfold, and that part of navigation, which was the most important, namely, steam vessels, have multiplied fourteen fold.

The Origin of Coal.

Various opinions have been put forth respecting the origin of our coal measures. The following is by R. Hunt, F. R. S. (author of "the Poetry of Science"), in a late article in the *St. James* (London) *Magazine*: It has been somewhat too hastily said that coal is formed directly from wood, and that much of it is found to retain its woody structure. There is great doubt on this point. That wood may be *eventually* converted into coal is admitted—but in changing, it entirely loses the form of wood—retains no evidence of fiber. It may, under the influences of heat and moisture, be converted into a bituminous mass, which is eventually consolidated into coal; but we cannot discover any evidence of wood being transmuted directly to coal. The remains of woody trees found fossil in the coal measure strata may become limestone, may be iron ore—certain it is they are never coal. The probability is, that the coal mass itself was produced from cactus-like plants, from club mosses, or peat mosses, or from aquatic plants, either marine or fresh-water.

The vegetable mass, whatever may have beenits origin, from which our beds of fossil fuel is derived, may have been formed from plants which grew on the spot where we now find it, and the *under-clay*, as it is called, is supposed to be the soil in which the plants grew; or it may have been removed by the waters in a plastic state, floated out into the deltas or seas, and eventually, in obedience to the law of gravity, have sunk to the bed of the then existing waters.

Knowing that many of these coal beds are now several thousand feet below the surface, we have either to suppose—if we adopt the first hypothesis—a gradual subsidence of the earth to the depth at which the coal is now found: or, if we prefer the second, to imagine the filling up of the seas, after the coal has been deposited, by enormous beds of sandstone or of shale. Sir Henry de la Beche describes a section near Swansea having a total thickness of 3,246 feet; in this there are ten principal masses of sandstone, one of these 500 feet thick. They are separated by masses of shale, varying in thickness from ten to fifty feet. The intercalated coal beds, sixteen in number, are generally from one to five feet thick—one of them, which has two or three layers of clay interposed, attaining nine feet.

Taking this instance only, we learn that there have been sixteen different formations of coal; that these have—each one of them—been covered up with hundreds of feet of sandstone and shale. The subsidence of the earth's crust is surrounded with difficulties of no common order—the filling up an ancient sea to the depth of more than 3,000 feet requires conditions which we can scarcely conceive to have existed—and in either case we seem to require ages of repose, during which a beautiful Flora drank in the sunshine, followed by ages during which sand was deposited, bearing down with it but little evidence of there being any vegetable life. Science has advanced far into the secrets of the earth's changes; but let us not deceive ourselves by supposing we have as yet heard the voice of Nature proclaiming the true phenomena of our coal formations.

COPPER SMELTING.—*The Ontonagon* (Lake Superior) *Miner* states that the representatives of the French company have been making investigations among the mines of the Ontonagon district in relation to the establishment of smelting works, and that the result of their investigations will undoubtedly be the early erection of such works. The fuel used will be wood. In June, the Isle Royale Mine, turned out 65 tuns of copper, the Franklin 80, the Pewabic 85, the Quincy 140, and the Huron, Hancock, and Portage 22 tuns, making an aggregate of 396 for the month.