

EXPLOSION OF A MOUNTAIN LOCOMOTIVE AT PRESCOTT, ARIZONA.

We have from time to time published engravings showing the effects of boiler explosions, and some of them have presented striking examples of the terrific disruptive energy that is pent up in a modern high pressure boiler. We do not remember, however, any of these catastrophes that equaled or even approached in its complete destructiveness the locomotive boiler



SHELL OF EXPLODED BOILER FOUND 1,200 FEET FROM ROUNDHOUSE.

explosion which forms the subject of the accompanying illustrations.

We are indebted for the photographs and particulars to Mrs. C. L. Richards, of Prescott, Arizona, where the disaster occurred. Our correspondent was at the roundhouse (or rather the site of the roundhouse, the structure having been swept away) a few minutes after the explosion, and the two photographs show the exact disposition of the wreck before any attempt had been made to remove the debris.

Prescott, Arizona, is a mountain town on the Santa Fé, Prescott, and Phoenix Railway, and the wrecked engine was a heavy "mountain locomotive," which weighed, exclusive of the tender, over 60 tons. At the moment of the explosion there were some fifteen or twenty men at work near the engine, and, remarkable to relate, although not only the engine but the roundhouse itself was blown to pieces, there were only three serious casualties. Two men were killed and one other who was passing at the time was badly injured, but will recover. As far as could be learned, everything on the locomotive was in a normal condition just before the explosion, and the cause of the disaster is a mystery to the company. The condition of the wreck, the extraordinary distances to which heavy fragments were hurled, suggests the work of some explosive of far greater energy than steam at ordinary boiler pressure. The testimony of one witness at the inquest to the

Our correspondent, who was an eyewitness, says: "As I saw it, it appeared as though the whole engine was blown fully three hundred feet into the air, pieces large and small flying in every direction, and some of them landing half a mile and more from the wreck." The main force of the explosion was expended in a southerly direction, toward the town. The boiler shell was ruptured longitudinally on the under side from end to end, and was flattened out as shown in the photograph. The entire shell, with the steam chest attached, weighing several tons, described a magnificent curve through the air, rising to a height of about 300 yards and landing 1,200 feet away. On striking the ground it rebounded into the air, finally landing on a warehouse, and completely demolishing the front of the building. This effect and the appearance of the boiler shell are shown in the engraving. As it opened out under the force of the explosion, the shell literally tore the massive bar frame of the engine apart longitudinally, as will be seen from the cut of the engine wreck. The view is taken looking forward, and the left hand frame, badly twisted, with an axle and the left driving wheel attached, together with the leading truck, are about all that remains of the 60-ton engine. The explosion not only tore apart the transverse fastenings of the side frames, but it forced all the wheels off their axles;

and when it is remembered that each of these is forced onto its axle under a pressure of from 50 to 80 tons, we have a further impressive evidence of the pent-up energy of a locomotive boiler.

In the immediate front of the illustration is seen a fragment of the foot plate still bolted down to the frame, and the left hand rocking shaft is also in place. The smoke box, with the front flue sheet and most of the tubes, is lying just ahead of the wreck, while the other remains of the locomotive are scattered around over a radius of thousands of feet, one piece of metal being found at Fort Whipple, over half a mile distant from the roundhouse.

The air pump, weighing 500 pounds, "was hurled with such force," according to our correspondent, "that it went whistling and shrieking through the air over the housetops, striking the ground, bounding fully 50 feet into the air, and finally landing near the post office, 2,500 feet from the wreck. The sound as it flew through the air was frightful and indescribable." Windows were shattered 1,500 feet away and the town was literally bombarded by fragments of iron which "went through roofs and sides of houses, making holes in walls and floors and breaking furniture." No one, fortunately, was struck, although "bolts, iron bars, crooked and twisted pipes, and pieces of brass and steel were strewn all over the town."

It would be interesting to learn just how far the "pop valve" adjustment, of which one witness seems to have spoken, was responsible for the disaster. The indications are that the ordinary boiler pressure must have been doubled, or even trebled, at the moment of explosion.

Volcanic Flames.

Although volcanic flames have been seen and described by many writers, their existence has been doubted by others. Special interest thus attaches to the outbursts of flame which occurred on Vesuvius in April last and which are dealt with in two papers—one by Prof. E. Semmola, in the Rendiconto of the Naples Academy, the other by Prof. V. Matteucci in the Atti dei

Lincei. From the former paper it would appear that this rare phenomenon may have been caused by the falling in of a part of the crater wall, and consequent blockage of the orifice, the pent-up gases becoming heated until a chimney was formed through which they escaped in flames. Prof. Matteucci's paper concludes with the following summary of the principal points: 1. The greater part of the aeriform substances evolved from volcanic magma has

the power of producing flames. 2. The small flames in the crater of Vesuvius were of longer duration than the large ones; these latter did not last without intermission for more than nineteen or less than fifteen days, and ultimately became small and quiescent like the others. 3. The complex phenomenon, of which the flames were one of the most interesting features, seems only comparable with that described by Sir Humphry Davy. It has not been reproduced or, at any rate, has not been noticed on Vesuvius for eighty-four years. 4. The spectrum produced by these flames is continuous, like that observed by Libbey in the incandescent lavas, also with flames, of Kilauea.—Nature.

AN IMPROVED STOCK-YARD GATE.

The illustration presented herewith represents a stock-yard gate so constructed that it may be quickly opened and closed and locked against live stock, or held partly raised whenever it is desired to separate small from large stock. The gate has been patented by Benjamin F. Strange, Corvallis, Mont.

The gate is hung by one corner on a transverse pivot carried by a post formed of uprights and mortised cross-bars, the construction being such as to permit the gate to swing between the uprights and the cross-bars. To the inclined top bar of the gate a rope is fastened that passes upwardly under a pulley journaled in the top cross-bar and through a bearing formed on a sliding latch normally resting on the top cross-bar. The upper end of the rope is provided with branches connected with levers in the manner indicated in the illustration. The latch is adapted to engage a shoulder on the upper end of the gate to hold the gate in locked position. Ropes connect the latches with the levers already mentioned, and hang down within reach of the hand. In opening the gate, one of these latch-ropes is pulled so as to raise the latch



STRANGE'S STOCK-YARD GATE.

and disengage it from the shoulder on the gate. A further pull causes the lever to swing and act on the branched gate-rope so as to move the gate upwardly on its pivot. When it has passed a central position, the gate will swing down by its own weight to the open position shown by dotted lines in the engraving. In closing the gate, the operation is repeated, a pull on one of the ropes that hang down sufficing to bring the gate back to its initial position. When it is desired to separate small from large stock, then the gate is swung upwardly to a position partly open and locked in place by a bolt engaging a bearing in the free end of the gate.

Railways of Hawaii.

There are three railroads on the Hawaiian Islands, according to The Railway Review. The Kahului Railroad, on the island of Maui, is 13 miles long, and the Hawaiian Railroad, on the island of Hawaii, is about 20 miles long. These two roads are used principally to carry the products of the plantations to the various points of shipment. The principal road is the Oahu Railway and Land Company line, which runs from Honolulu to Waianae, the total length, including sidings, being 38.5 miles. This road was opened for traffic July 1, 1890, since which time its business has shown a steady increase, both in its passenger and freight traffic. Last year the road carried 85,596 passengers, receiving a revenue of \$30,993.50; 66,430.49 tons of freight were carried, earning \$69,752.76. The equipment consists of 5 locomotives, 14 passenger coaches, and 132 freight cars. The road is bonded for \$2,000,000 at 6 per cent, with \$700,000 worth of stock, which is to be increased to \$1,500,000.

PHOSPHORUS is now produced by means of the electrical furnace. The method consists in heating a mixture of phosphate of lime and coke, which are first reduced to a powder. When the mass becomes pasty, the openings of the furnace are sealed except one, through which the vapor passes. The vapor is collected and distilled.



WRECK OF A 60-TON MOUNTAIN LOCOMOTIVE AT THE ROUNDHOUSE.

effect that one of the men was at the time on the top of the boiler adjusting the pop valve is significant, and it may have been that a steam pressure far in excess of the 180 pounds ordinarily carried in modern locomotive boilers had accumulated through neglect or oversight. Indeed, it is scarcely conceivable that steam at ordinary pressure could have produced disruptive and shattering effects that would do credit to a heavy charge of dynamite.