STEAM BOILER NOTES.

The absurdity of rating steam boilers by the extent of heating surface, meaning the areas that are exposed to the gases that emanate from the combustion of the coal, was made obvious, as it had been before, by some practical experiments made by Mr. J. Graham, an account of which was read before the Philosophical Society of Manchester, England, about the beginning of 1858. He placed a series of vessels along over the thoroughfare of the gases of a boiler furnace. The first one, being directly over the fire, represented the crown sheet and sides of a fire box boiler, or the fire sheet of an externally fired boiler; the second, third, and fourth vessels of the same size, corresponding in regard to efficiency to successive parts of a boiler toward the chimney. Their respective rates of evaporation were as 100 pounds for the first is to 27, 13, and 8 for the other three together, making 148 in a given time.

If, now, these had been a continuous boiler instead of separate vessels they would have had a common system of circulation, which might somewhat modify the results; but as it is not practicable to determine what each successive unit of a surface common to the same body of water would actually do, and as it is probable that the results, if they could be obtained, would not greatly differ, we may fairly make a comparison in boiler practice.

Mr. Perkins, some time about 1835, sought to establish the theory, in explanation of boiler explosions, that water thrown into superheated or anhydrous steam at high temperatures would flash into steam of a highly elastic character. But this is shown to be contrary to the deductions from the established laws of heat. Not only so, but experiments have uniformly failed to produce boiler explosions by this means. The experiments by a committee of the Franklin Institute, which were cited in the SCIENTIFIC AMERICAN of August 13, were full and exhaustive, and confirmed the laws of heat; they should be studied by every one who attempts to explain boiler explosions for the purpose of promulgating new theories.

Previous to the date of these valuable experiments the idea prevailed that boilers would not explode violently by a gradual accumulation of pressure, but would burst at the weakest place and harmlessly relieve themselves of strain. The eighth inquiry of the committee related to this subject. They made small iron and copper boilers, which they exploded by placing them in a sealed condition in a furnace prepared for the purpose in a pit. The pressure at which these boilers exploded was ascertained by a registering spring balance, so constructed as to be as safe as possible from injury.

One of these boilers exploded with a loud report, and was projected some distance, at a pressure of 172 pounds per square inch, 11½ atmospheres, "and," says the report, "stones and combustibles were widely scattered. A dense cloud of smoke and flame, capped by steam, arose from the pit."

A second experiment was with a copper boiler, with similar results, the difference being in the course of the rupture, which was along the head seam, it being weaker than the other joints from too close spacing of the rivets. . This second explosion occurred at a pressure of about 255 pounds, 17 atmospheres. The registering apparatus having been broken by the explosion, an accurate statement could not be made.

But Mr. Perkins' favorite theory, as he put it, was certainly plausible when applied to cases in which it was by their conditions admissible. It is still believed by great numbers of engineers who have not had the opportunity to observe for themselves to be a very common cause of explosion. It may be stated thus: water being allowed to get too low, the plates become overheated and superheat the steam, which, it was claimed, would contain a large quantity of heat. And here is where the fallacy lies, for steam has only a limited capacity for heat in its gaseous state, and, of course, can yield no more than it contains to bodies that come in contact with it in falling to the equilibrium due to the mixture or to the contact. The theory then supposes that water is mingled with the highly heated steam either by being pumped in upon the hot plates and quickly evaporated, or projected in the form of foam into the hot steam, forming a highly elastic vapor with explosive suddenness; or else the water remaining in the boiler below the heated plates is suddenly lifted by its contained heat and covers them, on a relief of pressure occurring from sudden escape of steam from the safety valve or by an open throttle valve on starting the engine.

This theory was first contested by Dulong upon deductions from the known laws of heat, and others have since proved by experiments the soundness of his conclusions. A writer in the journal above quoted declares that steam has been superheated to a temperature corresponding to 900 pounds per square inch of saturated steam, but not being saturated its pressure was less than 120 pounds per square inch. In this state sufficient water was injected to completely saturate it, which, instead of causing an explosion, lowered the pressure to 70 pounds.

The writer cited refers to the same experiments that are above referred to above, in reporting which the committee say: "We see that in no case was an increase of elasticity produced by injecting water into hot and unsaturated steam, but the reverse."

Some time previous to 1849 a gentleman of Brooklyn, N.Y., claimed the Rumford Medal of Harvard University on account of a discovery which seemed to him to fulfill the specification governing its award. He believed that steam heated out of contact with water became transformed into a new chemical compound, or perhaps a simple permanent gas, possessing valuable properties that rendered it more efficient as a vehicle of heat for the steam engine. He called this newly discovered body "stamm." His communications, having been published in the SCIENTIFIC AMERICAN, fell under the observation of Dr. Haycroft, of Greenwich, England, who made some experiments, first in a small way, which established his faith in "stamm." His first experiment, which appeared in the SCIENTIFIC AMERICAN, May 10, 1850, was with a steam engine and a tubular condenser. The cylinder was fitted with a steam jacket. He worked the engine first with common saturated steam, which was condensed, and the resulting water measured from a given volume of steam, the volume used being determined by counting the strokes of the engine piston. One hundred and seventy strokes yielded sufficient water to fill a given measure; but on admitting steam at a temperature of 440°, or somewhere near 500 pounds pressure per square inch, 1,800 strokes or charges of steam were required to fill the same measure with condensed steam, which seemed to indicate a very great gain. From this the experimenter was induced to believe the "stamm" was at least ten times more economical than steam. He therefore had a large engine built, and placed its cylinder in the fire, which, of course, was soon destroyed, although for a time it seemed to be successful. Subsequent experiment and calculation showed him that "stamm" returned to steam precisely such as was described by former investigators and engineers, and at atmospheric pressure occupied about 1,700 times the space that was occupied by the water from which it was generated. In consequence of the demand of Mr. Frost, the discoverer of the supposed new body or new property of steam, for the Rumford medal, some experiments were made at Harvard on the effect of superheating steam upon its expansion, which showed that 1,580 units of volume at 212° Fah. became 1,600 when heated to 216° Fah., and 1,630 at 228°, and their decision was against granting the medal to Mr. Frost.

The experiments have been since carried to an exhaustive extent, which prove that out of contact with water anhydrous steam obeys the laws of heat and expansion that govern simple gases, and that steam is a permanently gaseous compound while kept at a high temperature. It seems to follow, therefore, that when steam overcharged with heat falls by expansion in the steam engine to a temperature due to its pressure, it becomes saturated steam again, and at last water when given up its latent, which is less as the tension increases while in contact with the water of generation.

An Indiana correspondent some time ago seemed to misunderstand Mr. Zerah Colburn's teachings in boiler explosion, and imputes to him a similar theory to Perkins. But Colburn seemed to have no hobby or universal theory as most writers on the subject have had. Our correspondent properly says, "a boiler will not explode merely from suddenly injecting a large quantity of cold water into the steam space; it would merely lower the pressure."

Perkins' theory was doubted by Colburn, and figures were made to show its fallacy.

A terrific boiler explosion occurred near the west end of Third Street Bridge, in West Bay City, Mich., August 22, killing James Kealy, of Bay City, William J. Abrams, of West Bay City, and severely scalding Edward Finneron. The boiler was of the kind used for running thrashing machines, and at the time of the explosion was engaged in running a saw, sawing cedar blocks for the pavement in West Bay City. Abrams was cut in two by the boiler and horribly mangled. Half of his body was thrown over a slab pile 150 feet northwest, and the remainder to the north about half the distance. His head was terribly disfigured. He had been working here for two months as engineer. He was between 35 and 40 years of age, and it is thought came from Caseville. Mr. Kealy was 25 years of age and a native of Bay City, having a wife and child. He had been engaged by the contractor to saw the blocks, and was superintending the work when the boiler exploded. He was struck by a piece of iron on the neck, and was almost beheaded. He was blown about 50 feet north, and was alive when found, but died directly afterward.

Finneron was standing by Mr. Kealy's side at the time of the explosion, but was not struck by the flying pieces. He was, however, scalded very severely about the face and shoulders. A 14 year old boy, named Will Craft, who was standing on a raft of logs to the eastward about 50 yards, was struck on the hips by something, supposed to be a belt, and knocked down. Pieces of the boiler and engine, and the wagon on which they rested, were blown in all directions. The accident is the most terrible that has happened here in several years, and consequently there is no little excitement.

The jury of inquest returned a verdict to the effect that the explosion was caused by low water and the incompetency of the men having the boiler in charge.

The boiler at Henry Moody's sawmill at Campbellsville, Ky., exploded August 29. Henry Gaines was killed instantly, and John Fletcher and Samuel Cook were fatally injured. Benjamin Allen was badly scalded, but will probably recover. Two other employes were injured, but neither seriously. The explosion is said to have been caused by the use of sulphur water in the boiler.

Mineral waters should not be used in steam boilers; not so much on account of the possibility of an explosive compound being formed, as on account of the large amount of solids that are precipitated when these waters become concentrated by boiling. Sulphydric acid may arise from sulphur water, and although the gas mingled with certain proportions of oxygen is explosive, that is, it burns rapidly and completely when ignited, yet it is highly improbable that it ever was the cause of an accident to a steam boiler by taking fire and exploding in the presence of saturated steam.

The boiler on a hoisting sloop at Haverhill, Mass., exploded August 25, injuring two men, one seriously. The boiler was "old and unsafe, and there were 80 pounds of steam on."

The boiler of a thrashing machine exploded near Patoka, Ill., September 3. Six men and a woman were killed, and some of them horribly mangled. Several others were seriously scalded.

AJAX METAL.

About sixteen years ago, Mr. Francis J. Clamer, after considerable research, hit upon a peculiar chemical amalgamation, having copper for its base and possessing extraordinary hardness and tensile strength. This substance the inventor manufactured for some years under the name of "Ajax metal." The great usefulness of the article in various arts and industries having become widely known, Mr. Elkins, of Philadelphia, at the beginning of the present year, made a business arrangement with the inventor; invested a large amount of capital in buildings and machinery; and, under the name of the Elkins Manufacturing and Gas Co., began the manufacture of the substance on a large scale. At the present time, we are informed that the daily production is about 14,000 pounds, with a demand fully equal to that amount. To meet the requirements of the various industries in which the Ajax metal is applicable, the company furnishes this product in three different grades.

One of these, and perhaps the most important, is for use in the manufacture of bearings for steam and horse cars and machinery generally—a purpose for which long experience has proved it superior to any other metal or combinations of metals known. A second grade is designed especially for making steam and acid valves for use in coal-oil refineries, chemical works, and other industries where the application of ordinary metals for such purposes is attended with constant loss through corrosion.

The third grade is especially adapted for making fine ornamental castings (such as statuary, chandeliers, etc.) in greensand—a purpose for which it is peculiarly fitted, owing to the fact that the fluidity of the molten metal is such that the finest lines in the pattern are in every case exactly reproduced in the casting.

These various grades of the Ajax metal, which are furnished either in ingots or in castings made from patterns furnished the company, all possess the same characteristics of hardness and closeness of grain, and the same enormous tensile strength of 29,300 pounds to the square inch.

In addition to the foregoing, the company manufacture three grades of the metal in sheets. The first of these resembles 18-carat gold in color, and can be spun into almost any shape desired without annealing and without any danger of fire-cracking. It can be brazed with the hardest copper smith's solder without burning, and will take a very high polish, fully equaling that which is given to gold. The second grade is of a lighter shade, but has the same toughness as the first; while the third is of the same color as high brass, but very much stronger than that metal.

The jeweler's plating composition, made by this same house, and furnished in either bars or sheets, is now so well known to manufacturing jewelers that it scarcely requires description. It need only be said that it possesses the same hardness as that of the gold generally employed for plating, and will roll out even with the gold without causing the latter to crack, thus obviating a trouble and an expense to which manufacturers of jewelry have hitherto been subjected. The great usefulness of the Ajax metal in every application where toughness, hardness, tensile strength, and consequently great durability are requisite, promises a still wider field for its employment than we have briefly noted above, and its manufacture is probably destined to be ranked among our most prominent American industries.

Grain Storage in and around New York.

The great grain elevators and warehouses of this port provide storage for 22,800,000 bushels. Their capacities are given as follows: New York Central, 2,300,000 bushels; New York, Lake Erie, and Western Railroad, Jersey City, 1,500,000 bushels; Pennsylvania Railroad, Jersey City, 1,500,000 bushels; Dow's Elevators, Brooklyn, 2,500,000 bushels; Hazeltine & Annan's Elevators, Brooklyn, 2,500,000 bushels; Grain Warehousing Association, Brooklyn, 6,000,000 bushels; Robinson's Stores, Erie Basin, 2,800,000 bushels; Pinto's Stores, Brooklyn, 1,000,000 bushels; Woodruff & McLean's Stores, Brooklyn, 1,500,000 bushels; other elevators in New York and Brooklyn, 2,200,000 bushels.

The stock in hand August 27 was: Wheat, 3,882,051; corn, 3,070,716; oats, 2,817,638; barley, 7,041; rye, 9,692; peas, 9,713; malt, 82,273—total, 9,879,124.

The Cost of Carelessness.

The report of the New York Board of Fire Commissioners just issued gives a very interesting table, showing the number of fires in the city between June 1, 1868, and January 1, 1881, which were distinctly raced to carelessness, and the loss that has been sustained thereby. The principal items included carelessness of occupants with matches, lights, cigars, hot ashes, 4,689; children playing with matches, 887;