EXPLOSION OF TWO BOILERS AT PITTSBURG, PA.

On the 9th of December, about five o'clock, P.M., the heavy, dull sound of a disastrous boiler explosion reverberated among the hills of the busy city of Pittsburg, Pa. Two boilers of the nine composing the steam system of the Keystone Rolling Mills, shown in Fig. 1, situated in the Fourteenth Ward of the city, exploded with astonishing violence, causing the death of two workmen, injury to ten others, and the total wreck of the boiler house and adjacent blacksmith's shop, as well as a portion of a building belonging to a neighboring copper works.

Cornelius Dunn, the fireman, who was at the rear of the boilers, was instantly killed; Alvas Gideon, a blacksmith's helper, at work in the smithy, was shockingly injured; and John Price, a puddler, whose skull was crushed, died the second day after the explosion. Although the citizens of Pittsburg and of the iron regions in its vicinity are not strangers to the destructive effects of boiler explosions, yet this double disaster completely bewildered the average native observer; and, judging from the duration of the inquest, which has been repeatedly adjourned in order to obtain new expert testimony and facts, it appears to have thoroughly puzzled both the witnesses and the court, whose duty and evident desire are to explain the casualty and place the responsibility.

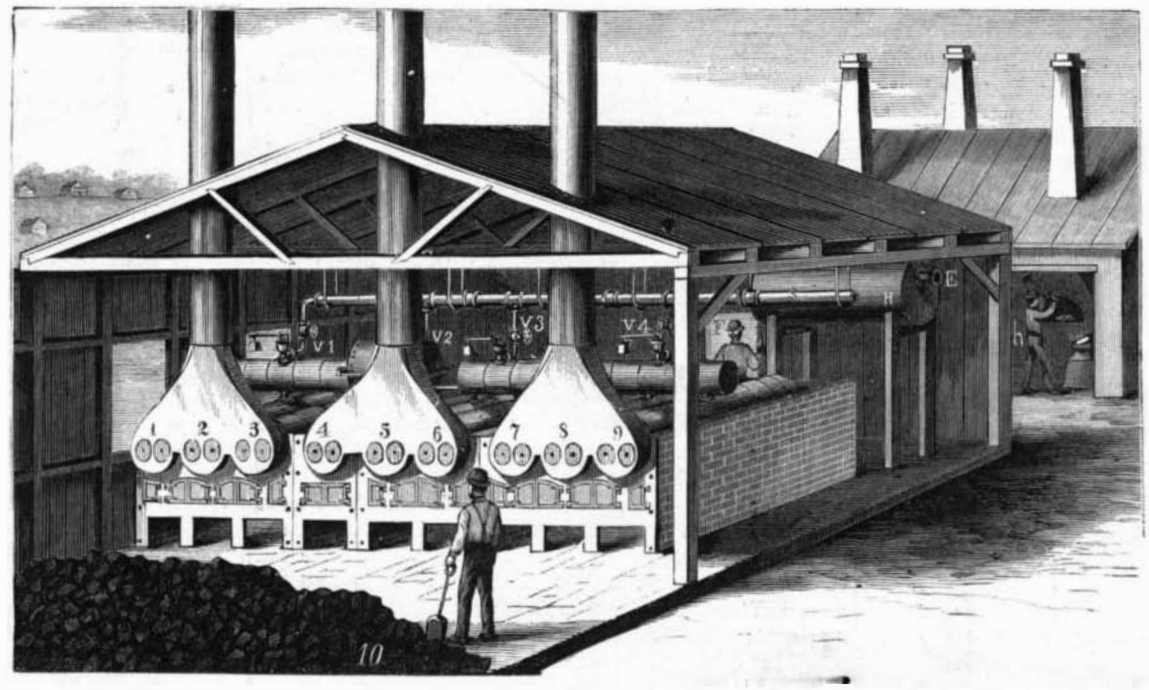
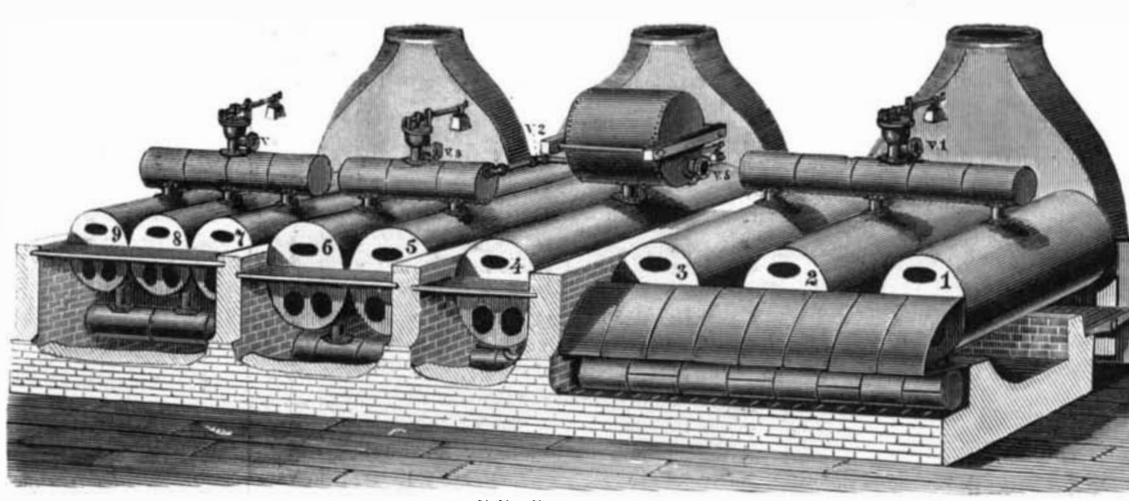


Fig. 1.—VIEW OF THE INTERIOR OF THE BOILER HOUSE OF THE KEYSTONE ROLLING MILLS, SHOWING THE ARRANGEMENT OF THE BOILERS BEFORE THE EXPLOSION.

A short history of the case, accompanied by our illustrations, will show that the task of the coroner, so far as the cause is concerned, ought not to be very difficult, since the cause is not obscure when sought for by means of a systematic study of all the phenomena, without bias caused by local or personal interests or preconceived and fixed opinions on the subject of boiler explosions.

The exploded boilers, numbered 5 and 6 in Figs. 3 and 4, were of the common two-flue type, with flues about 15 inches diameter, quarter inch thick, and shells originally of the same thickness, 42 inches diameter, and 24 feet long, made in twelve rings or courses of plates, two plates to each course. They were allowed, by the city inspector's certificate, to carry 120 pounds of steam pressure, but the evidence shows that it required 130 pounds to run the mills at full speed, and that they were working at about 125 pounds at the moment of the explosion.



V V.—Steam-stop valve.

Fig. 3.—VIEW OF THE REAR OF THE BOILERS.

According to one or more witnesses, it appears that these two, which were over the same fire, and had a separate steam drum and a mud drum, shown in Fig. 4, common to the three composing the second set, were made for and used on a river steamer, the Carrie Brooks, which formerly ran between Pittsburg, Pa., and Zanesville, Ohio. But, according to another witness, the proprietor of a spice mill in Pittsburg, it appears that they were new when put into his mill in 1866. His testimony shows that although he used them at only 40 pounds pressure, that being all he required, yet they were "*all the time giving out,*" and he became disgusted, and sold them for $100 each to a dealer in such goods, in 1872. They were bought by the National Tube Company, in 1879, and placed in the Keystone Mills on the recommendation of the city inspector, who, it appears, had tested them at 170 pounds, and reported them as old boilers requiring repairs, which having been made by putting several half-sheet patches, and perhaps some whole sheets, upon their undersides, according to his direction, they were, at that time, allowed to be used at 125 pounds per square inch.

Their history from 1872 to 1879 is not clear, perhaps they then were on the steamer Carrie Brooks.

On the 22d of April, 1881, they were last officially inspected as active boilers, in their places at the Keystone Rolling Mills, and allowed 120 pounds per square inch, as shown by the official certificate. The engineer thought he was allowed 125 pounds; as he was the year before, because the safety valve had not been changed to 120.

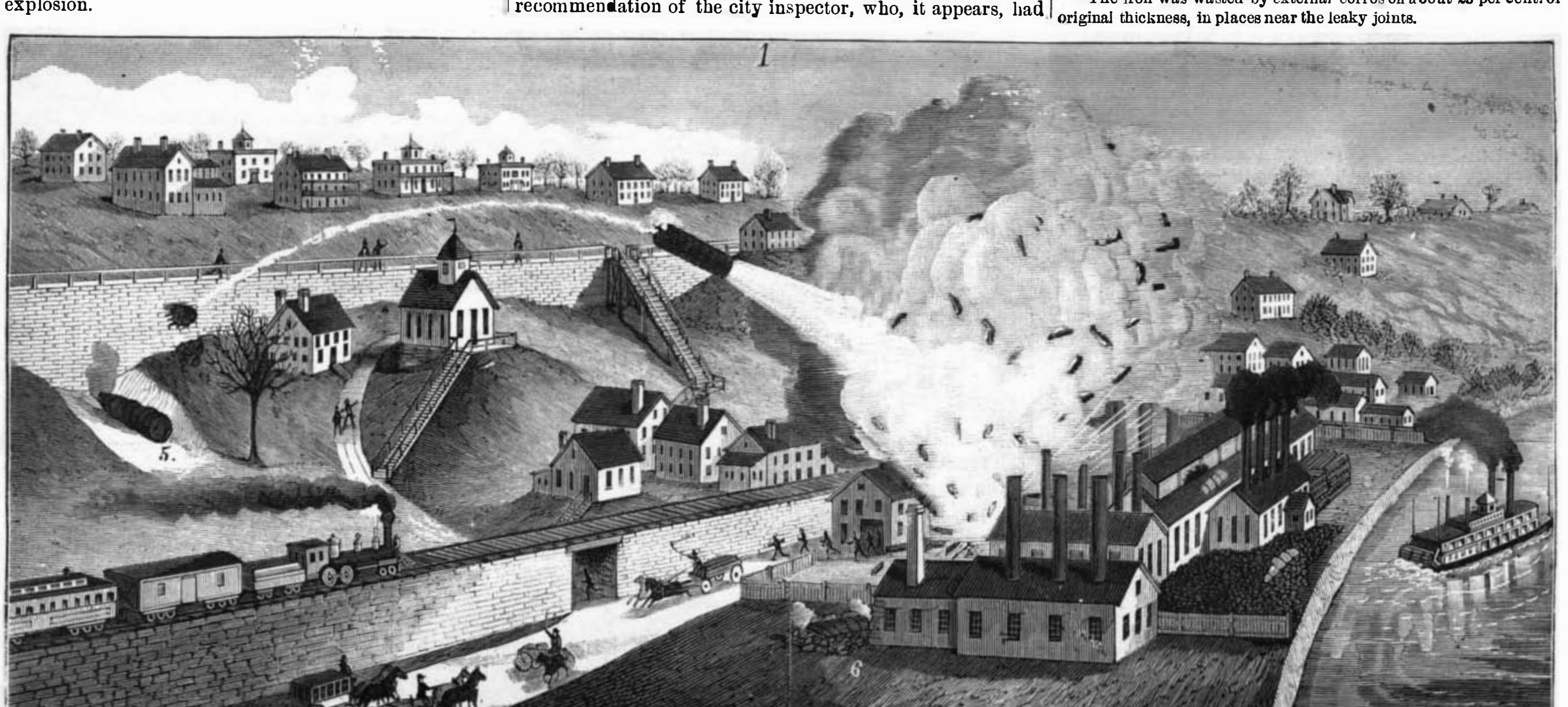
The above history is condensed from the sworn statements made before the coroner as they were reported for the Pittsburg *Despatch.* Now, if we apply to this case the practical facts, that prudent boiler insurance companies in this country, according to their published tables, would only allow 66 pounds pressure for an old 42-inch shell one-quarter inch thick,* having no important visible defects, and that the Manchester (England) Board of Trade rule would allow but 60 pounds, less than half what had been officially permitted in this case, it seems almost a waste of time to further argue the question of causes of the explosion.

But there are in every manufacturing community a large class of practical men who still hold to a variety of old theories on the subject of boiler explosions, and they were unusually well represented before the coroner in this case. In fact, each one of the more common old theories, mysterious and otherwise, had there a zealous champion.

It seems, therefore, important to sketch and answer the most specious of these theories, but the space is not now available for such a review. It may be found, from time to time, under the head of "Steam Boiler Notes," in the SCIENTIFIC AMERICAN.

The accompanying large landscape, Fig. 2, and the diagram, Figs. 5 and 6 (which is a plan of the works), constitute a pretty full graphical description of the scene of the explosion. On these illustrations may be traced the distribution of the fragments of

*The iron was wasted by external corrosion about 25 per cent. of its original thickness, in places near the leaky joints.



5.—Principal part of No. 5 boiler, which was thrown over the church on the bluff.

6.—Principal part of No. 6 boiler, that struck the copper works, etc.

Fig. 2.—EXPLOSION OF TWO STEAM BOILERS AT THE KEYSTONE ROLLING MILLS, PITTSBURG, PA.

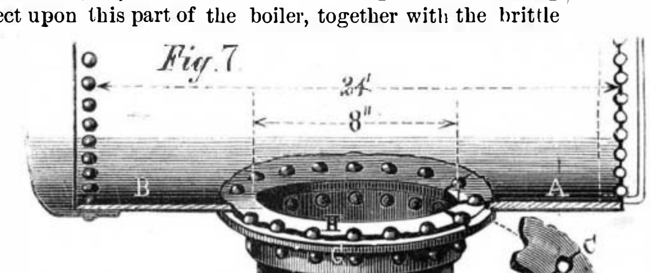
the two exploded boilers. Nos. 5 and 6, in the landscape, are the principal fragments, being 16 feet of the length of each of the boilers, which were not broken except at their separating line.

Figs. 1 and 3 show the arrangement of the nine boilers, the former the front and the latter the rear view, as they stood before the explosion. Fig. 4 shows the underside of the two exploded boilers and the lines of rupture, also their relation to boiler No. 4, belonging to the same set. It was two feet longer, and had eleven patches on its bottom.

It will be observed that the middle battery of boilers had two furnaces, a wall between Nos. 4 and 5 boilers forming the division. All the boilers rested upon stand pipes or legs, which connected them to their respective mud drums at the rear, and upon the fire front castings at their front ends.

The middle battery was supplied with water through the pipe, G, Fig. 4. The end of the steam drum which was attached to the two exploded boilers is seen at E, while F is the mud drum, common to these three boilers. A patch, consisting of about half a plate, had been put into the shell upon which the stand pipe of No. 5 boiler was riveted, A B, Fig. 4. The location of the initial rupture is pretty well established by the appearance of this plate, which is broken through the stand pipe opening and around the circle of rivets that secured the flange of the stand pipe to the boiler shell. The weakness here is indicated by old cracks on the line A B, and around the fractured edge between the rivets, and by external corrosion of the patch which had been kept wet from the leaks through the cracks and the flange joint. This part is shown enlarged in Fig. 7. These leaks—as no doubt others were that had from time to time called for repairs—was caused by feeding cold water in large intermittent doses in former years. This bad habit was occasionally practiced up to the day of the explosion.

When the main mill engine was running, water moderately heated could be had from the tubular heater, H, Fig. 1, through which the exhaust steam passed; but when the engine was stopped, cold water only could be had, which was fed to the three batteries of boilers alternately as they required it, by a large Blake steam pump, perhaps in large volumes rapidly introduced. Its cooling and contracting effect upon this part of the boiler, together with the brittle

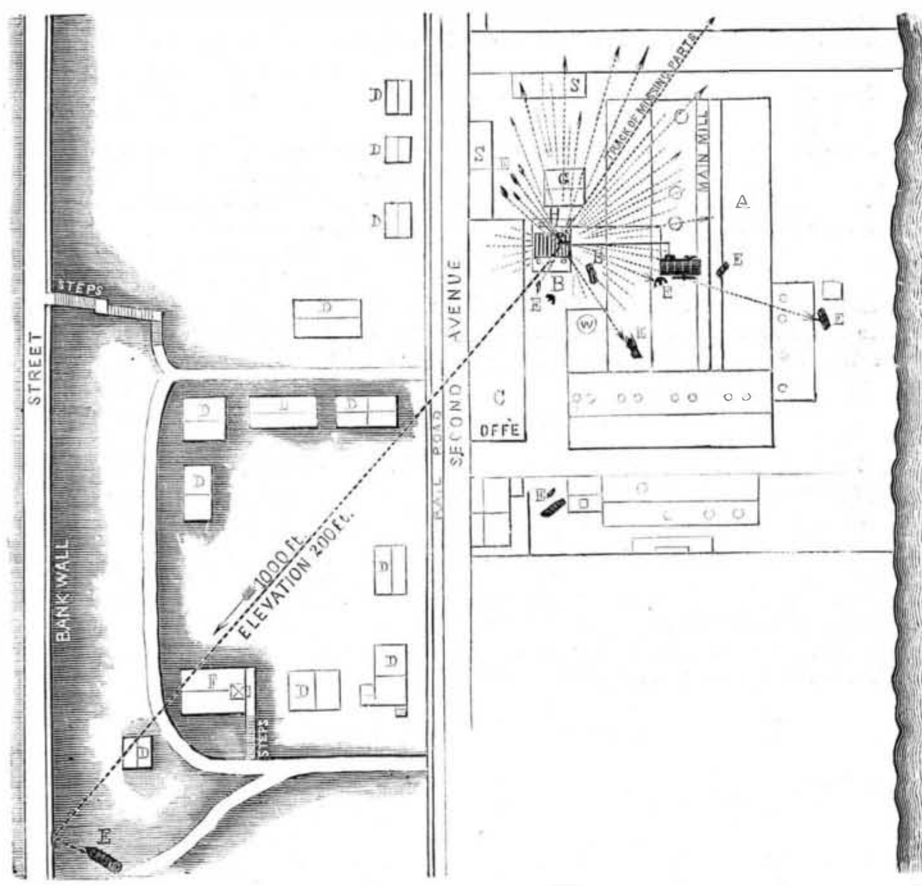


ENLARGED SKETCH OF STAND PIPE AND PATCH.—A B, INITIAL RUPTURE.—C, OLD FRACTURE IN SHELL PATCH THROUGH FLANGE RIVET HOLE.

quality of the patch and the extraordinary internal pressure, developed the weakness which gradually increased till the limit of endurance was reached. On the day of the explosion these boilers were shut off for repairs. Two hours, or less, before the explosion the flange of the stand pipe (see Fig. 7) had been calked to stop a leak. The boilers were then filled with water to the second gauge, and steam was raised. The boilers were then left in charge of Fireman Dunn, who was directed to feed the water up to three gauges.

Now, when the patch on No. 6 boiler suddenly burst open on the line A B, Figs. 4, 8, etc., the steam gauge had just been observed by a witness to register 127 pounds.

The pressure of the issuing water was, therefore, about equal to that of a vertical water column 300 feet high, and its temperature was about 355° Fahr. There were nearly 600 cubic feet of free steam in the steam space of the nine boilers, and, supposing the steam valves to be all open, this tremendous volume of steam, at 127 pounds pressure, instantly moved with lightning speed toward this opening, pressing only the portion of water that lay immediately in its path out at the now enlarging opening, the free ends of the broken ring of plates, *a*, Figs. 4, 8, etc., spread outward like wings of a bird, cross tearing the plates on the spiral line indicated (Fig. 4), and on the rear head seam; the left band free end strikes boiler No. 5, which was almost equally weak at corresponding points, and from the same causes that caused weakening of No. 6 boiler. The blow was sufficiently violent to indent the plate, *a*, where it struck a line of rivets on No. 5 boiler, and it had ample force to so shock the overloaded weak structure as to cause it to break on a line corresponding to A B through the stand pipe opening. No. 5 boiler now opened in the same manner as No. 6 had done, and six tons of highly heated water, that the two broken boilers contained, now relieved of pressure by the instantaneous escape of the free steam, expanded with explosive rapidity, giving out, in falling from 355° to the atmospheric boiling point 212°, 143 units per pound of water. Each pound of the 12,000 pounds of water gave out force enough to raise 143 × 772 = 110,396 pounds one foot high. The grand total of power given out in less than a second of time was therefore 110,396 × 12,000 = 1,324,752,000 foot pounds, a force quite sufficient to accomplish the observed destruction, even though a large percentum of it was diffused in the air, upon which it reacted almost as violently as exploding and detonating compounds do.



Figs. 5 and 6.—GROUND PLAN, SHOWING LOCATION OF WORKS AND LANDING PLACE OF BOILER. E E, etc., PARTS OF BROKEN BOILERS.

It has been repeatedly demonstrated, both by accidental and by experimental boiler explosions, that empty hot boilers do not accomplish a tenth part of the destruction that is done by boilers containing large volumes of water at a temperature due to the pressure.

There was no evidence of a lack of water in these boilers. They were carefully examined by a SCIENTIFIC AMERICAN representative. Moreover, we have the sworn statement of more than one uninjured competent witness that the gauges were tried a few minutes before the explosion, and water showed itself at the upper one.

The boilers were in the care of two engineers and two firemen of long experience, in two watches for the twenty-four hours, each one of whom firmly believed that his life depended on a full supply of water, and that no boiler will *explode* with water at the second or third gauge. They believe that a weak boiler will *blow out* in a harmless manner and relieve itself, as they have often seen them at small and circumscribed areas between rigid supports, or may be at the transverse seams.

The chief aim of these experienced men was to look out for plenty of water and then plenty of pressure to move the machinery at maximum velocity, which one of them swore could only be done with 130 *pounds of steam.*

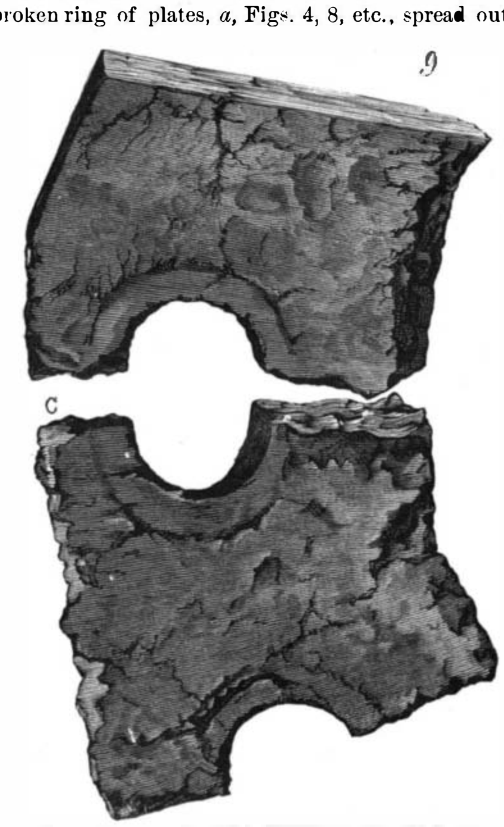
Four rear courses of boilers, Nos. 5 and 6, torn as indicated in Fig. 4, together with corresponding lengths of the four flues, were distributed in about twenty pieces to the right and left of the rear of their site, and the unbroken principal sections, 16 feet of the front ends of both boilers, were thrown as indicated on the landscape at 5 and 6, and plan at E E, etc.

The plate, *a*, Figs. 4 and 8, sailed over and entirely clear of the main mill and landed on the coal pile near the river. This piece was easily identified as the plate *a* of No. 6 boiler by the marks of recent calking at the stand pipe flange. The main section of the same boiler, No. 5, was identified by the gauge cock openings in the front head; the other boiler which exploded, being the middle one, had none. The principal section of No. 6 boiler flew directly to the front and struck a building belonging to the neighboring copper works. The corresponding section of No. 5 was diverted by some incident in the progress of the explosion, so that it took a direction some 30° or 40° to the left, front, and upward over the small church and a dwelling on the slope of the high bluff. It struck almost exactly head foremost against the heavy retaining wall of the street above the buildings, and turning to the front its rear end was flattened against the same wall, and it then landed in the small ravine, as shown at 5 on the large landscape.

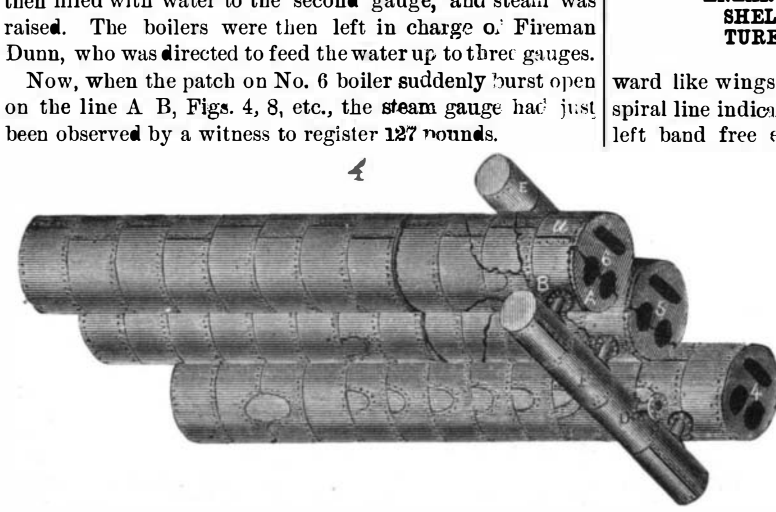
The roofs of the buildings to the rearward of the boilers were covered with *débris* and dried marks of dirty water, pieces of boiler and bricks, all of which point to the same conclusion as to the quantity of water that escaped from the boilers.

Boiler No. 4, the unbroken one of this battery, tumbled over into the pit occupied formerly by Nos. 5 and 6, and lay upon its side in such a manner that most of the water it contained was still there on removing the man-hole plate after the explosion.

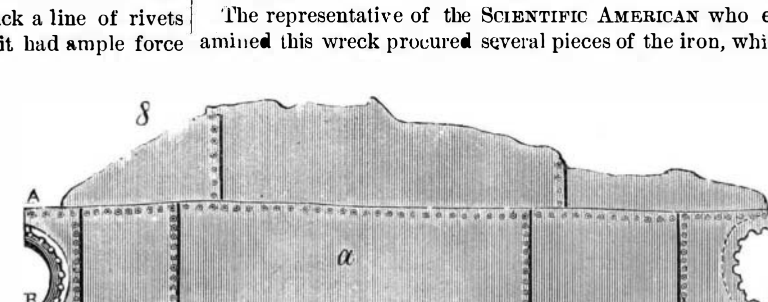
The representative of the SCIENTIFIC AMERICAN who examined this wreck procured several pieces of the iron, which



ENLARGED FULL SIZE SKETCH OF PART OF SHELL PATCH.—C, SAMPLE OF OLD FRACTURE THROUGH FLANGE RIVET HOLES.



VIEW OF UNDER SIDES OF THE SECOND SET OF BOILERS.—Nos. 5 and 6, EXPLODED BOILERS, ON WHICH ARE SEEN THE LINES OF FRACTURE.—A B, THE INITIAL RUPTURE.—E, THE STEAM DRUM OF Nos. 5 and 6.—F, THE MUD DRUM OF THE SET.—G, THE FEED PIPE.



RING OF PLATES FIRST TORN OFF.—A B. THE INITIAL RUPTURE.

were easily broken off with a common wrench, indicating its brittle character.

The pieces shown full size, Fig. 9, and also on a smaller scale in Fig. 7, were obtained by cutting off the rivet heads that held them to the flange of the stand pipe, as shown.

They are pieces of the patch, and have, at *c*, a sample of the old cracks that existed before the explosion. These cracks were filled in places with lime scale deposited from the water.

The conclusion is almost inevitable, after careful study—

That these two boilers exploded in succession so rapid as to be practically simultaneous, beginning at the weak line A B of No. 6 boiler.

That they contained the usual supply of water.

That the pressure was too great for boilers of their size and thickness of iron.

That the use of cold feed water has hastened the deterioration of the poor iron, causing cracks and leaks, from which external corrosion arose, and that the force stored in the water of these two boilers by its sudden liberation through sufficient openings caused the destruction observed.

It is, therefore, strongly recommended that heavier and stronger material be used for boilers of this size and pressure; that regular and continuous feeding of hot water be practiced; and that more care be exercised by inspectors and those in charge of steam boilers in searching for and immediately repairing dangerous defects.

The fact that the proprietors of the Keystone Rolling Mills have ordered first-class steel boilers to fill the places of the exploded ones indicates that they appreciated the recommendations of the SCIENTIFIC AMERICAN representative, who explained to their superintendent the causes of the failure of these old boilers.

Chinese Method of Manufacturing Vermilion.

BY HUGH MACCALLUM.

There are three vermilion works in Hong Kong, the method of manufacture being exactly the same in each. The largest works consume about six thousand bottles of mercury annually, and it was in this one that the following operations were witnessed:

First Step.—A large, very thin iron pan, containing a weighed quantity, about fourteen pounds, of sulphur, is placed over a slow fire, and two-thirds of a bottle of mercury added; as soon as the sulphur begins to melt the mixture is vigorously stirred with an iron stirrer until it assumes a black pulverulent appearance with some melted sulphur floating on the surface; it is then removed from the fire and the remainder of the bottle of mercury added, the whole well stirred. A little water is now poured over the mass, which rapidly cools it; the pan is immediately emptied, when it is again ready for the next batch. The whole operation does not last more than ten minutes. The resulting black powder is not a definite sulphide, as uncombined mercury can be seen throughout the whole mass; besides, the quantity of sulphur used is much in excess of the amount required to form mercuric sulphide.

Second Step.—The black powder obtained in the first step is placed in a semi-hemispherical iron pan, built in with brick, and baving a fireplace beneath, covered over with broken pieces of porcelain. These are built up in a loose porous manner, so as to fill another semi-hemispherical iron pan, which is then placed over the fixed one and securely luted with clay, a large stone being placed on the top of it to assist in keeping it in its place. The fire is then lighted and kept up for sixteen hours. The whole is then allowed to cool. When the top pan is removed the vermilion, together with the greater part of the broken porcelain, is attached to it in a coherent mass, which is easily separated into its component parts. The surfaces of the vermilion which were attached to the porcelain have a brownish red and polished appearance, the broken surfaces being somewhat brighter and crystalline.

Third Step.—The sublimed mass obtained in the second step is pounded in a mortar to a coarse powder, and then ground with water between two stones, somewhat after the manner of grinding corn. The resulting semi-fluid mass is transferred to large vats of water, and allowed to settle, the supernatant water removed, and the sediment dried at a gentle heat; when dry it is again powdered, passed through a sieve, and is then fit for the market.—*Pro. Pharm. Soc.*

BOTANICAL NOTES.

The Color of Spring Flowers.—In a contribution to the *Science Review*, on the color of spring flowers, Mr. A. W. Bennett states that out of a list of sixty-four species, 40·5 per cent are white, 20·3 per cent yellow, 17·4 per cent blue or violet, and 7·8 per cent pink. Thus the white and yellow flowers would appear to preponderate. He accounts for this by the fact that white flowers owe their color to the presence of air in the cells of the petals, and that the yellow flowers of spring, such as *Tussilago farfara, Eranthis hyemalis, Primulus, Cheiranthus*, etc., owe their color to xanthine, a solid pigment, probably a modification of chlorophyl, only slowly soluble in alcohol and potash. The predominance of flowers of brighter hues during summer and autumn he considers to be due to the presence of coloring matters which require a strong light and a high temperature for their production, particularly the red coloring matter, as shown by Batalin. The effect of light is shown by a reference to the flora of Switzerland, in which the larger portion of red, pink, and blue flowers in spring is remarkable. H. Müller attributes this to the greater transparency of the mountain air, and consequently more intense light. On this account, and because of the spring being a month later than at lower elevations, the alpine flowers are more brightly colored. This explanation is confirmed by Siemens' recent experiments with the electric light.

White-fruited Blackberries.—Mr. G. M. Wilber, in a note in the *Torrey Botanical Bulletin*, reports that in two localities in Dutchess County, in this State, he has detected plants of the common blackberry (*Rubus villosus*) bearing berries that were perfectly white when ripe, and that were as sweet and pleasant to the taste as the usual black fruit of the same species. Some of the bushes having been transplanted were found to produce the albine berries in succeeding years.

Superabundance of Pollen in Indian Corn.—Prof. C. E. Bessey says, in the *American Naturalist:* "Nature evidently intends to secure the fertilization of the young ovules in the Indian corn (*zea mais*) beyond all chance of failure. In the autumn of 1875 I made a large number of careful counts and estimates, which resulted in fixing upon twenty-five hundred as the average number of pollen grains in each anther. Each panicle of male flowers (the "tassel") was found by careful estimates to contain about 7,200 stamens, so that the number of pollen grains produced by each plant is about eighteen millions. Allowing two ears, of one thousand kernels each, to each plant (a very high estimate), there are still nine thousand pollen grains for every ovule to be fertilized!

What is an Apple?—Is an apple a fruit? It is generally regarded so; but, botanically speaking, a *fruit* is that part of a plant which contains the seeds, and it is nothing else. The *core* of an apple, then, according to this, is the true fruit, for that is the part that contains the pips, and the pips are the seeds It is a cartilaginous five-lobed capsule splitting along the edges. "What oddities," says Dr. M. T. Masters, "these botanists are; they leave on their plates the fruit, and they eat something which they say is not the fruit! What is that something which is not the fruit? To answer this question to his own personal satisfaction . . . the reader should see before him a flower of an apple or pear in the earliest stage of its growth, and he should trace in other stages, from this earliest condition to the ripe state, the growth of the apple or the pear." A careful examination of this kind, says our author, will "enable him to discover that the flesh of the apple or pear is nothing whatever but the end of the flower stalk, which gradually swells out into a succulent mass, and which holds embedded within it the true fruit —the core. What in ordinary language is called the fruit is, then, only the swollen flower stalk. Alechemillas and spiræas, peaches and cherries, are not to be h d in flower just now, else a cut down through the center of the flower of either of these would reveal the cup-like stalk encircling the young fruit in the center, just as a pill is inclosed within a pill box. Now, suppose the cup to be fleshy, and so thick as to come in contact with the fruit, and we have exactly the condition of an apple. So, then, to say that the core of an apple is the true fruit, and the flesh thereof the dilated flower stalk, is no dogma to be accepted as an article of faith, but it is a statement which any one with a pair of eyes, ordinarily nimble fingers, and a little patience, can, at the proper season verify for himself. . . . To be able to recognize the core of an apple as the fruit proper, and to see in the flesh of the apple a swollen flower stalk, is not to indulge in a mere botanical technicality, as some might at first be inclined to suppose; but it affords a means of ascertaining a truth, and, as such, of opening up possibilities of future utility and development; for truth is never barren of result —the sterility lies with the man who does not avail himself of the truth so far as he can. Deep thoughts to be evolved from the castaway core of an apple!"

Dried Foods.

At present we export to Europe about 6,000,000 pounds of evaporated apples. The process is extremely simple. The fruit is "cored" and sliced into pieces one-sixteenth of an inch in thickness; it is then exposed to sulphur fumes, which arrest all fermentation, and then to a dry and hot blast of air, which reduces it to about half its original weight. The sulphur fumigation prevents the fruit from becoming dark, and after drying it is almost as white as when first cut. Simple as is this process, it costs about twice as much as drying the fruit in the sun, but such is the saving in weight and flavor that it is preferred, and evaporated apples sell to-day in the European markets for fifteen cents a pound

An old produce dealer interested in the European export trade told an *Evening Post* reporter that, in view of the astounding magnitude of the export trade in food products, it would not be surprising to hear of attempts at compressing or drying every product of the country. The same process as that applied to apples has been used with some success with peaches, and some berries that can be grown cheaply, and as the export of dried food products increases the import is constantly decreasing. The raisins from California promise to drive all foreign raisins out of our markets. There are vineyards of hundreds of acres in Placer, El Dorado, Los Angeles, San Diego, and other counties, given up to growing and drying grapes, partly by evaporation and partly by sun heat.

Another recent use of the evaporation process applied to food products concerns the preparation of codfish for Europe, and especially for tropical climates. The business has been established in this city about six months. The persons who use the process assert that ninety per cent of the weight of a fresh codfish consists of water. By evaporating the matter until the fish product becomes a sort of fine dry meal, a substance is obtained which can be packed in boxes and exported, one pound of the evaporated cod being equal to ten pounds of fresh cod, so far as nutritive properties go. The company which is engaged in the business has factories on the coast of Maine and at Gloucester, Mass.

Wet and Dry Thunderstorms.

A correspondent of the London *Times*, writing from the Transvaal, South Africa, says: "Every afternoon tremendous storms of thunder and lightning burst upon us. These were of two kinds, the wet and the dry. The first is harmless, though noisy; the second exceedingly dangerous. During the dry thunderstorms, which were prevalent toward the end of October, the lightning seemed quite stupefying. It was unaccompanied by either wind or rain. The angry flashes were followed almost simultaneously by awful crashes of thunder, which seemed to shake the earth. One or two tents were struck, and the grass was set fire to in several places within sight of our camps, but no life was lost, only some arms damaged. The dry thunderstorms were soon followed by wet ones. The rain, mixed up with enormous hailstones, soused the thirsty earth, and every little crack on the veldt bore its burden of water to the Vaal, which rose and became impassable."

Oxygen as a Source of Energy.

As is well known, however, the highest temperatures are obtained by combustion—that is, by the combination of other bodies with oxygen. Since oxygen is continually inhaled and consumed by animals during life, we are obliged to consider this as the source of heat and force. We have here a problem which is open to discussion, namely, whether the energy liberated by the combustion was originally contained in the oxygen or in the other substances. It appears as if the latter assumption was generally accepted; at least, statements are often met with, such as, for instance, that coal contains the heat of the sun which has been stored up during thousands of years. Although we cannot at present, with the means at our disposal, definitely solve this problem, it can at least be shown that the statement has little in its favor. The decomposition of carbonic acid by the influence of the light and heat of the sun is effected in such a manner that the carbon is employed in the formation of the compounds of which the plant is built up, while the oxygen escapes into the atmosphere. Now, we know that solids contain the least energy, because it must be supplied to them in the form of heat in order to convert them into the liquid or gaseous state, while, on the contrary, heat must be withdrawn from gases to condense them to liquids or solids. Oxygen is one of the most permanent gases, and must therefore possess an enormous amount of energy, while carbon, on the other hand, being one of the most difficultly diffusible and volatile bodies, can only contain a little energy. This makes it extremely probable that the force of the sun, taken up by the plants, is not stored in their bodies, but in the free oxygen of the atmosphere. Hence the latter is to be considered as the inexhaustible source of power on which man and animals draw, and in the carbon we possess a valuable aid for making this energy, contained in the oxygen, available.—*Edmund Drechsel, in Popular Science Monthly.*

RECENT INVENTIONS.

An improved whip has been patented by Messrs. Henry Mullen and James Noble, Jr., of Westfield, Mass. The core of this whip is formed of a leather or rawhide piece at the butt and a whalebone piece at the lash end, so that the advantage of a whalebone whip is retained, while the cost is greatly reduced.

An improvement in fishing reels has been patented by Mr. John Palmer, of New York city. The invention consists of a fishing reel provided with an extensible crank for increasing the length of leverage when necessary when reeling in the line, the extension arm being adapted to be withdrawn to shorten the lever to ordinary length while casting out the line.

Mr. John Owen Smith, of Savannah, Ga., has patented a means for protecting windows or doors against burglars. It consists in a strong protective frame of metal or wood, provided with lugs at the top, adapted to enter seats formed in plates in the sides of the window frame, and provided with tongues of metal at the bottom, projecting at right angles to the frame inwardly, and adapted to enter horizontal holes in the window sill and be locked by set screws or pins inside.

An improved combined button lap and stay for garments has been patented by Mr. David W. Thompson, of Englewood, Ill. The invention consists in the combination, with the garment or body piece having simply a straight slit cut in it where the opening is to be, of a single piece of material, which, when folded and stitched to the sides of said slit, constitutes both an upper and under button lap or fly, a facing, and a stay for re-enforcing the bottom of the opening, making a finished piece of work without raw edges.

An improved process of making skinless furs and articles thereof has been patented by Messrs. Charles Koch, Jr., and Charles E. Burgmüller, of Newark, N. J. By this process the inventors are enabled to produce real fur without the pelt or skin of the animal. The process is such that articles of apparel, such as caps, collars, muffs, and the like, of any shape or style, may be made in the manufacture of the fur, and the articles may be made seamless, and fur may be left upon both the inside and outside of the articles, if desired.