Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

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

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year postage included..... $3 20
One copy, six months, postage included 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each: additional copies at same proportionate rate. Postage prepaid.

Remit by postal order. Address
MUNN & CO., 37 Park Row, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies, 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year postage free, on receipt of *seven dollars*. Both papers to one address or different addresses as desired.

The safest way to remit is by draft postal order, or registered letter.

Address MUNN & CO., 37 Park Row, N. Y.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large, and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO. 37 Park Row, New York.

NEW YORK, SATURDAY, OCTOBER 1, 1881.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT,

No. 300,

For the Week ending October 1, 1881.

Price 10 cents. For sale by all newsdealers.

FIELD AND FOREST FIRES.

During the fire week of September a large part of two counties and a portion of adjoining counties in the triangle between Saganaw Bay and Lake Huron, in the eastern part of Michigan, were swept by fire, destroying not only the remaining forest, but many small villages and a large number of the outlying houses and barns of the settlers. In the newer districts everything was destroyed and many lives were lost. Much of the country had but recently been cleared, and everywhere there were large areas covered with brush and other food for fire, thoroughly dried by the long-continued drought. For two months there had been little or no rain, and as usual small fires were burning almost everywhere. On Monday, September 5, a high wind arose, and for several subsequent days everything was aflame. The volume of fire was so great that the ordinary means of resistance were useless; woods, fields, villages, farm buildings, fences, crops, live stock, and their hapless owners were overwhelmed without chance of escape. Whole families were burned in their houses, or in the fields and roads while flying for refuge, or smothered in wells, their only resort from the flames which swept the surface. The Mayor of Detroit estimates that 750.000 acres were burned over, and as many as 15,000 persons made homeless and destitute. The whole area of the afflicted district was perhaps 10,000 square miles, with a population of 50,000 or more. Most of the people were new settlers, just getting a start in life, though the loss of property in the older settlements was heavy. The immediate loss of life is estimated at from three to five hundred. Many more were seriously if not fatally burned, and the exposure of houseless and bereaved women and children entailed great additional suffering, if not hazard of life.

Thanks to prompt and liberal contributions from Eastern and Western cities, much has been done for the relief of the victims; but hundreds have been impoverished, and years must elapse before the lately prosperous settlements can regain their lost position.

Lessons of this nature, happily not so severe, occur almost every year, certainly every dry season, teaching the unwisdom of the common practice by new settlers of surrounding themselves with materials for future conflagrations. Forests are cleared, and vast accumulations of brush, tree limbs, waste lumber, and the like are allowed to form on all sides. At last there comes the inevitable drought, with a chance that the rubbish will not yield to small and isolated fires. Ordinarily the brush fires are confined to the clearings, and are easily kept under control. Occasionally, as in the recent instance, and similarly ten years ago, a general conflagration ensues, and a terrible price is paid in property and suffering and loss of life for the neglect to burn the brush-heaps in detail and at seasons when they will not burn so readily.

It is only by concerted action on the part of all the members of a new settlement that this serious hazard of their lives and properties can be kept down, and it would seem possible that something in the way of general legislation might be devised to compel wood-cutters to clear up and burn up their rubbish as they go along. Without such laws for all wooded regions we must expect the periodical recurrence of calamities such as has now overtaken Eastern Michigan.

METALLURGY OF NICKEL.

At the recent exhibition of the German patents and designs the metallurgy of nickel and cobalt was illustrated in an interesting manner by Fleitmann & Witte, of Iserlohn. Dr. Kollmann describes it as follows:

It is only within a few years since the discovery of pure malleable and weldable nickel by Dr. Th. Fleitmann, that nickel has entered the rank of those metals which are technically employed on a large scale. Previously only the alloys of nickel with copper and other metals couldbe easily wrought, while pure nickel could neither be hammered nor rolled. The reason of this was that pure nickel absorbs (occludes) gases while melted (Fleitmann thinks it is carbonic oxide), and the nickel cannot be worked until these gases are removed.

Fleitmann's process for making nickel malleable consists in adding a very small trace, only one-twentieth of a per cent of magnesium, which is introduced in the form of a bar into the liquid nickel while in the crucible. This small percentage of metallic magnesium renders this brittle metal perfectly malleable, and it can even be welded. Magnesium is well known to oxidize very easily (at high temperatures) and hence serves to remove these injurious gases. (Would not phosphorus accomplish the same end?)

The extraordinary technical importance of the new discovery (which is already patented in all countries) is evident at once. Formerly alloys with comparatively only a little nickel could be used, say, for coin. The German 10 pfennig pieces (like the American 5 cent piece) contain only 25 per cent of nickel to 75 of copper. Now, on the other hand, we can have pure nickel cast in any desired shape, and also forge it and roll it like iron or steel. We may, indeed, assume with tolerable certainty that if Fleitmann's method had been known ten years ago we Germans would not have been pestered with our unhandy little 20 pfennig silver coins, for much more convenient ones could have been stamped from pure malleable nickel. Pure nickel, in addition to its malleability, possesses the great advantage that it does not lose its luster in moist air and is unaffected by organic acids, while its alloys, we know too well, gradually lose their luster and turn reddish.

Fleitmann, in his very interesting investigation, also made the discovery that pure nickel treated with a very little magnesium became weldable just like iron, and upon this he founded a method of welding nickel to iron. This discovery has gained very considerable importance, since we are now able to weld plates of nickel on both sides of the iron or steel instead of merely depositing on it a thin coating by electricity.

The question of welding, which is not yet settled in the metallurgy of iron for Bessemer metal, for example, may perhaps be solved in a manner similar to that in which Fleitmann solved it for nickel. Its importance technically and economically hardly can be overestimated. Nickel made by the new process with magnesium has a resemblance to carbureted malleable iron.

Kollmann made a series of tests of strength with Fleitmann's nickel, and arrived at a surprising result, namely, that the elasticity as well as the absolute strength corresponds exactly with those of medium hard Bessemer steel.

The expansion by rolling and forging of the two metals is the same, so that they can be rolled together.

Kollmann then gives some of the numerical results of his tests, which we omit, but they go to show that the physical properties of nickel and iron are very analogous, so that the thought arises that perhaps nickel is, after all, only an allotropic state of iron!

Since nickel and steel expand equally, blocks of nickel can be welded on both sides of an ingot of steel, and the whole rolled out into sheets of any desired thickness already covered with nickel. Iron wire covered with nickel could be drawn out just like ordinary wire. Another advantage is that the welding as well as the melting temperature of steel and nickel is close together, so that the nickelized steel can be welded as before.

Cobalt can be rendered malleable and weldable in the same manner, *i. e.*, by the addition of a little magnesium.

Fleitmann has also discovered that not only can nickel and cobalt be welded on steel and iron so as to form nickel plated wire and sheets, but that it can be welded on to the alloys of copper and nickel, which can be rolled at a very high temperature. In this operation the metals to be welded are surrounded with thin sheet iron, which is afterward dissolved off, or is heated in an air-tight apparatus. In this way, too, sheet iron can be combined with alloys of copper and nickel by welding.

To prevent articles made of nickeled steel or iron from rusting on the cut surfaces the iron beneath is dissolved away at the edges with dilute acids, and the projecting nickel then hammered down and welded over it. In Birmingham H. Wiggin makes nickel malleable by adding 2 to 5 per cent manganese.

THE GERMINAL VALUE OF NEW TRUTHS.

In his presidential address before the recent Medical Congress in London, Sir James Paget dwelt at considerable length upon the necessity of special studies in science and the impossibility of making any just comparative estimate of the relative value and importance of the several divisions of the science of medicine, or any other science, however widely they may seem to differ in present utility. This mainly for the reason that every fact in science, wherever gathered, has not only a present value, which we may be able to estimate, but a living and germinal power, of which none can guess the issue. The speaker added:

It would be difficult to think of anything that seemed less likely to acquire practical utility than those researches of the few naturalists who, from Leeuwenhoeck to Ehrenberg, studied the most minute of living things, the Vibrionidæ. Men boasting themselves as practical might ask, "What good can come of it?" Time and scientific industry have answered, "This good: those researches have given a more true form to one of the most important practical doctrines of organic chemistry; they have introduced a great beneficial change in the most practical part of surgery; they are leading to one as great in the practice of medicine; they concern the highest interests of agriculture, and their power is not yet exhausted."

And as practical men were, in this instance, incompetent judges of the value of scientific facts, so were men of science at fault when they missed the discovery of anæsthetics. Year after year the influences of laughing gas and of ether were shown: the one fell to the level of the wonders displayed by itinerant lecturers; students made fun with the other. They were the merest practical men, men looking for nothing but what might be straightway useful, who made the great discovery which has borne fruit not only in the mitigation of suffering, but in a wide range of physiological science.

The history of science has many similar facts, and they may teach that any man will be both wise and dutiful if he will patiently and thoughtfully do the best he can in the field of work in which, whether by choice or chance, his lot is cast. There let him, at least search for truth, reflect on it, and record it accurately; let him imitate that accuracy and completeness of which I think we may boast that we have, in the descriptions of the human body, the highest instance yet attained in any branch of knowledge. Truth so recorded cannot remain barren.

THE second-class steel armor-plated turret ship and ram Conqueror was launched September 8, at Chatham, Eng. She is of 6,200 tons, and her engines are of 4,500 horse power. Her armament will be two 25-ton guns.

The Removal of the President.

The successful removal of President Garfield from Washington to Elberon, on the New Jersey coast near Long Branch, a distance of 240 miles, on the morning of September 6, afforded a striking illustration of the perfection of modern means of transit. The vitality of the wounded patient had sunk so low that it was morally certain that he could not survive for many days the heat and bad air of the Capital. As a last resort it was decided to remove him. The railway companies were notified, and in a few hours the necessary arrangements were made, including the construction of about a mile of railway from the Elberon Station to the cottage the President was to occupy.

Mr. Garfield was borne on a stretcher from the White House to a wagon, and slowly drawn to the railway station, where he was as carefully transferred to a car expressly fitted up for the occasion. The seven hours' journey by way of Baltimore, Wilmington, Philadelphia, and Trenton to the sea was admirably endured, a speed of a mile a minute being maintained at times without greatly discommoding the patient.

Opening of the Mechanics' Fair in Boston.

The second of the great exhibitions which Boston is having this fall was opened with due "pomp and ceremony," September 13, the Governor of the State, the Mayor of the city, and numerous other officials participating, with the military in the exercises. The attendance was large, so that the great building in which the fair is held was comfortably filled, and this, too, without lessening the crowds which all day flocked to the other exhibition, which had been about four weeks in progress. The fact that two such great shows are so well attended at the same time in a city no larger than Boston, and but moderately populous suburbs, not only speaks well for the management of these exhibitions, but tells of the active interest which nearly everybody in New England feels in manufactures and the mechanic arts.

The building in which this exhibition is held is an ornament to the city, and is so well fitted for the purposes for which it was designed as to reflect great credit upon the managers of the Massachusetts Charitable Mechanic Association. It is triangular in ground plan, having a frontage of 600 feet on Huntington avenue and 300 feet on West Newton street, a section of the city which has been wholly made by "filling in" the "back bay" on the Charles River, and all of this new portion is being built up with public edifices and private buildings which reflect great credit upon Boston architects.

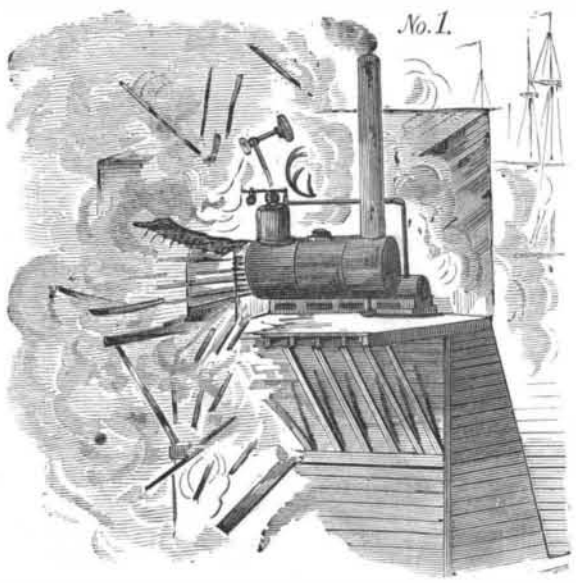
The exhibition building is in the Renaissance style, with free treatment. Distinct lateral lines, except that designating the basement, have been avoided. Arches of graceful curves rise nearly to the coping—giving space within their sweeps for numerous windows, through which the interiors are thoroughly lighted. These arches and the adjacent walls are massively laid in red brick with sills and caps of Longmeadow freestone and terra cotta ornaments. On one side of the main arch is a head of Franklin, on the other that of Oakes Ames, representing respectively electricity and railroading. They are surrounded by spandrels of palm, oak, and olive branches, in which appear the arm and hammer of the association's seal. Around the structure is a wide space of sodded ground, through which is laid a brick sidewalk, and in which are placed numerous gas and electric lights, under whose combined glow the beauties of the front are to be seen almost as plainly by night as they are by day. In the verdant triangle, at the eastern end of the building, a fountain of highly ornamental design is placed. An octagonal tower forms the easterly termination. It is about 40 feet in diameter and 90 feet high, and has in its upper story a lookout, from which a fine view may be obtained. There are two wide entrances into the tower, one directly from Huntington avenue sidewalk, the other through a covered porch and steps twelve feet wide, from the covered carriage porch, built of brick and stone, with hard pine open timbered and tiled roof. In the center of the octagon is the ticket office, and leading from it, and separated by a fence with three turnstiles, is a corridor 20 feet wide, which is the main avenue of approach to the exhibition halls. The administration building, which adjoins the tower, has a basement 15 feet high and three stories above it. At the left of the corridor, which runs through the building from the main entrance to the exhibition hall, is the president's room, a large apartment for the use of the president and directors of the association. Adjoining this is the treasurer's room; then comes a large room fitted with desks for the accommodation of the representatives of the press; and beyond this is the superintendent's office. At the right of the corridor is an elevator running from the basement to the upper stories; adjoining this is the janitor's room, the remainder of the space being occupied by toilet rooms and coat rooms. On the second floor of the administration building is the dining-hall, measuring 34 by 84 feet, and well finished. On the same floor, and separated from it by a corridor corresponding with the one on the main floor, is a private dining room for the managers of the association, the serving room, and ladies' toilet rooms. In the third story is a hall, 46 by 84 feet, which, during the fair, will be used for the military museum. At the close of the fair it will be handsomely finished for the use of the association, and will also be let for concerts, theatricals, lectures, balls, etc., the seating capacity being about seven hundred. It will have an open timbered roof, finished in hard wood, a hard wood floor, suitable for dancing upon, a stage, ladies' and gentlemen's dressing rooms, toilet rooms, committee rooms, etc. Five elevators are conveniently located in different parts of the building, giving ready access to each of the four floors on which the exhibits are arranged, and it is thought that, after the exhibition, and the reservation of the portions which the association will permanently occupy, the other parts may be so let as to cover the interest on a large portion of the money invested in the structure.

BOILER EXPLOSION ON A DRY DOCK.

The steam boiler on Bollman & Brown's floating dry dock, foot of Essex street, Jersey City, opposite New York, exploded with astonishing violence on the morning of September 13. No intelligent engineer who examines, even in a cursory manner, the principal witnesses, namely, the corroded safety valve and the torn crown sheet, will be likely to doubt the cause, while the responsibility may almost as readily be placed.

Capt. L. D. Decker, of the iron tug Gladwish, and James Tammany, a calker, were instantly killed, both being

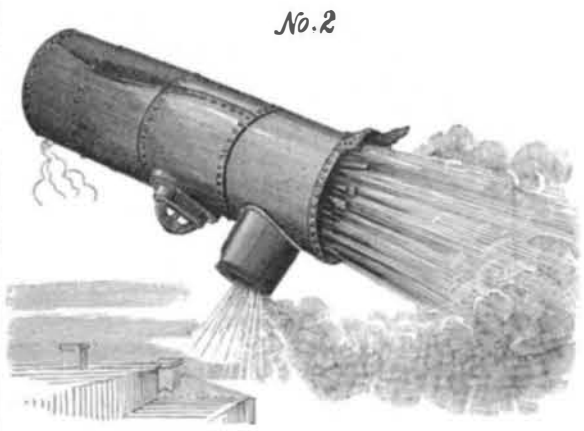
No. 1.



nearly abreast of the boiler and on the tugboat Gladwish, which was on the dock and about to be lowered after having undergone repairs. The names of the deck hands who were injured are John Smith, Alex. McQuinn, Walter Everson, who had temporary charge of the boiler in the absence of the regular attendant, and Victor Lambeck. Three of these persons will doubtless die of their injuries.

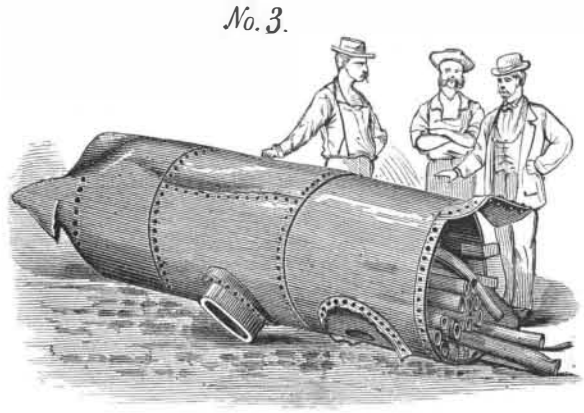
Sketch No. 1 shows how the boiler, which was of the locomotive type, was located on an overhanging platform, built upon the second section of the dock, about 20 to 25 feet,

No. 2



according to the stage of the tide, above the street level. It furnished steam to a 14" x 24" horizontal engine which stood alongside of it, through a 2½ inch wrought iron pipe flanged to the body of the safety valve, as shown in the engraving. The engine and boiler were covered by a shed building having a tinned roof, and they were used in connection with suitable gearing to pump the water from the four pontoon sections that composed the floating dock. The boiler was 16 feet long, including the 4 feet of the fire box

No. 3.



part (see Fig. 1) which was blown to pieces. The original form of this part is shown in dim outline, while the external sheet, with the screw stays attached, is seen spread out in the act of commencing its flight to parts unknown. Up to this time this plate has not been found.

The top and sides of the inner shell of the furnace were flat and formed of a single plate, which was driven down upon the grate bars by the pressure as soon as the overloaded stays gave way by pulling through this plate. It fell upon the dock in the background of Fig. 1, and its condition is shown in Fig. 4. It is five sixteenths of an inch thick; and in another part of the firebox the quality is indicated as Glasgow C H No. 1 flange, tensile strength 50,000. The barrel of the boiler is three eighths, single riveted, and contained 37 tubes 3 inches in diameter and 10 feet long. The boiler itself, well made, is clean inside, and shows no defects indicating long use. It is said to be four years old.

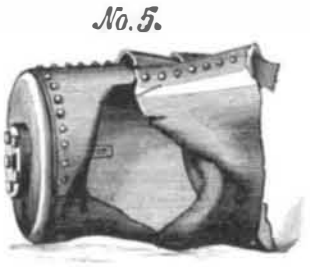
There was no indication of overheating of the plate shown in Fig. 3, which would be the first uncovered portion of the fire

No. 4.

surface in case of low water in the boiler; but there was unmistakable evidence that the so called safety valve was and had been for some time absolutely inoperative. The iron stem of the valve was immovably fixed by corrosion in the iron bonnet of the valve case. This valve, which is of the wing pattern, is 2½ inches diameter, was loaded by lever and weight to blow off at about 60 pounds when in order.

On the morning of the explosion the engine was not running, the temporary attendant was absent, a brisk fire was burning, and there being no outlet for the steam the pressure accumulated till the boiler gave notice by leaking steam through the weaker seams of the fire-box. The young man in charge, on seeing this, was in the act of running to open the furnace door when the explosion took place. The stay bolts pulled through the inner plate, and the flat top of the furnace was forced down upon the furnace grate bars, and the outer shell plate was forced upward, as indicated in the sketch No. 1. The whole furnace part of the boiler was thus separated from the barrel, which, impelled by the issuing contents, flew like a rocket in nearly a direct line of its projected axis, as indicated by sketch No. 2, up Essex street, plainly marking its trajectory upon buildings and signs; it reached the ground after turning about one-fourth of a revolution on its axis, at a distance of about 300 feet, where it encountered and cut down a fire hydrant, leaving the marks of the fluted casting plainly embossed in the iron of the dome, which was crushed and detached from the boiler, as shown in sketch No. 5. At this point in its course it struck the curbstone, and several rivet heads were ground smoothly off as though by contact with a fast running dry grindstone, changing the iron to a blue color by the heat of the friction. Here also it struck two large trees near the ground and the man-hole yoke was broken off. It was diverted by contact with these objects slightly to the left, and thereby prevented from entering a large dwelling house, and continued by a single bound up the middle of the street to a total distance of nearly 750 feet from the starting point—demolishing two wagons, killing a horse, and finally resting upon a two-wheeled truck to which the animal was attached. The explosion was followed by a terrible roar of the expanding water, which so frightened the horses along the street that they ran away; and the people fled terror-stricken into the nearest buildings.

No. 5.



The safety valve was found after the explosion firmly fixed in its seat, in which it is rusted in. The coroner proposes to weigh the force that will be necessary to move the safety valve from its seat, and no doubt there will be many guesses at the pressure that was required to do this work of destruction.

This case is very nearly parallel to one that occurred at the works of the Standard Oil Company, in Centerville, N. J., in 1878, and from the same cause—overpressure from a defective safety valve. Some of the parts of that boiler, which was also of the locomotive type, flew a distance of 1,200 feet. The boiler was broken into twelve principal fragments, and scattered over several acres of open ground.

The lesson taught by these disasters is obvious and should be learned by every steam user. It is that no steam boiler is safe without an efficient and well kept safety valve.

The worn-out theory of low water as a common cause of boiler explosions must soon give way to the more common causes—defective safety valves and weak boilers. It has become a trite remark among engineers that the most stupid boiler attendant knows enough to keep plenty of water in his boiler, while, on the other hand, many well-informed engineers are too careless about their safety valves, and seem to think if once well fitted and properly proportioned it will remain a safety valve without trouble and care. There is now more than one observer of boiler explosions that believes that the Eleventh street explosion in New York City arose from leaving the fastening upon the valve after the annual hydrostatic test, simply forgotten by the person who placed it there.