TALK WITH THE BOYS.

No. 4.—Carbonic Acid in the Steam Engine—The Difference between High and Low Pressure Engines.

"In the engine which I described to you last week, the steam. after it has done its work, is allowed to escape into the atmosphere. The atmosphere extends up from the earth about 45 miles, and a column of it an inch square, and the whole 45 miles in hight, weighs about 15 lbs. As the air is a fluid, flowing freely in all directions, the weight of the column of air presses sideways with the same force that it does directly downward—pressing, in fact, near the earth in every direction with the same power of 15 lbs. to the square inch. Consequently, as the piston moves along, driving out before it the waste steam from the cylinder, it has to push this steam against the pressure of the atmosphere. The early inventors of the steam engine understood this matter perfectly, and to get rid of the back pressure of the atmoshere, they kept the eduction valve closed and condensed the steam by spirting into it a jet of cold water."

"I do not see how that gets rid of it, sir?"

"A cubic inch of water converted into steam occupies 1,700 cubic inches of space; consequently, if the steam which fills a cylinder containing 1,700 cubic inches is condensed into water, it will occupy only one cubic inch of room. The steam is not entirely got rid of, but the cylinder is almost emptied."

"I should think, though, that if it got a little water in at every stroke it would soon get full of water."

"It would, unless the water was taken out. Instead of going through with the early history of the contrivances, let me describe to you the present arrangement of the low pressure engine. The main cylinder is placed to stand upon a second cylinder directly below it, called the condenser. Into this condenser is constantly spirting a jet of cold water, filling it with spray. As soon as the upward stroke of the piston is completed, a valve is opened by the machinery from the lower part of the engine into the condenser. As the steam flows into this cold vessel it is rapidly condensed into water, leaving the whole cylinder below the piston entirely empty of either steam, air or anything else. A pipe leads from the upper end of the cylinder into the condenser, and when the downward stroke of the piston is completed, a valve is opened into this pipe from the upper end of the cylinder, allowing the steam which has just pushed the piston down to flow through the pipe into the condenser, where it is quickly turned into water."

"I should not think it would flow fast enough to get out of the way of the piston."

"It is surprising to learn how rapidly it does flow. But steam or air passing into a vacuum moves with astonishing rapidity. A cylinder 12-feet long empties itself in the twinkling

subject which we have traveled such a roundabout road to reach, namely, the presence of carbonic acid in the steam engine. This is owing to the relations of carbonic acid to water. Water has the property of absorbing carbonic acid, the particles of the acid distributing themselves among the particles of water and forming a portion of the liquid. Now, when the steam in the cylinder is condensed, the carbonic acid which it contained is not condensed with it, but remains in the gaseous form; the absorption of the gas by the water being a slow process, while the steam is condensed instantaneously. In the high pressure engine, where the waste steam is blown out into the open air, the carbonic acid gas goes out with it and is not perceived; but in the low pressure engines, where the waste steam is boxed up tightly and condensed, it is found that the condenser becomes rapidly filled with carbonic acid gas, stopping the engine unless it is removed. Low pressure engines are accordingly supplied with large air-pumps for sucking out the carbonic acid and other gases contained in the water. This part of the machinery is generally in sight on our Sonnd and North river steamboats. If you go upon one of these boats which has a beam engine, you will see a stout connection rod attached to the beam, part way hetween the end and the fulcrum, and at the lower end of this rod a piston working into a cylinder. That is the air-pump."

"What did you say about other gases?"

"There are other gases besides carbonic acid which are absorbed by water, the principal one being atmospheric air. It is this air in the water that is breathed by fishes. A fish does not procure the oxygen supports his life by decomposing the water, separating the atom of oxygen from the atom of hydrogen and appropriating the former to his own blood: his gills have not the power of effecting this separation. But he breathes the air which has been absorbed by the water. A fish will die in water which has no air in it, just as quickly as be will on dry land. You can easily try this by putting a fish into water that has recently been boiled."

"While the water is hot?"

"No; as soon as it has had time to cool. Boiling drives the air out of water, but in time it is slowly absorbed again. In the condensing engine, the air-pump is used, not only to remove the carbonic acid and other incondensible gases, but also to pump out the water of the condensed steam and the water that has been employed to condense the steam, and which has been warmed by the process, so that it is unfit to use again. All these operations take a good deal of power, and counterbalance, to a considerable extent, the advantage gained by condensing the steam."

"The advantage! What advantage?"

"If, in the high pressure engine, the piston is always pushed against the pressure of the atmosphere, 15 lbs. to the inch; and if, by shutting out the atmosphere and condensing the steam, we get rid of this back pressure, do we not get more available power from the same steam?"

"I should not think that 15 lbs. to the inch would amount to much."

"Ha! Get your slate and see. I think the cylinder of the engine in the steamship *Metropolis* is 105 inches in diameter, but you may make the estimate for an engine 100 inches. What would be the area of a circle 100 inches in diameter?"

"7,854 inches."

"Now, if there was a pressure of 15 lbs. on each of those inches, how many pounds pressure would there be?"

"117,810 lbs."

"That is equal to the weight of 117 large oxen, weighing 1,000 lbs. a piece. And if the piston makes 24 strokes (counting both ways) in a minute, 12 feet to a stroke, the power lost by working such an engine against the pressure of the atmosphere would be sufficient to lift this large drove of cattle right up perpendicularly 288 feet every minute. Such is the power lost, but this power is not all saved by introducing the condensing apparatus. In the first place, a perfect vacuum is not produced, and there is generally a back pressure of about three pounds to the inch in the cylinder of the low pressure engine. Then the working of the air-pump and all the machinery connected with it takes a good deal of power. But there is another advantage of low pressure engines, greater than the saving of power; they are far safer. It is very seldom, indeed, that the boiler of a low pressure engine explodes."

"Are most of our engines, then, high pressure?"

"Yes; the high pressure engine is so much simpler, that it costs less and requires less skill in the engineer to manage it than the low pressure engine. For this reason, nearly all small engines are made of this class. It is seldom that you will see a low pressure engine excepting on large vessels, such as ocean-going steamers, and the large boats on the lakes, the North river and the Sound. Our manufactories and the boats on the western rivers are nearly all driven by high pressure engines."

"Well, father, we have followed carbonic acid through the steam engine, where shall we go with it next?'

"I propose, at our next conversation, to collect some of it in jars separate from everything else, and let you try some experiments with it. Here, Charles, is some 'change;' sometime during the week, you may get a small basket or pailful of marble dust and a little bottle of sulphuric acid. And John, can you not set your trap and catch a mouse, and have him alive next Saturday?"

FRENCH VIVACITY ON A MUD TRAP.

We translate the following sparkling account of a recent invention in Belgium, of a mud trap for collecting the impurities of water in steam boilers, from the Paris *Journal de L'Eclairage au Gaz.*

We often have the satisfaction of seeing inventors come to us whom we have, they say, made happy by a word which scarcely cost us anything; but we have never experienced a greater pleasure than to-day in seeing enter into our sanctum two citizens of Liege, bringing incrustations from their boilers and from those of the royal foundry of cannons.

"You do not recognize me perhaps?" said one; "I am Lambert Ghaye who came to consult you some time since, to know how I should get rid of that infernal deposit which attaches itself to steam boilers and which can only be removed by means of a chisel and hammer.

"You indicated to me several means well-known but costly, for changing these stones into mud, at the same time observing that not one of them was completely efficacious. You then gave me your idea; which was to cause all the impurities to deposit themselves in receptacles placed in a portion of the boiler where the water should be calm. You added that it would be possible, by fashioning the receptacles of the incrustations into suitable molds, to make every boiler a manufactory of bas-reliefs. This advice did not fall upon deaf ears. I attached a "paralithon" to my boiler and to several others, and they were all completely successful. Behold the stones and the pieces which I have gathered from them.

"A singular thing, and which I am not able to explain, is that no sooner is my apparatus attached to a boiler incrusted to the depth of half-an-inch or an inch, than this incrustation detaches itself and comes to lodge in my receptacle, so that the boiler plate becomes clean and bright, even the rivet heads yielding their caps of stone, and the water of the boiler, which is ordinarily salt and black, becomes limped and clear as distilled water. In a word, it is like a miracle before which engineers remain mute with astonishment. In seeing me withdraw my flakes from the man-hole, they say that electricity must have a great role in this affair."

If Mr. Ghaye's apparatus works as well as is here stated, it must be materially different from the mud traps which have been so long known in this country and England, and the fortunate inventor should lose no time in patenting and introducing it into these great steam engine countries.

BOILER EXPLOSION CAUSED BY SULPHUR WATER.

A correspondent at Sparta, Ga., writing us on business, adds the following:—"I have also a favor to ask you? We had a boiler explosion the other day. It was a tubular boiler, having one fire-box; it exploded by tearing loose one of the inside sheets forming the fire-box, the whole length of the box, up the sides, &c., pitching the boiler some 50 feet, smashing up everything badly, but fortunately not materially injuring any person. Now the question which I want solved is this: the boiler was new, and appeared to be well-made. It was situated near a spring which is impregnated with what we term here 'sulphur,' and, when blowing off, the water would have a red appearance, yielding quite a quantity of red sediment. Could this have injured the iron of which the boiler or fire-box was formed?"

of an eye. Now, we come to the

Remarks.—If iron is heated to a white heat in contact with sulphur, it combines with the sulphur, forming the protosulphuret of iron, which has very little tenacity. A bar of iron at a white heat may be cut off by holding a piece of roll brimstone upon it. Under some circumstances, the combination takes place at a lower temperature than a white heat.—Eds.

Silver Discoveries at Pike's Peak.—It will be remembered that, in the Scientific American of the 18th ult. (page 121), we described the silver-bearing rocks of the West, and prophecied the discovery of silver in the Pike's Peak region, and advised our readers in that vicinity to search for argentiferous rocks along the base of the Rocky Mountains. By the latest arrivals from Denver City, news has come to hand that the actual discovery of silver-bearing rocks has been made on both sides of the mountains, and much excitement is stated to exist, as a consequence, among the miners and others. A rich silver lead is stated to have been discovered near Tarryall—about sixty miles from Denver City—and the miners have flocked in large numbers to the diggings. The silver ore is stated to assay from $1,700 to $1,800 per tun; if so, it is pretty rich.