Interesting Experiments with Steam Boilers.

Our constant readers will remember the views we presented, on page 302, on the explosion of steam boilers, in reviewing the inquiry into the cause of the explosion of a boiler in the city of Albany, N. Y., last spring.—Some of the engineers examined as witnesses attributed the explosion to hydrogen, and other gases generated in the boiler, on account of low water. This opinion we pronounced erroneous, stating that this could not occur. In that article we also pointed out the fallacious opinion entertained by many engineers, that explosions are caused by water assuming the spheroidal state when injected upon red hot plates. These views have been practically demonstrated to be correct by some recent experiments made in London by William Radley, Chemical Engineer, who has contributed an account of them to the London *Mining Journal* of June 28th.

He had a cylinder 4 1-2 feet long, 12 1-2 inches diameter, 1-9 of inch thick of good iron, and capable of standing a pressure of 480 pounds to the square inch. This he sometimes used as a steam boiler, and had a furnace under it of 2 1-4 square feet. A short time since it was worked till it was empty, while a powerful fire was under it, and as a consequence, one third of the lower surface became *red hot*. In this state 4 gallons of hot feed water was let into it slowly, which produced a roaring sound, but not sufficient steam to raise a safety valve of 10 lbs. weight to the inch. As the steam rose, the gas in the boiler was collected and tested, and was found to be only atmospheric air—not an inch of *hydrogen*. Shortly after this he evaporated nearly all the water in the boiler, and then left it to cool, with the safety valve open, to allow the free entrance of air. Next day he replaced the safety valve, loaded it with 30 lbs. to the square inch, and forced in a cubic foot of impure hydrogen gas. He then, by a contrivance, ignited and exploded this hydrogen gas and air mixture in the boiler; a puff came through the safety valve, and a small steam engine was worked for 42 1-2 strokes by it, but the boiler was neither burst nor strained.

On another occasion he was conducting an experiment which required the steam to be kept up at a pressure of 50 lbs. per inch for 36 hours consecutively, but using a very small quantity of steam. The boiler was filled to within two inches of the top (10 1-2 inches of water) and it was not fed during the 36 hours; at the end of that period it was only reduced 4 1-2 inches, and contained 6. The feed pump was then set in motion to fill the boiler, and although the steam only fluttered gently at the safety valve all day, at the very first stroke of the feed water, the boiler commenced to roar, the engine bounded off with a higher velocity, and with the second and third strokes of the pump the safety valve was forcibly raised, the steam burst from two joints in the top of the boiler, and Mr. R. declares that had he not quickly opened a 3-4 inch steam way, he believes the boiler must have exploded, as it exhibited great spasmodic action. He did not anticipate such a result, and the peculiar fact led him to reflect as to the cause. He came to the conclusion that the water in the boiler might have attained to a higher temperature than 280° Fah.—the heat at 50 lbs. pressure—and if so, a rapid evaporation of steam would be caused when the feed water was supplied. thus suddenly generating a great pressure.—He, however, could not satisfy himself of this without an experiment. As he required more steam than his small boiler furnished, he put up two others, side by side, in line with it, and placed the furnace under the end of one of the new ones, which we will call No. 1; then the flues was deflected and passed under the middle one, No. 2, then returned under No. 3, and into the chimney. The feed water entered No. 3 only, and passed thence by a pipe to No. 2, and from it by a pipe to No. 1. The steam was carried by a small pipe from each, and was collected in a larger one for use. A thermometer was placed in each boiler through a stuffing-box, and dipped low down into the water. The boiler No. 1, with the furnace under it, had its steam up in 1 hour; No. 2 had its steam up in 1 hour 40 minutes; No. 3 in 2 1-2 hours, at which period the three thermometers indicated 212°—an equality of heat. At the end of the first six hours the thermometer in No. 3 indicated 280°, Fah., in No. 2, 2 8°, in No. 1, 290°. The bulbs of the three thermometers were then slid upwards, to raise them out of the water, when the temperature of each fell to 280°—that of the steam in each boiler at 50 lbs. pressure. The thermometers were slid down into the water again, and the experiment continued for 6 hours longer, when they were examined again. The thermometer in No. 3 indicated 282°, in No. 2, 290°, in No. 1, 300° Fah. The thermometers were again raised out of the water, when they all fell to 280°. This, he states, convinced him of the *rationale* of many mysterious steamboat explosions; but his chemical experiments not being finished, he again restored the thermometers, and left them for 18 hours longer. On examining them again, thermometer No. 3 was standing at 285°, No. 2 at 298°, and No. 1 at 312°. They were again raised out of the water and fell to 280°—the steam in each boiler being at the same pressure, although there was a difference of 27° between the water in No. 1 and No. 3.

We will now present Mr. Radley's conclusions respecting these experiments :—

"Here we have conclusive data suggesting certain rules to be vigorously adopted by all connected with steam boilers who would avoid mysterious explosions: First, never feed one or more boilers with surplus water that has been boiled a long time in another boiler, but feed each separately. Second, when boilers working singly or fed singly are accustomed, under high pressure, to be worked for a number of hours consecutively, day and night, they should be completely emptied of water at least once every week, and filled with fresh water. Third, in the winter season the feed water of the boiler should be supplied from a running stream or well; thaw water should never be used as feed for a boiler."

Now Mr. Radley has demonstrated (not discovered) the fact that water in a steam boiler can be highly heated above the particular degree indicated by the steam pressure; he does not explain the cause—if he has caught a glimpse of it. It is very evident to us, from his description of the experiments, the reason why the water in any of the boilers rose in heat above the temperature of the steam; it was the absence of atmospheric air in the water. If a small feed of water containing air had been going on into the single, or into each of the three boilers, the water would never have risen above the steam temperature

In our columns the discovery was first published in this country that water deprived of its atmospheric air does not boil until it attains to 300°, and that it is liable to explode at this temperature. On page 357, Vol. 5, Scientific American, these facts are set forth, and scientific information presented, which Mr. Radley's experiments have fully confirmed.

In the first experiment of Mr. R., when the single boiler worked so long without feed water, and when two of its joints were burst at the second stroke of the feed pump by the sudden generated steam pressure, it is evident to us that the whole of the atmospheric air had been boiled out of the water, and that its temperature thereby had been greatly elevated. In the experiment with the three boilers it is also evident that most of the air would be expelled from the water in No. 3, where the feed was supplied, then perhaps the whole of it was expelled in No. 2, which would leave No. 1 to be supplied with feed water containing no atmospheric air at all. Thaw water from ice contains little or no atmospheric air; therefore we would infer that Mr. R., in forbidding its use for boilers affords us evidence that he is aware of the cause, although he does not state it in so many words. Being a chemist he must be acquainted with Prof. Donnets' and Faraday's discoveries, described on the page of the Scientific American already referred to.

Locomotive, steamboat, and stationary engine boilers have their fires frequently *banked up* for hours, without feeding water, and the steam fluttering at the safety valve, so as to have them all ready for starting at a moment. This is a dangerous practice, as the foregoing experiments demonstrate. While so standing, all the atmospheric air may be expelled from the water, and it may thereby attain to a high heat, ready to generate suddenly a great steam pressure when the feed pump is set in motion. This is, no doubt, the cause of the explosion of many steam boilers immediately upon starting the engine, even when the gauge indicates plenty of water.—The remedy for such explosions must be evident to every engineer—keep the feed pump going, however small may be the feed required.

[For the Scientific American.]

Walls of Hollow and Solid Bricks.

My opinion, based upon the experience and observation of some years, is, that walls for dwellings, in city or country, for stores or mills, are stronger, warmer, drier and cheaper, when built double or, technically, "vaulted," of solid bricks, then when built single of hollow bricks.

The ordinary thickness of a common class of dwellings, is two courses, making in this vicinity an eight-inch wall.

By laying the two courses an inch and a half apart, making a nine and a half inch wall, bonded by "flemish headers" once in ten courses, but one-thirtieth of the wall, superficially, is solid; whereas, in a wall of hollow bricks, nearly or quite one-half will be. A vault of an inch and a half, if kept clear, is enough for a double wall.

For buildings of a heavier class, an 8 and a 4 inch wall, two 8 inch walls, or thicker, as the case may require, bonded in the same manner, or as in the case of the celebrated Pacific Mill, at Lawrence by 4 inch cross walls, two or three feet apart.

Vaulted walls have a broader base, and are consequently firmer than solid ones; in fact, the only objections to them being the loss of the land covered by the space, and increased care in laying—minor considerations—in view of their great superiority. What is still cheaper, and requires less care,is to give the inside of the outside course a coat of cement before "backing up," thus forming a sheet of cement between the two courses, making it stronger, and when well done, impervious to water.

In either case it is plain that such a wall must be stronger than when laid of hollow bricks, for the reasons that the "bearing" is the whole size of the brick, and the brick itself is not weakened by the space formed through it.

One great objection to the use of hollow bricks, is the increased waste, which, in solid bricks, amounts to quite a percentage, and to handle them as we do ' face brick," to avoid breaking, would materially enhance the cost.

In the haste to build many rather than good buildings, the subjects of vaulting, ventilating, draining, &c., our houses and our stores, churches, school houses, &c., have been sadly neglected, but I am happy to think an improvement is becoming more apparent.

In thus expressing my opinion, I am influenced only by a desire to assist any who may be practically ignorant upon the subject, and whom might be desirous of obtaining information or advice from practical builders—who should be supposed to understand the best modes of building; nor do I speak in reference to any other section of country than this, well knowing, from some experience in other countries, and in distant parts of this, that the materials and modes of building differ as widely as do the tastes and customs of the people.

Bricklayer.

Boston, Mass.

Mechanical Discussions.—American Institute Club.

A Club, for reading essays on subjects connected with science, art, and philosophy, has existed for a few months in connection with the American Institute, this city. Its objects are commendable, and we have frequently suggested the formation of such a department in connection with the Institute. Some very excellent papers have been already read at the meetings, and more may be expected. In some instances, those who have read papers, and some who joined in discussions which followed the reading of certain essays, indulged in personal allusions. These must be avoided for the Club to maintain a good character. A gentlemanly candor should reign supreme at every meeting.

Locks.—At the meeting last month, Wm. H. Butler, of the firm of Valentine & Butler, extensive safe manufacturers, of this city, read a very interesting paper on the subject of Locks. These, in general, may be divided into two classes: first, those in which many fixed obstacles were presented to stop the key in its efforts to touch the bolt; and, second those in which hinged or sliding obstacles were to be removed before the bolt would move, however strong it was acted on. The first are termed ward locks, and though provided with complex keys, can be picked by a crooked wire. A general name for the second and better class is that of "tumbler" locks, Tumblers are levers or pins which catch in the bolt, and must be all lifted at once. A Mr. Baron, in England, improved on this simple idea, by so constructing the tumblers that lifting them too high was as bad as not lifting at all. This change had led to improvements, of which there will probably never be any end. The English Bramah lock, picked by Mr. Hobbs, an American, who thereby won a large prize at the great Fair in London, in 1851, had sixteen tumblers, all of which were required to be elevated to different hights. Of one hundred men, equally ingenious and equally familiar, both with the business and with the construction of that particular kind of lock, probably not ten would possess fingers sufficiently delicate, and not five the patience necessary to accomplish the object. The changeable key and lock introduced within the last twenty years, made the lock safe against its maker, or any burglar who might purchase one to examine it. These locks were now perfected, so that a simple change in the bits or parts of the key impressed a corresponding change on the lock, and a bank safe might be secured every night unknown to any but the cashier.

Two splendid changeable bank locks,—Butler's and Yale's were dissected and lying on the table, and reference was made to them by Mr. B. It was remarked, in the discussion which followed, that all these locks were expensive, and could not be purchased by the masses, and as a consequence the locks still in general use could easily be opened with a crooked nail by any expert burglar. Mr. Butler then explained his rotary lock, which has no bolt, and which has a *fall lever* that prevents the lock being easily opened on the outside. With the true key made for it, and which required to be pressed simply into a narrow slit, the door opened easily, but without the true key, Mr. B. said, "a skillful lock-picker might work for hours and days before he could get the tumblers arranged properly to open the lock. The key of this lock is thrown out, when its work is done, and it never can remain in the lock for an impression to be taken of it by a burglar.

Thomas D. Stetson, on the same occasion, explained the new lock of E. M. Hendrickson, of Brooklyn. It combines the principles of the ward and tumbler locks. Levers and tumblers have to be very accurately adjusted before it can be opened. The key-hole is small and round, and the key, when inserted, opens like an umbrella. The arms of the key extend through intricate passages in a revolving ring, which is moved by a certain action of the key. The locking is performed without the key, by pressing a small button on the face of the lock. In answer to a question, whether this lock was unpickable, Mr. S. stated that every new lock was unpickable until it was picked, and so this one was. This was a pretty good answer, and contained more truth than poetry.

New Source of Chloroform.

If 600 parts water, 200 parts chloride of lime, and 25 parts oil of turpentine are well mixed in a retort and distilled, a violent reaction takes place, carbonic acid gas being liberated in great abundance. As soon as the mixture begins to rise the retort is withdrawn from the fire, and the process goes on to the end without the application of external heat. The receiver is found to contain three layers of liquid, the undermost having a scent of chloroform. If separated from the higher liquids by means of a pipette, rectified, and re-distilled over chloride of calcium,it presents the usual composition and properties of chloroform