BOILER EXPLOSIONS IN 1881.

The number of boiler explosions in 1881 that have been of sufficient importance to attract the attention of local press reporters is not as great by about half a dozen as was reported in 1880. But the number is quite sufficient, being 160 explosions, by which about 250 persons were killed or fatally injured and died soon after from the effects of their injuries, while over 300 more were seriously but not fatally injured.

Of these explosions almost exactly thirty per centum were in mills that use light and quick burning fuel, sawmills standing far ahead of any of the class in number and disastrous results. The class includes besides sawmills, all such as use the refuse timber and shavings from wood cutting machinery, and should also include such thrashing engine boilers as are fired with straw. But it is not practicable to separate such for the purpose of classification from others that use coal for fuel. It is probable that one-third of all the steam boilers that explode with destructive violence are such as use flashy, quick burning fuel. The furnace doors of such boilers must be often opened, and in the case of green sawdust the draught must be strong, so that when the furnace doors are opened a sudden chill of the furnace plates is caused by the inrushing cold air. The effect of the sudden coaling of parts of the boiler is to unduly contract and strain them, the contraction being resisted by those parts that are not so suddenly cooled. In long cylinder flue boilers, externally fired with flashy fuel, the contraction of the bottom of the shell is resisted by the rigid internal flues. Then the strain causes slight bending of the head flanges, if they have pliable wrought iron heads; or if heavy unyielding cast iron heads, then the strain caused by the contraction of the lower side of the shell is concentrated at the transverse seams, the weakest of which will yield and begin to leak, or it will pull in two between the rivet holes, perhaps one-third the way round the boiler before exploding.

The strains on the flanges of wrought iron heads from contraction of the bottom of the shell of this type of boiler, which contraction is resisted by the rigid internal flues, causes bending at the angle of the flange, and the strained and yielding line near the angle of the flange is at once attacked by the boiler water. The slight imperceptible motion is sufficient to crack off any lime scale that may have been deposited from the water and lay bare the disturbed molecules of the iron, and they are acted on over a larger area than when undisturbed, and with only a small area, that which lies in the general surface of the plate, exposed to chemical action of the water.

The weak line becomes weaker with every recurrence of the motion, and if the weak line is sufficiently long it may give way suddenly on the whole weak line, when an explosion may occur immediately on the escape of the free steam which presses on the highly heated water.

Weaknesses caused from this or any one of the many causes of deterioration of boilers, are, however, not necessary conditions for an explosion. In fact it has been often remarked, and with propriety, "the stronger the boiler the greater the destruction." But it is plain that the force must be greater than the resistance to it when the boiler breaks open. It is only necessary to prevent the escape of the heat by radiation from the exterior surface of a boiler and through all steam outlets, and to continue the fire in the furnace at a temperature higher than that of the boiler water in order to effect a continued gradual increase of heat and of pressure in the boiler. This may be done sufficiently to accomplish the destructive explosion of the strongest boiler by fastening down the safety valve, closing the steam stop valves, and keeping up a moderate fire in the furnace. It is by the accidental arrangement of these conditions that many, perhaps most, explosions of strong boilers that occur are brought about.

It is fair to conclude that farmers and lumbermen who undertake to run their own steam boilers are more likely to make the fatal mistake than almost any other class of steam users. Therefore we need not wonder that so large a proportion as 33 per cent of boiler explosions are in saw and lumber mills.

Next in order of their numbers and effects come the explosions in iron works of various kinds. Something less than 11 per centum of the exploded boilers were in this class of manufactories. The most notable explosions have been in rolling mills and furnaces, but for convenience in classification, boiler shops, machine shops, and foundries are included in this class.

The most important, however, and the most numerous explosions in this class, are iron manufactories proper, and it is these that give this class its right to have this second place in the order of classification, and to these the reader's attention is invited.

Most of the boilers used in iron works in this country are externally fired, although there are a few of the English Rastrick and a few upright flue boilers still in use.

Of the externally fired varieties there are the plain cylinder, the cylinder flue, the cylinder tubular, and the French double cylinder boilers. In iron furnaces it is a common practice to heat the boilers by means of the waste gases from the furnace, and for this purpose the furnace top is closed with a cast iron cover, and a large pipe is let into the side near the top, which conducts the gases to the chamber beneath the boilers, when sufficient air is sometimes admitted to complete the combustion of the gases and heat the boilers.

The sulphurous vapors from the contents of the furnaces are condensed by contact with the cool parts of the boilers, and corrosion sometimes goes on very rapidly, especially near the feed water inlet. Leaks occur, and the moisture from them increases the activity of the corrosive agents, and if not repaired the plates are soon reduced to such a weak condition that they give way. Now, if the break is of considerable extent, giving way suddenly, an explosion may be the result. It is a common saying among engineers that a weak boiler will not explode, but will simply blow out at the weak place, and relieve itself without breaking into fragments. It is true that weak places of smallish area, and surrounded by rigid stays or parts of full strength, often do blow out in this manner, causing damage only to such objects or persons as happen to be in range of the escaping stream of water at the moment; but it is also true that if the weak place happens to be of such extent and so located as to break with a snap and make a large opening through which the free steam instantly escapes, the explosion of the highly-heated water may break the boiler into fragments more or less completely, according to the relative quantity of water, its temperature, the [illegible] and location of the initial opening, and the direction in wh[illegible]he escaping water acts on the unsupported plates. But the conditions are so various that it is the veriest quackery to predict a specific set of results in any given case.

Puddling and reheating furnace boilers are often placed so that the gas from the burning coal is driven first through the reverberating chamber, where the ore, the bloom, or the iron pile, as the case may be, is placed to be heated; thence urged by a blast fan, it enters the chamber beneath the boiler, or in case of the upright flue boiler, it enters the flue or flues which pass upward to the stack.

If the intensely heated gases impinge directly on a limited area of the boiler shell or flues in a concentrated blowpipe stream, it is sometimes impossible for the iron to transmit the heat to the water as rapidly as it is delivered by the blast on the small area of the iron plate. The iron may thus become weakened by being crystallized, and especially if a seam is thus exposed; because there the lap not only doubles the thickness of the metal between the hot gases and the water, but also there is less rapid transmission on account of imperfect contact of the plates, and of the rivet heads with the plates.

Sudden cooling of long externally heated boilers that are insufficiently or improperly supported causes very severe strains on the shells of iron works boilers. They are sometimes as much as twenty diameters in length, and when such boilers have three or more supports the distortion caused by the unequal heating sometimes throws the entire weight upon the middle and end supports alternately as the boilers are heated and cooled.

Overpressure, generally accidental, has, no doubt, contributed a full quota to disastrous explosions of iron works boilers. Safety valves that "breathe" a little on occasions, indicating to the unpracticed or thoughtless attendants that they are ready to take care of the steam in case the demand for it is stopped by the sudden shutting down of the works, are not always capable of opening sufficiently to discharge the full volume that may be produced by an active fire. One such safety valve is often expected to relieve three, four, or half a dozen large boilers with steam outlets closed and heavy fires burning. Then, if any one of the lot has a sufficiently extensive weakness, no one who knows and thinks about the conditions would be astonished if the weak boiler should blow up and break its nearest neighbor, which in turn might break the next one if no sufficient masonry was there to prevent it.

In one case, eight boilers in a lot of ten, in a sawmill, are reported to have been blown to pieces in the past year. And a few years ago nine boilers likewise exploded in an iron-making establishment in Ohio.

There is a prevailing idea among attendants of steam boilers, more especially those in iron works, that no boiler will explode while there is sufficient water in it to prevent overheating of the fire surfaces, and this idea is entertained by many intelligent iron masters, which is unfortunate, because they naturally take less precautions in keeping a full safety margin of strength in their boilers than in keeping a full supply of water, perhaps the colder when pumped in the better.

Railroad locomotives usually stand near the head of the list, generally in the third place, but this year only about seven per centum of the explosions have been locomotives; thirteen only have been reported, and the same number stands against steamers.

Portable engine boilers, hoisters, pile drivers, and thrashing machines stand third in this year's classification, which is not surprising in view of the extended introduction of agricultural and thrashing engines.

In distilleries, breweries, soap and candle works, and the like, there have been eleven boiler explosions

In steam heating and drying and in dwellings there have been seven cases of disaster.

In bleacheries, dyeing, digesting, and other works where steam and water are used in vessels remote from the generator, there have been six cases of destructive explosions. There have been during the past ten years as many as thirty-five or forty of this class of explosions. This fact, if known and understood by those who believe in explosions from low water alone, ought to shake their faith in their own creed, since there can be no such thing as overheating of plates about a steam chamber remote from the generator and heated only through a small steam pipe. These cases are in all respects similar to those of steam generators. They burst and fly in a similar way, the destruction usually corresponding to the amount of the contained water and its temperature, the same as in a generating vessel that is exposed to the fire. It is not probable, however, that so great a percentage of this class go to pieces as is found among generators, because they are not exposed to so many deteriorating influences as regular steam boilers are. There have been enough, however, to fully establish the fact that it is not necessary that a boiler should be empty or partly so in order to produce a destructive explosion.

In the ninth item in this classification, viz., paper mills, flour mills, grist mills, and grain elevators, there have been *five* explosions.

In the tenth—cotton, woolen, and knitting mills—*four;* in mines, oil wells, etc., *three;* while there have been nineteen explosions in other mills and works not characterized in the press reports.

RECAPITULATION.

	Explosions in 1881.
(1) Sawing, planing, and woodworking mills	48
(2) Iron works	17
(3) Portables, thrashers, hoisters, etc	15
(4) Steamers, tugboats, etc	13
(5) Locomotives	13
(6) Distilleries, breweries, soap works	11
(7) Dwelling, steam heating and drying	7
(8) Bleaching, boiling, digesting, and dyeing	6
(9) Grist, flour, and paper mills, and grain elevators	5
(10) Cotton, woolen, and knitting mills and factories	4
(11) Mines, oil wells, and works	3
(12) Mills and works not classified and those not characterized	18
	160
Number of persons killed	250
Number of persons injured	328

ELECTRICAL SHEEP SHEARS.

Mr. Edison has referred to us a communication from New Zealand in which the writer sets forth at length the pressing need of some means of shearing sheep evenly, rapidly, and without risk of hurting the animal. Sheep raising, it will be remembered, is most largely carried on in sparsely inhabited districts where skillful shearers are hard to get.

The writer appeals to Mr. Edison, thinking that an electrical apparatus might be made to answer, the cutting to be done by means of a wire highly heated by an electric current. The length of the heated wire or cutter would have to be about three inches.

The use of an incandescent wire of platinum for cutting has been entirely successful in surgery, in removing tumors and other diseased or morbid growths, and there is a possibility that it might answer for cutting wool. Whether the heated wire would injure the wool, or whether the accumulation of ash would speedily make the cutter inoperative, are questions which trial alone can decide.

Some years ago patents were taken out for a method of felling timber by the use of wire electrically heated, but when the method was put to practical test it failed, as the ash of the burnt wood soon surrounded the wire with a fireproof shield.

Whether a similar difficulty would arise from the coating of the wire with wool ash and charred wool on applying the method to wool cutting, and whether this or other possible difficulties can be easily overcome in an electrical shearer, can be determined only by trial.

A Curious Appearance of the Moon.

A singular appearance of the moon was observed by several residents of Lebanon, Conn., on the evening of July 3. The moon, almost full, was about three-quarters of an hour high. An observer says: "Two pyramidal luminous protuberances appeared on the moon's upper limb. They were not large, but gave the moon a look strikingly like that of a horned owl or the head of an English bull terrier. These points were a little darker than the rest of the moon's face. They slowly faded away a few moments after their appearance, the one on the right and southeasterly quarter disappearing first. About three minutes after their disappearance two black triangular notches were seen on the edge of the lower half of the moon. These points gradually moved toward each other along the moon's edge, and seemed to be cutting off or obliterating nearly a quarter of its surface, until they finally met, when the moon's face instantly assumed its normal appearance. When the notches were nearing each other the part of the moon seen between them was in the form of a dove's tail."

Table of Early American Patents.

In the January issue of the *Journal of the Franklin Institute*, is a useful "chronological table of American patents granted between 1825 and 1859," prepared by the librarian of the institute, Mr. E. Hiltebrand.

The period covered was one of great activity and originality among American inventors, and though the *Journal* table is not exhaustive (since it includes only such patents as were mentioned in the issues of the *Journal* during the period covered), it is likely to be of use to many.

A Year's Production of Window Glass.

At a meeting of the American Association of Window Glass Manufacturers lately in Washington, the product of the past year was reported to have been nearly 2,250,000 boxes, valued at about $6,000,000. The demand for consumption has taken the entire product.