

THE ARRANGEMENT OF STEAM PIPES.

We have, from time to time, called attention to the importance of suspending and securing steam pipes properly, and providing for their expansion and contraction. In this article we wish to call attention to a common but dangerous method of connecting boilers with main steam pipes.

Fig. 1 shows the way in which the connection is frequently made, the stop valve being near the boiler, and the pipe entering the steam main from below. The action of this arrangement is as follows: The boiler being out of use,

entraining water from the other boilers in the battery, as well as water of condensation, settles in the space between the stop valve and the steam main. Then, when the boiler is put in use again, in order to prevent any sudden strain from being thrown on the boiler, the stop valve is not opened until the pressure in the boiler has risen slightly above that in the main steam pipe. When it is opened there is a sudden outflow of steam, which raises the water in the connections, throws it against the first elbow, and, if that does not break, hurls it the full length of the horizontal pipe against the second elbow, and then up into the main steam pipe. The shocks so produced are greater than would be imagined by one who has not had experience with water-hammers. In one case that came under our observation recently, three elbows were fractured in succession from this cause. When the first one broke the superintendent of the mill considered that there must have been a flaw in it. It was replaced by another, which lasted only a few days. A third elbow was put in, with a precisely similar result, and by that time the superintendent had become satisfied that something was wrong with the arrangement of the piping. The defect was pointed out to him, the pipe was re-arranged, and there has been no trouble since.

It might be said that the stop valve should be opened when the pressure in the boiler is just *equal* to that in the main. This is true, but it is not easy to determine, with any degree of

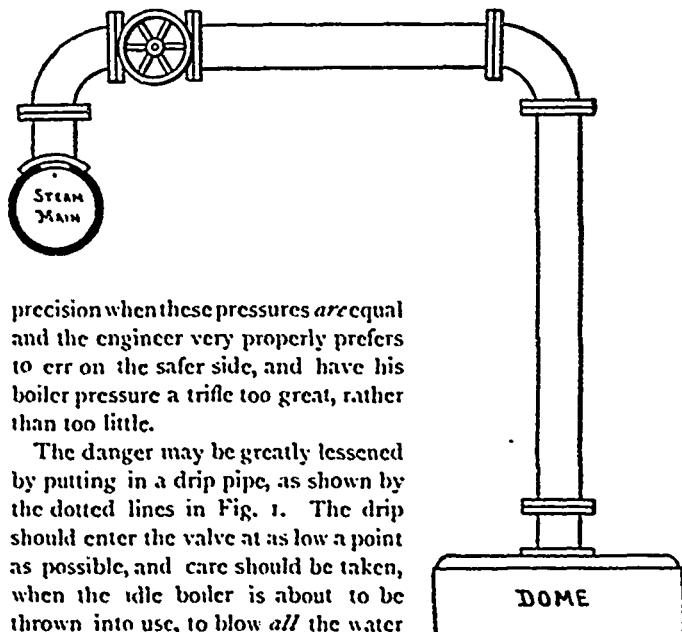


FIG. 2.—A SAFE MODE OF CONNECTION.

precision when these pressures are equal and the engineer very properly prefers to err on the safer side, and have his boiler pressure a trifle too great, rather than too little.

The danger may be greatly lessened by putting in a drip pipe, as shown by the dotted lines in Fig. 1. The drip should enter the valve at as low a point as possible, and care should be taken, when the idle boiler is about to be thrown into use, to blow *all* the water out through the drip pipe immediately before opening the main stop valve. If this were carefully attended to each time, the arrangement of piping shown in Fig. 1 should give no trouble; but it is a matter of every day experience to find engineers, who perhaps do not fully recognize the importance of the drip pipe, growing somewhat careless about it. After they have used it conscientiously fifteen or twenty times, there is a tendency to slight it a little, and open the main valve before the water is all

out. If no trouble results, this is apt to fix itself on the man as a habit; and some day, when he is in a hurry, he may pay no attention at all to the drip, but open the main valve at once, exposing himself to the danger described above.

It is a far better plan to fix the pipe right, and do away with the drip. A proper arrangement of the connections is shown in Fig. 2. The piping passes up above the steam main, which it enters at the top; and the stop valve is placed in the horizontal part of the connection, and as near the steam main as it can be, conveniently. It will be seen that with this arrangement there is no possibility of trapping water. The entire connection, from boiler to main, remains dry, and no water-hammer action is possible.

Fig. 3 shows another way of arranging the connection so as to avoid the trapping of water. In this arrangement the pipe enters the steam main at the side, the elbows are done away with, and an angle valve is used to connect the horizontal and vertical pipes. A perspective view of this method of connection was given in *The Locomotive* for May, 1892, on page 66. When new work is being put in, we usually recommend the arrangement shown in Fig. 3; but if the piping has already been put up, in the manner shown in Fig. 1, or in any similar manner that involves the same element of danger, the arrangement shown in Fig. 2 is cheaper to put up, because it enables one to use the same valve that was in use before.—*The Locomotive*.

EXPERIMENT WITH A STEAM BOILER.

THE author of a paper read to the Institute of Civil Engineers has been experimenting with a boiler:—

In calculating the evaporative capacity of boilers, it is usual to reckon it at so many pounds per square foot of heating sur-

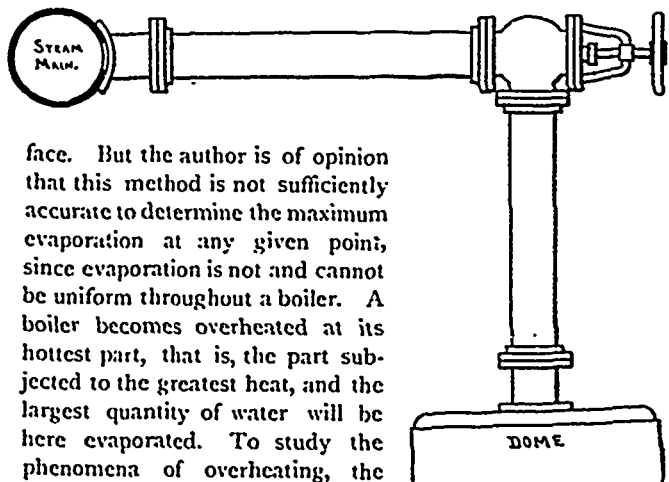


FIG. 3.—ANOTHER SAFE MODE OF CONNECTION.

face. But the author is of opinion that this method is not sufficiently accurate to determine the maximum evaporation at any given point, since evaporation is not and cannot be uniform throughout a boiler. A boiler becomes overheated at its hottest part, that is, the part subjected to the greatest heat, and the largest quantity of water will be here evaporated. To study the phenomena of overheating, the effects of heat at this particular point, and the amount of evaporation from it must be determined. The author isolated a portion of a boiler plate immediately above the bridge, where the heat is known to be greatest and overheating most frequently takes place. He placed upon it a small vertical iron tube, which was firmly bolted to the bottom of the boiler; the top of the tube rose above the level of the water and opened into the steam. The tube was fed through a separate pipe with water at the same temperature as that in the rest of the boiler, and the quantity of water evaporated by this limited area of heating surface was carefully measured.

The experiment was made on a cylindrical boiler, with four separate lateral feed-water heaters. The boiler was 10 feet long, and 2 feet 2 inches in diameter, with a heating surface of 35¼ square feet; heating surface of the feed heaters, 107½ sq. feet; total, 142¾ square feet. The grate surface was 3.85 square feet, and a blower increased the draft when a stronger fire was required. The small experimental tube was 4 inches in diameter, with a heating surface 19.3 square inches, bolted to the boiler, and the joint made with asbestos and india rubber. The tube was connected to the water gauge of the boiler, and