SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXVIII.--No. 17. [NEW SERIES.] NEW YORK, APRIL 26, 1873. [$3 per Annum IN ADVANCE.

TAYLOR'S AMERICAN FIELD PIECE.

First successfully employed during our late war, and more recently in the struggle between France and Prussia, the battery gun, like the submarine torpedo, may be safely predicted as designed to exert no small influence in the determination of future conflicts. Even in the crude forms in which, as necessity demanded, it has been hurried to the field, its terrible execution has proved it a most formidable and deadly arm: and as in late years improvements have been made in its construction, all tending to increase its power, the fact has become more clearly apparent that the mitrailleuse forms still another link in that chain of weapons of human destruction, which, beginning with the bow of the savage, the world believed forged and complete when the needle gun at Sadowa brought to a sudden ending a short though bloody war.

With the general principles upon which the construction of the battery gun is based, we presume our readers to be reasonably familiar. Explanations and illustrations of the Imperial, the Gatling and others, have already found place in our columns; so that, in illustrating the new mitrailleuse of Mr. Taylor, description of the minor details will be dispensed with. A short brass cylinder, containing twenty-four barrels, together with a quantity of machinery, is mounted on an ordinary gun carriage. Such is the general appearance of the invention. The length of the piece is about 28 inches, and its weight, with its appurtenances, is in the neighborhood of a thousand pounds. We begin our description with the loading mechanism. A is a magazine consisting of 24 tubes, each of which contains nine cartridges of size suitable to the caliber of the barrels. The tubes are confined between heads. The entire receptacle can be instantly removed from its position when its charge of ammunition is exhausted, and another similar filled magazine substituted, so that the gun may be thus kept almost continually supplied with cartridges. A suitable number of these charged reservoirs are designed to be carried in the ordinary caisson. At B is a cylindrical case, which encloses the feeding apparatus, consisting of 24 steel rods, which are intermittently moved forward into the magazine tubes through the medium of the rack shown above the casing, actuated by suitable mechanism in connection with the lever, D. At each movement of the rods one cartridge is forced out of every magazine tube, and into corresponding cavities in a rotating chamber plate, a portion of which is shown projecting at C. This plate consists of four wings, and revolves in the slotted breech piece into which the barrels are screwed. In each wing are 24 cartridge chambers circularly arranged. Of course all four wings or sets of chambers are on the same plane, and rotate on a common axis, so that one after the other, as each is charged from the magazine, is revolved so as to come into exact line with the barrels of the piece.

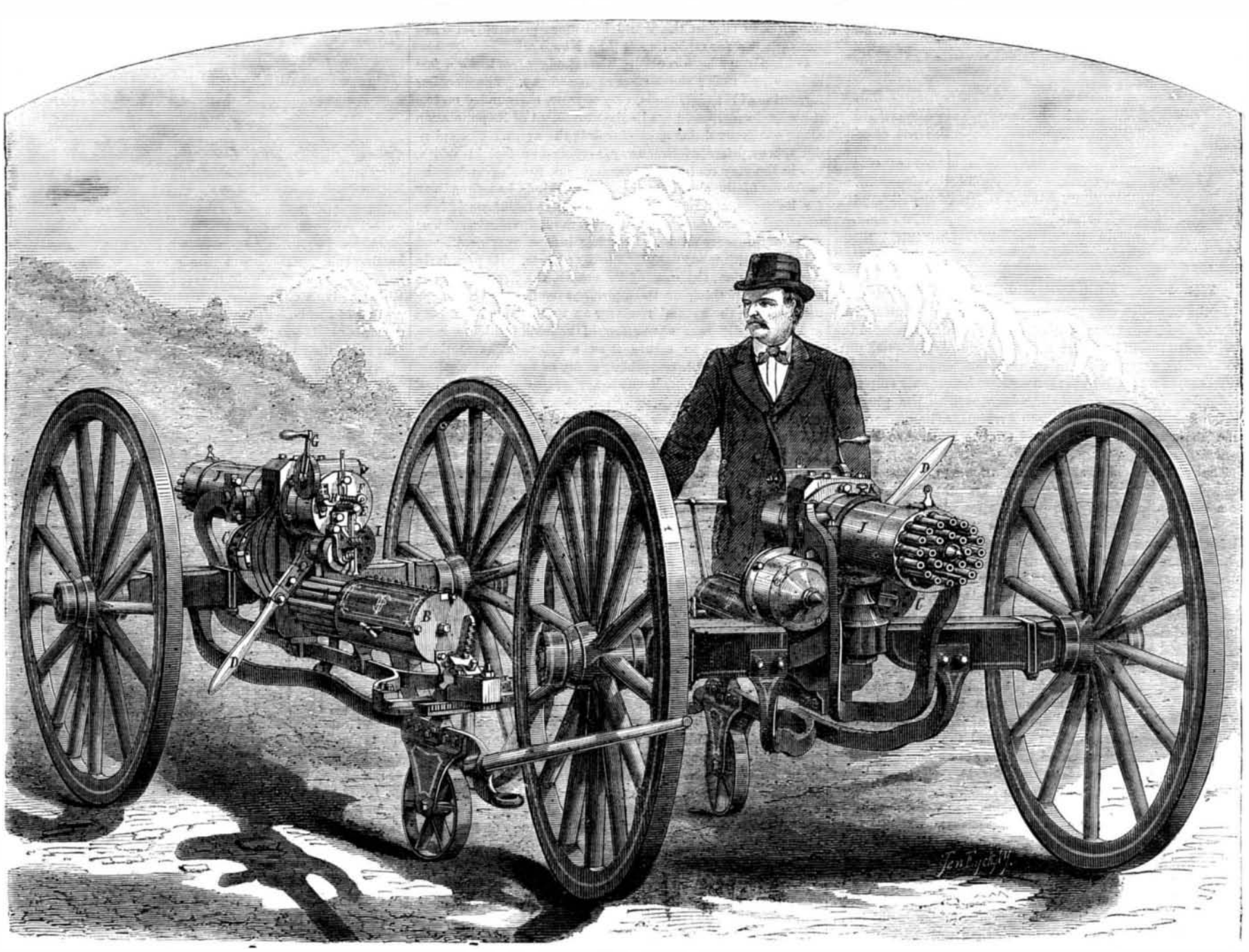
The same lever, D, that actuates the feeding apparatus, also communicates motion to the volley firing plunger or piston, E. F is a movable latch fixed longitudinally upon the top of the latter, holding it out of action when a fusillade discharge is desired. The details of the mechanism which explodes the cartridges are necessarily unrepresented in our engraving. We need, in reference thereto, only allude to a number of spring spindles which are either simultaneously thrown against all the cartridges, in the wing that is in position, by the piston E, or which are caused to strike their corresponding cartridges separately by means of a cam arrangement, within the breech and rotated by the steel crank, G. The first system causes a volley; the second, a fusillade.

When firing on the latter plan, as soon as each wing of the chamber plate is exhausted, a spring catch, H, automatically stops further rotation of the crank until another filled wing is revolved into position by the lever, D. Between the wings are arranged brushes and sponges which, in passing, clean the rear of the barrels between the discharges.

The lever, D, performs three offices; it works the feeding apparatus, rotates the wings, and operates the shell ejector. This last mentioned apparatus is contained in the case, I. The movement of the lever which brings up a filled wing necessarily turns away the one that has just been fired and which still contains the empty cartridge shells. The cylinder, I, however, is so situated as to be exactly in the path of the discharged chambers, and besides other mechanism, encloses 24 rods, which, as above intimated, by the action of the lever, D, are caused to enter the chambers and push out the discharged shells, which fall to the ground.

The arrangement of the barrels is clearly indicated in the gun to the left of the engraving. It will be noted that their muzzles are placed in the form of an ellipse, while at the breech they are circularly disposed, the object of the former configuration being to give a wider dispersion to the balls. J is the water casing, into which water may be introduced through the orifice, K, and the barrels thus continually kept cool. But three men are necessary to operate the piece, one at the crank and lever to fire, another at the rear to point, and a third to renew the magazines; and it will be remarked that all vulnerable portions are carefully so placed as to be out of danger from damage by rifle shots from the front.

At Sand's Point, L. I., a series of interesting experiments were made by the inventor, which proved quite satisfactory. At a range of 100 yards the target was pierced by a broadside which described an elongated horizontal ellipse, 2 feet wide at center and 12 feet long. At a range of 200 yards the width of this ellipse remained nearly the same, but the length increased in the same proportion as the increase of range. This was repeated, both by broadside and fusillade, a great number of times, the effect being uniform throughout the experiments. The piece was discharged several times over the waters of Long Island Sound, and the effect was quite interesting. A volley or broadside of shot striking the water 1,200 yards away produced a noise like that of beating the surface with the flat side of a board, the projectiles covering a line of about 144 feet. The effects of the fusillade were equally curious. The missiles would fall in quick succession, producing the same sharp sound, and for more than



TAYLOR'S AMERICAN FIELD PIECE.

a second after ceasing fire this would continue, so that a charged wing could be brought up to the lever, the shells ejected, and the fire reopened by the time the last missile of the previous charge had struck. The inventor concludes that, virtually, a continuous and unceasing stream of bullets may be kept up by the crank fire, for any desired length of time.

To Mr. J. P. Taylor of Tennessee is due the credit of this very ingenious weapon, of the successful operation of which we have assured ourselves by personal observation. In the experimental battery, an excellent piece of mechanical work from the shops of the Holske Machine Works in this city, from which our engravings were made, we remarked but few points that were susceptible of simplification, and we could suggest nothing which had not been anticipated by the inventor and fully provided for in a second gun which we learn he is about to construct. The piece has already attracted no small degree of attention in military circles, and we do not doubt but that it will excite even a greater interest when it appears, as we understand it will, according to the intention of the inventor, at the Vienna Exposition. Further and more detailed particulars may be obtained by addressing J. P. Taylor, patentee, or D. Hockett, attorney, Knoxville, Tenn.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year - - - - - - - - $3 00
One copy, six months - - - - - - - - 1 50
CLUB RATES { Ten copies, one year, each $2 50 — 25 00
Over ten copies, same rate, each — 2 50

VOL. XXVIII., No. 17. [NEW SERIES.] *Twenty-eighth Year.*

NEW YORK, SATURDAY, APRIL 26, 1873.

Contents:

(Illustrated articles are marked with an asterisk.)

THE SOURCES OF OUR MODERN KNOWLEDGE.

In the uncertain prehistoric ages during which the ancient human civilization was evolved, Science, which regulated the social relations, did not rise above the purely material purposes which occupied the minds of men. The small number of truths, of which Science then consisted, were only empirical deductions from facts; but she advances with the progress of humanity, and from Thales to Archimedes immense scientific labors extend her limits and tend to generalize human knowledge.

Thales, who lived twenty-six centuries ago, is one of the first philosophers, known to us, who brought his knowledge to a systematic whole. He was the founder of the Ionic school in Greece, and was equally successful as a mathematician and an astronomer. The school founded by him was afterward split up into different sects, which embraced in their researches all branches of human knowledge,

Pythagoras then appeared; this philosopher, who by grateful mankind of his age was called "divine," extended the domain of the mathematical sciences, and the tradition that he sacrificed one hundred oxen to the gods, from gratitude for the discovery of the famous problem which bears his name, is a proof of his trust in the guidance of a superior power. He had clearer notions than his successors; he taught the globular form of the earth, of which Anaximander had not the least idea, and he described the earth's motion around the sun; but mankind was not yet able to grasp this truth, and it had to be elaborated for two thousand years before general recognition of it was obtained.

After Plato, who, 2,200 years ago, had above the door of his lecture room the words "Nobody can enter here who is no geometrician," came the great Euclid, and then the illustrious Archimedes, the greatest philosopher of his time, who solved the most advanced problems with all the might of genius. The works of Apollonius, Hipparchus, Ptolemy, Diocletian, etc., fill up this earlier period of scientific history; but the authors are more specialist than universal philosophers; however, they contributed powerfully to the progress of knowledge.

At the beginning of a second period, Science seems to have been suddenly arrested, and ceases to appear as an element in the regeneration of humanity. She sheds, however, some of her light in the school of Alexandria; but after Diophantes her lamp appears to be everywhere extinct. Several centuries later, Science revives and is given back to the world by the same people that once slew her in her last asylum, and surrendered the celebrated library of Alexandria to the flames, a library which contained all the philosophical works of preceding ages.

If the Arabs gave back to Europe, during the middle ages, some of the sciences, the records of which they destroyed in Alexandria, Europe in her turn became not only a rival, but a far superior master in the advancement of philosophy. It was then that Science took possession of certain grand theories, of which the preceding ages had scarcely any presentiment; the war which thus far had only existed in the moral world was carried into the scientific field; and human intelligence had begun to crave the discoveries developed by examination and discussion in the realm of positive sciences. It was then that Luther defended freedom in the examination and discussion of moral principles, and Copernicus defended freedom in scientific research, and established the true astronomical system. Then a galaxy of great men appeared: Italy produced Galileus Galileo; Germany, Gottfried Leibnitz; Holland, Christian Huyghens; England, Isaac Newton; and France, Rénate Descartes. Since that time discoveries have succeeded discoveries with the most unexampled rapidity; and thanks to their practical tendency, the appearance of the surface of our earth has changed during the two centuries since the time of these great men more than in the two thousand years previously. The number of discoverers and promoters of progress of the present day is indeed too great to enumerate, and what is a most striking fact, it has been steadily increasing during this century. In regard to the discoveries themselves, it appears to be reserved for the end of this century to place the crown on the now magnificent edifice of human knowledge, the labor of so many centuries, by a mighty doctrine which reunites all the isolated and various phenomena, by deducing them from a single absolute principle, the main object of modern research: The conservation of force or motion, which is founded on the principle of universal gravitation.

THE BROADWAY UNDERGROUND RAILWAY.

The bill for an underground railway beneath the great thoroughfare of New York city, known as Broadway, has finally passed both branches of the State legislature, received the Governor's signature, and become a law. The wonder is, in a community like this, so noted for the number of its intelligent, active, and vigorous men, that such an important enterprise should have been so long postponed. No city in the world has more pressingly needed the facilities for rapid transit than New York.

It has always been conceded that the best route for a fast railway was under the surface of Broadway. The peculiar formation of the metropolis, very narrow, surrounded on two sides by deep rivers, permits the movement of its population along one general line only—towards the north. The splendid thoroughfare of Broadway, seventy-five feet in width, lies in the very center of this movement, forming in fact the backbone of the city. Business of all kinds has Broadway for its focus, and probably no other street in the world is so constantly thronged with passengers and vehicles. The value of property on Broadway has become very great, and it is lined with many noble and costly edifices. Its peculiarly central position, the ease of its grades, the firmness of its soil, to say nothing of its enormous traffic, have always marked it as the natural route for an underground railway; and many different companies of railroad builders have vainly attempted to secure it as a prize. The property owners on the street, comprising many of our most wealthy and influential citizens, have always, until recently, opposed the railway, and nobody appears to have had wit or power enough to overcome their opposition.

The grounds for their hostility were plain and simple. They alleged that the operation of digging for the railway would endanger the water mains, break up the sewerage, set the gas pipes leaking, and tumble down every building on the street; causing a thousand times more damage and mischief than all the underground railways in the world were worth. This idea, in whole or in part, has pervaded the minds of owners and so united them in purpose that whenever any persons made a movement for the railway, they met with formidable opposition and signal defeat. Many and memorable have been the contests in the State legislature on the subject, and immense the sums of money expended; but the property owners invariably triumphed. In vain were they told that London had built such a railway and property, instead of being injured by it, was improved. To this it was replied that New York was not London, and that a road built here would certainly destroy the houses. For fifteen years has this sort of nonsense been allowed to bear sway, while the people suffered for want of the railway; and by reason of its lack thousands of families and business establishments were driven out of the State into New Jersey.

Our readers are familiar with the details of the construction of the short experimental section of railway under Broadway, by the Beach Pneumatic Transit Company. They will remember how this tunnel was bored by mechanism, under the surface of the pavement, below the water pipes, sewers, gas pipes, and foundations of adjoining buildings, the enormous traffic of the streets going on as usual, directly over the heads of the diggers. The public had no knowledge of the work until it was finished, and were greatly pleased with the quiet but effective manner in which it was done. That tunnel has been in existence and the experimental railway has been in operation for three years, presenting at all times an unanswerable argument in favor of an enlarged railway, and a practical refutation of the frivolous reasoning of the property owners. Meantime the company asked from the legislature the privilege of enlarging and extending the work, so as to provide a first class underground railway, and the public gladly seconded their request. For three years the company have pressed their enterprise upon the attention of legislature, and have at last succeded. Their charter is secured. Their aim now is to make the work the model of its kind. The railway is to extend under Broadway, Madison avenue, and Harlem river to Westchester county, nine miles, with an additional lateral branch. The work of construction is to be done under the supervision of State engineers. Stringent provisions are made by law to guard all public and private interests.

We shall, from time to time, present such information concerning the progress of the work as may be of interest to our readers. The office of the company is at No. 260 Broadway, corner of Warren street, and all communications should be addressed to the Secretary, Joseph Dixon, Esq.

THE FIRE ON BOARD THE STEAMER ALASKA.

We recently published a communication from Mr. Norman Wiard, giving us the particulars of the ignition, by "over heated steam" as he alleged, of the felting of one of the boilers of the United States steamer Alaska. The report of this fire was sent to us by Mr. Wiard for the purpose of vindicating his theory of "ignition by superheated steam" from the charge of being "absurd," as criticised in the SCIENTIFIC AMERICAN, and also for the purpose of placing before our readers a positive example of such ignition, the facts concerning which might be examined and verified by any one who so desired: the previous examples referred to by Mr. Wiard not being open to such examination.

It appeared to us when we published Mr. Wiard's last letter that the fire on board the Alaska could not have been caused by overheated steam, and we then gave our reasons for so thinking. We will now present further information concerning the fire in question, derived from an authentic source, which completely upsets Mr. Wiard's superheated steam theory.

We give a diagram showing the general form of the boilers of the Alaska, and the arrangement of the superheating tubes. The steam passes from the boiler into the superheater and thence to the engine in the usual manner. We also give a diagram on an enlarged scale of the upper portion of the boiler and superheater at the junction with the uptake. It was at the corner *A*, where the uptake begins, that the felting took fire, and the ignition was occasioned by the contact of the felting with the uptake. The felting had very improperly, been packed against the uptake, the heat of which finally produced ignition. Neither the boiler proper, the superheater, nor "overheated steam," had any thing to do with the fire, and so Mr. Wiard's superheated steam theory is again shown, by the facts in the very example he adduces, to be absurd.

Fig. 1.

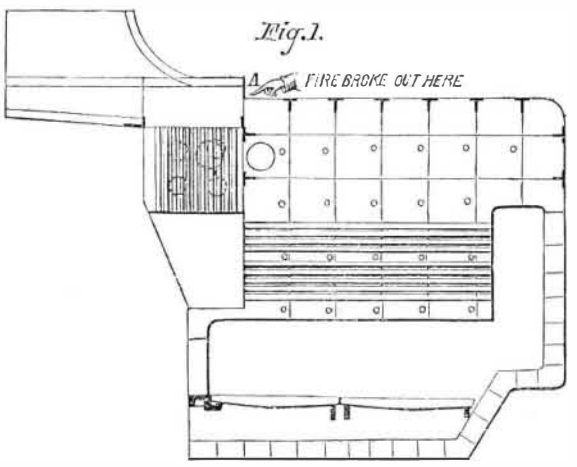
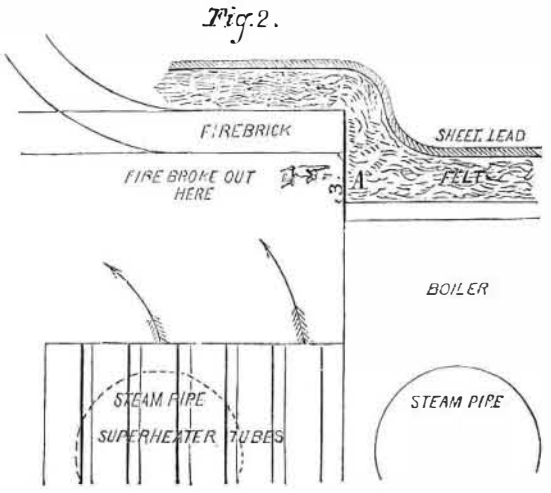


Fig. 2.



We trust that the fire on the Alaska will serve as a warning to engineers, and others who are charged with the duty of clothing boilers, to use proper care in such matters. The felting should never be packed against the uptake or chimney, as in this case. We are glad to know that since the fire the proper precautions have been taken on board the Alaska to prevent a recurrence of a similar disaster. The felting