auxiliary tank, where it is stored up to assist in starting again. The illustration shows the car bed and lower works.

A car provided with

SMITH AND DE COPPET'S AMMONIA ENGINE

is represented in Fig. 8. Liquid ammonia, stored in a reservoir, *a*, is withdrawn and injected by a pump, *b*, into a vaporizer, *c*, heated by a lamp beneath. The gas is conducted to the engine, *d*, by a pipe, and is exhausted into a condenser, *e*, where it is liquefied by a shower of spray falling through a perforated plate, the water being supplied by tanks, *f*, one at each side of the car, and withdrawn therefrom by a pump. A third pump removes the ammonia from the condenser and forces it into a tank, *g*, beneath the car, where it is retained for further use. Chains communicate motion from pulleys on the engine crank shaft to pulleys on the driving wheel shaft.

In Fig. 9 three views of a dummy engine are given, showing the compact arrangement of boiler necessary to adapt it to the limited space in street cars.

Communications.

A New Method of Projecting Spectra.

To the Editor of the Scientific American:

If the inner coating of a Leyden jar be connected by a wire or a chain to one terminal of an induction coil, and the outer coating to the other terminal, when the battery connection is made or broken, the induced electricity is very much condensed, and shows itself as a much shorter spark; but the intensity of its light is vastly increased, and the passage of the sparks is accompanied with quite a deafening sound, especially if several follow each other in quick succession. Advantage has been taken of this form of spark to study the spectra of the elements by making the spark to pass between terminals of the material to be examined. I have lately found that the intensity of the light from such a spark from one of Ritchie's 10 inch vertical coil is sufficiently great to admit of projection upon a screen in the lecture room. The terminals were arranged one above the other, so as to give a vertical spark. A 1 gallon Leyden jar was used, and the battery had three Bunsen 2 gallon cells. The terminals could be separated about an inch. About a foot in front of the terminals was fixed a double convex lens, 4 inches in diameter and of about 1 foot focus, and a single bottle prism of bisulphide of carbon in front of the lens, where the larger part of the refracted rays would fall upon it at the proper angle, the refracted and dispersed rays falling upon the screen, the focussing being done by moving the lens until a plainly marked spectrum appeared. This spectrum could be very plainly seen when it was eighteen or twenty inches long. In this case, the spark itself answers for the slit in the ordinary method of studying spectra; and inasmuch as the spark is seldom or never straight, it follows that the spectrum will consist of a series of bright lines all with the same zigzag pattern, which gives a very curious and interesting effect, for no two have the same form; and yet all the bright lines hold the same relation to each other as in ordinary spectra.

It is only necessary to affix small pieces of different metals to the terminals of the coil and pass the spark between them to exhibit, to forty or fifty persons at a time, the characteristic spectra of the elements. Those that I used were sodium, copper, zinc, calcium, and brass. There is usually a tolerably plain continuous spectrum, which I take to be due to incandescent dust particles in the path of the spark, but this does not interfere with the bright line spectrum. This method may be usefully employed when the class is not too large, and when neither a fifty cell battery nor an oxyhydrogen lantern are owned. A. E. DOLBEAR.

Physical Laboratory, Tuft's College.

Are Iodide of Potassium and Chlorate of Potassa Therapeutically Incompatible?

To the Editor of the Scientific American:

In your issue of January 20, 1877, the above question is answered affirmatively in an article copied from the *American Journal of Pharmacy*.

I recollect having once seen a very sick patient treated with iodide of potassium and chlorate of potassa, administered alternately every two hours in large doses, for a number of days in succession, and the patient recovered. I called the attention of the physician to the possible danger of administering the two drugs at the same time; but he averred that he had frequently done it without any bad results following.

His knowledge of chemistry and incompatibles would have allowed him, no doubt, to administer tannic acid and iron, or iodide of potassium and acetate of lead, in the same prescription; yet sometimes from people's blunders we gain practical information. It is possible that the safety in these cases consisted in the fact that the drugs were administered with intervals of two hours between them, the one having been absorbed from the stomach before the other entered.

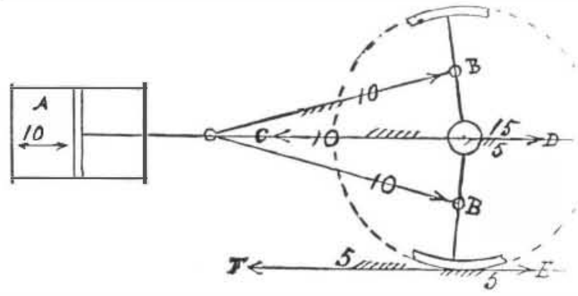
I am of the opinion that, when these drugs are administered with intervals of two or three hours between them, there is no danger of the formation of iodate of potassium. It would be reckless, however, with our present knowledge, for any practitioner to prescribe the two drugs in the same formula. A. C. SIMONTON, M.D.

Mitchellville, Iowa.

Traction of a Locomotive.

To the Editor of the Scientific American:

The inquiry is often made as to the principle upon which a driving wheel draws its load. The annexed simple analysis will, I presume, make the matter clear. An engine with a 16 inch piston, 4 feet driver, and 12 inch crank, working at a maximum cylinder pressure of 100 lbs. to the inch, will exert a force of about 10 tons upon the piston, A, and crank pin, B, and an equal force upon the head of the cylinder, and,



through the medium of the engine frame, upon the center of the driver in the opposite direction. When the crank is below the center of the wheel, the 10 tons acting upon its pin is divided equally, in this case, between the center of the wheel and its tread. 5 tons at each point; but as the 10 tons acting against the head of the cylinder and the center of the wheel in the opposite direction is just double this amount, the impelling force, in the direction of F and C, will of course be 5 tons.

When the crank is above the center of the wheel, the 10 tons acting upon its pin will exert a force of 5 tons at the tread of the wheel, as a fulcrum, in the opposite direction. This added to the 10 tons gives 15 tons as the force of acting upon the center of the wheel in the direction, D; but as this 15 tons is opposed by the 10 tons acting upon the head of the cylinder and center of wheel, we have just 5 tons progressive force towards E and D. The operation is clearly shown by the arrows.

The reader will perceive that the progressive motion is caused by the action of an ever-varying leverage whose effective fulcrum is the adhesion of the wheel to the rail. When the crank is below the center of the wheel, the length of the lever is the radius of the wheel, and the positive agency to locomotion is the pressure of steam against the head of the cylinder, and the negative agency is the pressure of steam against the piston; but when the crank is above the center of the wheel, the case is reversed. The pressure against the piston then becomes positive, and that against the cylinder head negative, and the length of the lever is the radius of driver *plus* the length of crank. I use the term positive because the engine moves in that direction.

Worcester, Mass. F. G. WOODWARD.

State Legislation Concerning Patents.

To the Editor of the Scientific American:

Apropos of your article in the SCIENTIFIC AMERICAN for February 17, in reference to State legislation tending to abridge the rights of patentees and owners of patents, I presume that the bill recently introduced in the New York Legislature is patterned after a law of this State (Pennsylvania), approved April 12, 1872, which enacts substantially as follows: That the words "given for a patent right" shall be prominently and legibly written or printed upon the face of any promissory note or other negotiable instrument, the consideration for which, either in whole or in part, shall consist in the right to make, use, or vend any patent invention or inventions claimed to be patented; and the party taking such note shall, as to any defence which the maker may or might have, stand in the shoes of the original payee or holder. The act proceeds still further, and makes it a misdemeanor, with a maximum penalty of $500 fine and sixty days' imprisonment, for any person to take, sell, or transfer a negotiable instrument not having the words "given for a patent right," as before mentioned, knowing the consideration thereof to be, wholly or partially, an interest or right in a patent or in an invention claimed to be patented.

In a case tried here some months ago, brought to recover on a note given for a patent, and not containing the statutable words, the judge charged that if the plaintiff knew, at the time he took the note, that the consideration was an interest in a patent, he committed a misdemeanor, and the note was, consequently, absolutely void. It has, however, been decided in a later case that a negotiable writing given for a patented thing or machine is not within the statute, as, the latter being a "very extraordinary" act, parties who invoke its aid must bring themselves strictly within its provisions, and the words of the act are a "right," etc., only.

When I first learned, a few days after its passage, of this law—which might better have been entitled "an act to relieve certain fools from the legitimate consequences of their folly," or "a law trap for the unwary"—I unhesitatingly expressed the opinion that it was in direct conflict with that provision of the Constitution wherein plenary power is granted to Congress to legislate upon patents. I have seen no reason to alter this opinion; and if the opportunity occur, professionally or otherwise, I shall seek to test the constitutionality of this absurd and impolitic State enactment in the court of final appellate jurisdiction, as provided by the Constitution of the United States.

Would it not be equally just and reasonable to require that notes given for horses, cattle, grain, etc., should bear across their face the words "given for a mule," or "given for a hog," as the case might be: or that an accommodation note (which, as between maker and payee, represents no value received) should have the words "given for accommodation" apparent on its face? It would not, assuredly, require superior astuteness or invention to discover a plan whereby anti-patent State legislators could, by an extended but similar interpretation of State rights, so legislate as to practically strangle, so to say, a valuable franchise granted by the *whole* United States. J. PUSEY.

501 Chestnut St., Philadelphia, Pa.

PRACTICAL MECHANISM.

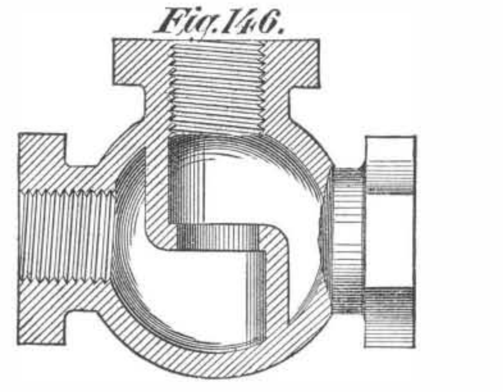
BY JOSHUA ROSE.

NEW SERIES—NO. XXI.

PATTERN MAKING.

In Fig. 146, we have for an example a common globe valve, shown partly in section and with a gas thread cut in

Fig. 146.



the openings. The flanges vary in shape; but as a rule, small valves are provided with hexagons and large ones with round flanges suitable for bolting to similar flanges to make joints. For small valves, say up to 2 inches, the pattern is usually made with the hexagons cut out of the solid, but for sizes above that, they should be made in separate pieces, as shown in Fig. 147, and screwed to the pattern, so that in case of necessity they may be removed, and flanges substituted in their stead. In Fig. 148, we have a perspective view of the finished pattern; and Fig. 149 represents the pattern as prepared, ready to receive a flange or hexagon as may be required. A globe valve pattern should be made in halves, as shown in Fig. 150, the parting line of the two halves being denoted by A B. To make this pattern, we first prepare two pieces of wood so large that, when pegged together, the ball or body of the pattern can be turned out of them, and long enough not only to reach from P to P, in Fig. 149, but also to allow an excess by means of which the two pieces may be glued or

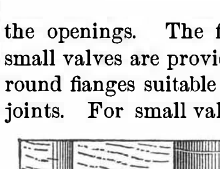
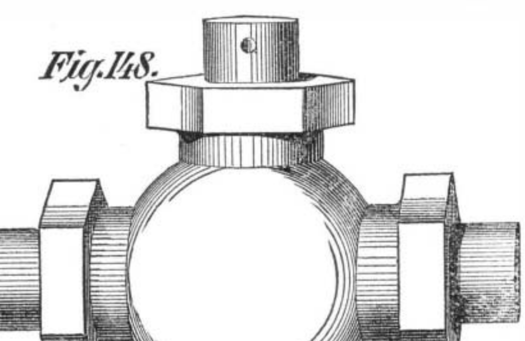


Fig. 147.

Fig. 148.



otherwise fixed together. These two pieces we plane to an equal thickness, and then peg them to retain them in a fixed position, taking care, however, that the pegs do not occur where the screws to hold the flanges will require to be. We also place two pegs within a short distance of what will be the ends of the pattern when the excess in length referred to is turned off. We next prepare, in the same way, two more pieces, to form the two halves of the branch, shown at B, in Fig. 149, for which, however, one peg only will be necessary. These pieces must be somewhat wider than the size of the required hexagon across the corners, that is, supposing the hexagon is to be solid with the branch; otherwise we must make them a little wider than the diameter of the hub of the flange, or of the round part of the hexagonal pieces. Their lengths must be such as to afford a good portion to be let into the ball or body of the pattern (as shown by the dotted lines in Fig. 149), which is necessary to give sufficient strength. The two pieces must be firmly fixed together, and then turned in the lathe.

During the early stages of the turning, or, in other words, during the roughing out, we must occasionally stop the lathe and examine the flat places on the body; for unless these places disappear evenly, the work is not true, and one half will be thicker than the other, so that the joint of the pattern will not be in the middle. It was to insure this that the pieces were directed to be planed of equal thickness, since, if such is the case, and the flat sides disappear equally and simultaneously during the turning, the joint or parting of the pattern is sure to be central. If the lathe centers are not exactly true in the joint of the two pieces, they may be made so by tapping the work on the side having the narrowest flat place, the process being continued and the work being trued with the turning tool at each trial until the flat places become equal. By this means, we insure, without much trouble, two exact halves in the pattern, which is very important in a globe valve pattern on account of the branch and other parts, not to mention the moulding. Having turned the body of the pattern to the requisite outline, and made while in the lathe a fine line around the center of the ball where the center of the branch is to come, as shown in Fig. 149, by the line, A, we make a prick point (with a scriber) at each crossing of the line, A, and the joint or parting of the pattern. We then mount the body upon a lathe

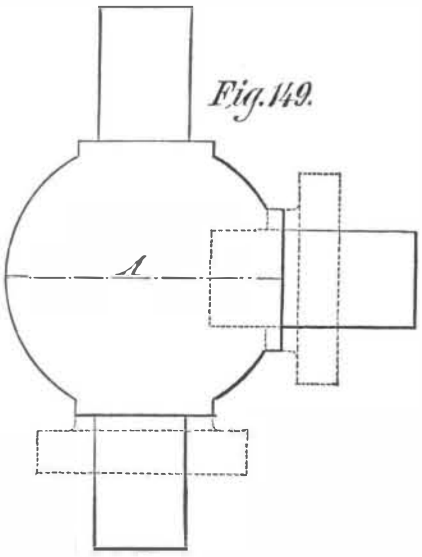


Fig. 149.

chuck, in the manner shown in Fig. 151. A point center should be placed in the lathe and should come exactly even with the line, A. In Fig. 151, V V are two V blocks made to receive the core prints. These Vs are screwed to the lathe chuck, and the pattern is held to them by two thin straps of iron, placed over the core prints and fastened to the Vs by screws. If the chuck and center point run true, the V blocks are of equal height, and the core prints are equal in diameter, the prick point opposite to the one placed

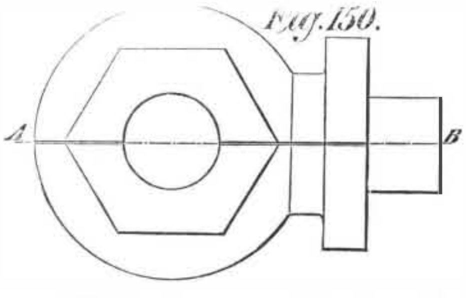


Fig. 150.

to the center point will run quite true; and we may face off the ball or body to the required diameter of branch, and bore the recess to receive the same. We make the holes in the flanges of the same size as the core prints; but we should not check in the print, because, if a flange with a different length of hub were substituted, it would be a disadvantage. To obtain the half flanges, we take a chuck and face it off true in the lathe; then, with a fine scriber point, we mark the

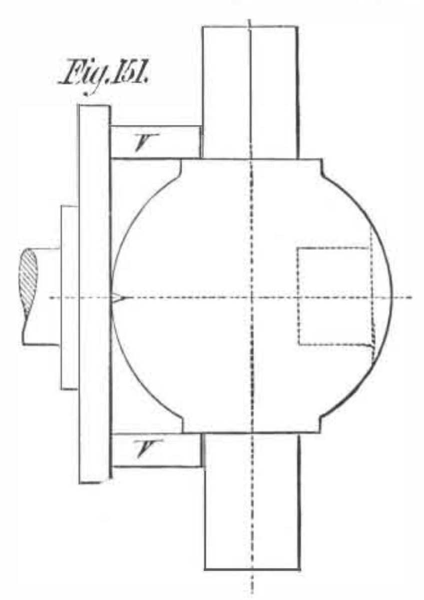


Fig. 151.

center while the chuck is revolving. We then stop the lathe, and, placing a straight edge to intersect the chuck center, we draw a straight line across the chuck face. We then take two pieces suitable for the half flanges, and plane up one flat side and one edge of each piece. If the flanges are not large ones, they may be planed all at once in a long strip. We place the pieces in pairs, and mark on each pair a circle a little larger than the required finished size of flange. We then fix each pair to the chuck, with the planed faces against the chuck, and the planed edges placed in contact, their joint coming exactly even with the straight line marked on the chuck face, and we may then turn them as though they were made in one piece and to the requisite size.

In Fig. 152, we have a representation of one half of a suitable core box, the other half being exactly the same with the exception that the position of the internal partition is reversed. To get out this core box, we plane up two pieces of exactly the same size and length as the pattern, and of such width and thickness as will give sufficient strength around the sphere, allowing space for the third opening. After pegging these two pieces together, we gauge, on the joint face of each, lines representing the centers of the openings and the center of the sphere. We then chuck them (separately) in the lathe, and turn out the half sphere. We next place the two halves together, and chuck the block so formed in the three positions necessary to bore out the openings; or if preferred, we may pare them out. The partition (A, in Fig. 152) follows the roundness of the center hole,

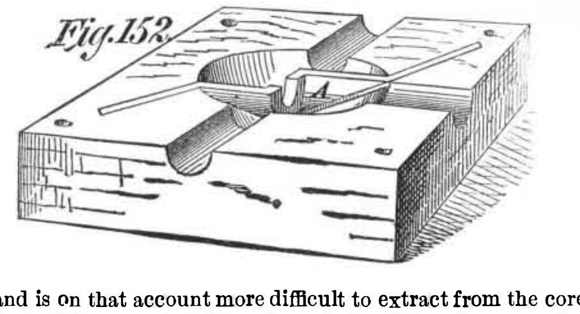


Fig. 152.

and is on that account more difficult to extract from the core than if it were straight and vertical. When, however, the partitions are of this curved form, the pieces of which they are formed are composed of metal, brass being generally preferred. Patterns have in this case to be made wherefrom to cast these pieces, and they may be made as follows: First, two half pieces, such as shown in Fig. 153, are turned; each

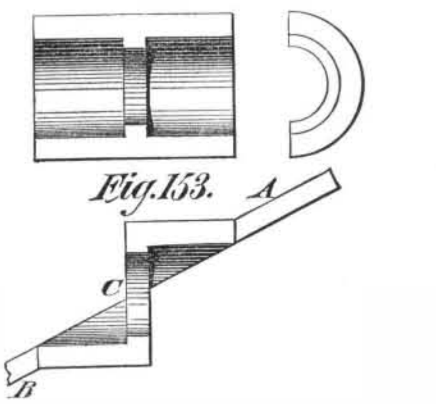


Fig. 153.

is then cut away so as to leave the shape as shown at C in the same figure, and is then fitted into the spherical recess in the core box, letting each down until both are nearly but not quite level. The two pieces, A and B, in Fig. 153, are then fastened on, and this pattern is complete. When the pieces are cast, they must be filed to fit the core box, and finished off level with its joint face, a small hole being drilled in the center, and a pin being driven through the piece and into the box to steady the corners. We then saw the pieces in halves with a very fine saw.

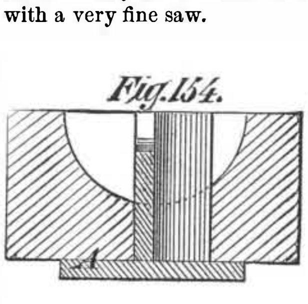


Fig. 154.

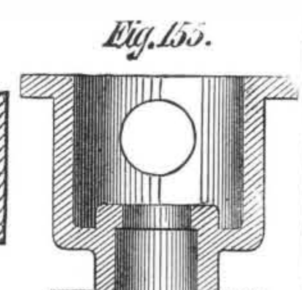


Fig. 155.

If the partition, instead of following the roundness of the valve seat, is made straight, the construction of the core box is much more simple. In this case, a zigzag mortise is made clear through each half of the box, its size and shape being that of the required partition. Fig. 154 represents a half core box of this kind. A piece of wood, A, is fixed as shown to the partition, to enable the core maker to draw it out before removing the core from the box. The mortise for the partition should be turned out before the half spherical recess, the mortise being temporarily plugged with wood to render easy the operation of turning.

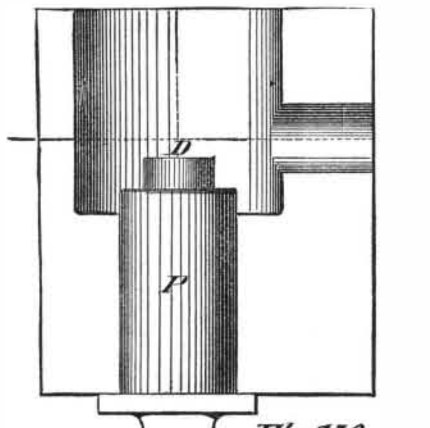


Fig. 156.

In very large valves (say 10 or 12 inches) a half core box is generally made to serve by fitting the two half partitions, shown at C, in Fig. 153, to a half core box, and keeping them in position by means of pegs, a half core being made first with one and then one with the other in the core box. It is often necessary to form a raised seat in the body of an angle valve, such as shown in Fig. 155, which represents a section of such a body. It is shown with flanged openings, though in small valves hexagons to receive a wrench would be substituted.

Fig. 156 is a plan of half the core box necessary for forming the raised seat. From this construction, it will be seen that the large core, though solid with the branch core, is not solid with that forming the hole in the seat and the part below it; therefore the core prints on the body pattern must be left extra long to give sufficient support in the mould for the overhanging cores. The loose round plug, P, is made of the size of the outside of the seat and fitted to the box. The part outside the box is a roughly shaped handle to draw it out by. The diminished part, D, is a print, and into the impression left by it is inserted the core made in box shown in Fig. 157. The print, D, is of the same diameter as the hole in the seat; and the print on the pattern is of the size of the increased diameter below the seat. Large angle valves are made with half a core box by making a branch opening in the box right and left, a semicircular plug being provided. Two half cores are made with the plug, first in one and then in the other branch opening. The plug, P, should be in this case only half round.

Fig. 157.

Washington Life Insurance Company.

Life insurance is for the protection of widows and orphans after the death of the insured, while premiums are required in advance. Ability to meet policies issued should be beyond question, because of the nature of the contracts and the time to be fulfilled. Well managed companies owe it to themselves, as also to their policy holders and the public, that official proof of their good management and solidity exists and should be published for the guide of the public. The Washington Life Insurance Company of New York has set a good example by causing an official examination to be made, not only of its practice but its financial standing, by disinterested experts under and by the authority of the New York Insurance Department. The result of this examination reflects credit upon the management of the Washington, and shows it pre-eminently sound, with over five million dollars officially admitted assets, nearly all invested in United States, State, city, and town bonds, and bonds and mortgages; while its total real and contingent liability, including "reserve" for all its risks in force, $4\frac{1}{2}$ per centum of interest, New York standard, are only $4,386,685.83, leaving a surplus of $786,685, without counting $92,000 good, though technically inadmissible, assets, which would increase the actual surplus to nearly $900,000.

Good management solicits investigation and publicity, while mismanagement fears it. The examination of the Washington shows it not only sound, but its management "able, prudent, and honorable," expressions well worthy the ambition of any company.—*Insurance Agents and Brokers' Magazine.*

By reference to our advertising columns, the particulars of the official report of the good condition of the Washington Life may be seen.

More Telephone Triumphs.

The Boston *Daily Globe* enjoys the honor of being the first newspaper which has printed a telephonic news despatch. Appropriately enough, the subject of the message is Professor Bell's lecture on his wonderful instrument (illustrated in the SCIENTIFIC AMERICAN SUPPLEMENT of February 10), which was delivered at Salem, Mass., on the evening of February 12. At 10.55, on the same evening, the *Globe* reporter in Salem made a verbal report of the occurrence to the *Globe* office in Boston, eighteen miles away. Not only was the voice of the reporter clearly recognized, but the receivers of the message also heard the applause of the audience which attended the lecture.

Professor Bell's lecture was in itself a wonderful exhibition of the powers of the invention. From his platform, the speaker placed himself in communication with Mr. T. A. Watson, his associate in Boston. The latter then sent the Morse alphabet by musical sounds, which was distinctly audible to the entire audience. The airs played on an organ were transmitted; and on being asked for a song, Mr. Watson complied with "Auld Lang Syne," and finally made a short speech, the words being perfectly distinguishable to all the people present, who broke into prolonged applause, for which Mr. Watson returned thanks. Every experiment was successful, and the invention was subjected to severe tests.

We await, with much pleasurable anticipation, Professor Bell's introduction of the telephone to a New York audience.

Captain Eads' Success.

Captain Eads has received the first instalment, five hundred thousand dollars, in United States bonds, on account of the payment for his Mississippi jetties, which have proved, as we always predicted they would, a grand success. The United States ship Plymouth has passed through the line of jetties at low water, and is the first war vessel to traverse the new channel. She drew seventeen feet of water, and the least depth found by the lead was eighteen feet. The passage of the upper jetties was made by the ship under full steam power in 8 minutes and 17 seconds. Between the jetties there is a channel twenty-four feet deep and two hundred feet wide. At the head of South Pass there is a minimum depth of twenty-seven feet. On the charts of 1873 the last-mentioned sounding was but fifteen feet; and at the mouth of the Pass, at mean low water, the lead showed but three, four, and seven feet.