A. S. LYMAN.

Steam Pressure Gage.

No. 6,955. Patented Dec. 18, 1849.

Fig. 1.

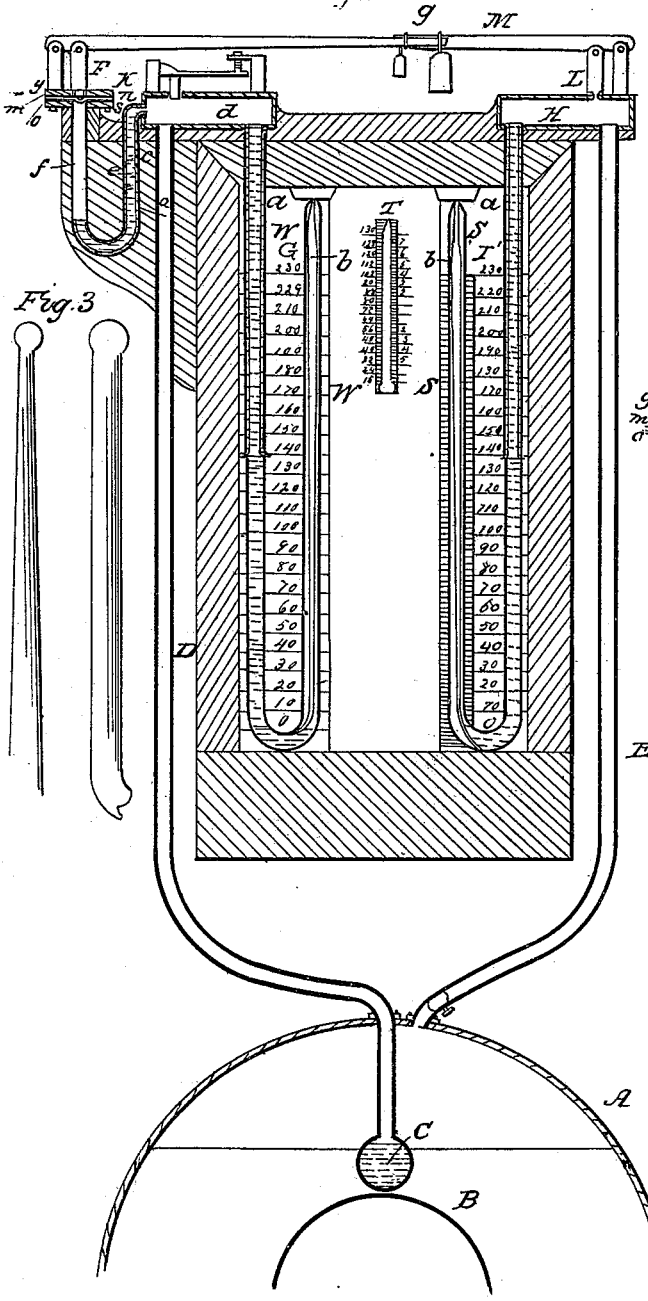
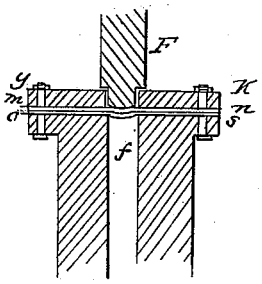


Fig. 3

Fig. 2



UNITED STATES PATENT OFFICE.

AZEL S. LYMAN, OF UPPER ALTON, ILLINOIS, NOW OF NEW YORK, N. Y.

ALARM FOR INDICATING WANT OF WATER IN BOILERS.

Specification of Letters Patent No. 6,955, dated December 18, 1849.

To all whom it may concern:

Be it known that I, AZEL S. LYMAN, of Upper Alton, in the county of Madison and State of Illinois, have invented a new and useful Improvement on an instrument or apparatus to be named "Lyman's steam and water safety gage" for indicating the pressure of steam in the steam-boiler, and also to indicate when the water is too low in the boiler and to give warning of the same; and I hereby do declare that the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1, is a vertical section. Fig. 2, is an enlarged vertical section of the elastic valve. Fig. 3, is a view of the bore of the glass tube.

The same letters of reference indicate like parts.

The nature of my invention consists in the combination of the air gage or mercurial tube, with a metallic vessel, filled with water secured to the flue of the boiler, or other part, which will receive extra heat, whenever the water falls too low; said vessel also, being connected by a metallic tube to an elastic valve, which when the heat is greater in the vessel secured to the flue, (which will only occur when the water is low) will raise the mercury in the water gage, and also the lever of the elastic valve; this lever at the same time raises the steam valve of the gage and operates a steam whistle to give warning.

The apparatus is a steam and water gage, S is the steam and W is the water gage A is the boiler. B is the flue of the boiler, C is a metal box or vessel containing water. It is strapped or fastened to the flue.

D is a metallic tube extending up into a box *d* above, which communicates with a cold water tube *c*, which projects downward and is connected with the elastic valve F; it also communicates with the cold water metal tube G which intervenes between the mercury in the glass tube (*w*) to indicate the degrees of pressure when the water below in the box C gives off steam.

The steam glass gage or indicator S communicates with the boiler by means of the metallic tube E, which communicates with the mercurial glass tube (*s*) through the box H at the top of the cold water tube I. The cold water tubes I, G, (*c*) project below the place where they come in contact with the heat. The tubes containing the cold water are made of metal. They are lined with india rubber *a a a* or with an india rubber tube within the metal one. The mercury glass tubes are formed so that the area of the bore shall decrease toward the top, so that the mercury shall rise through nearly equal spaces, by equal additions to the pressure. This may be accomplished either by making the tube with a conical bore with a small bulb at the top as represented by Fig. 3, or by introducing a conical glass rod *b b* into the bore of the common glass tube as in Fig. 1.

Double the pressure drives the air into nearly half the space, and unless the area is lessened as we ascend upward in the glass tube, the mercury would rise about three inches between the 0, and 10 lbs. while between 220, and 230, lbs. it would not rise the $\frac{1}{100}$ of an inch in a gage of the size of the drawings. Without this change in high pressure the difference of 20, or 30 lbs. would with difficulty be perceived, while with it we distinguish the variations of half a pound. I believe it has never been used, and it is absolutely essential in the gage intended for very high pressure. L is the steam valve and whistle; it is kept down by the lever M and weight in the usual way. There is no certainty in the action of the common steam valve, especially on the Mississippi. There the mud composed of sand, lime, iron and sulfur forced by the steam at very high temperature, up around the valves, cements them down, so that they are with difficulty raised with a lever. But this elastic valve is constructed in such a manner that it can never adhere or stick. The tube *f* is filled with oil, kept cool by the water in the other part C of the bend between it and the steam.

The valve consists of a piece of leather, *m n*, see Fig. 2, and protected from the oil or water below by a piece of bladder or sheet lead, or other suitable substance *o*, *s*. This leather is laid on loosely and pressed down into the tube *f*, in the form of a dish as represented.

The ring or plate *y*, *k*, is laid on this and drawn by screws F is then introduced with its shoulders resting on the ring so that it shall not strain, but only touches the leather. We then have an elastic valve which will act with uniform freedom, as

it is acted upon only by the cold oil. It suffers no steam to escape from the box on the flue, so that it (the box) never will become empty and fail to work, it vibrates sufficiently to raise the lever M of the steam valve L, and sound an alarm. It is attached to this lever by the strap *g*. The area of this elastic valve is much larger than the steam valve L, so that a few lbs. per inch addition to the pressure on the elastic valve will raise the steam valve L even though it should be cemented down.

T is a thermometer, it is arranged between the gages for the following purpose. Air is expanded by heat, and it requires a greater pressure to drive it into a given space when warm, than when cold, and I have found by experiments, that it matters not at what pressure or temperature,—eight degrees of temperature makes a difference of one pound in the indication of the gage; for this reason the thermometer is added, and the scale is made when the mercury stands at 72 degrees. At this temperature, therefore the scale is strictly correct, when it stands at 8 degrees above, or at 80 degrees, we add one pound to the indication of the scale; at 88 degrees, add 2 pounds, at 64 degrees, or 8 degrees below, subtract one pound; at 56 degrees subtract 2 pounds, &c.

By providing a pipe with cold water to intervene between the steam or heat and the mercury and arranging the said pipe to project below the place where the steam comes in contact with the water the glass tube will never be broken by hot mercury being forced up its bore, and expanding its inner surface more rapidly than the outer; while, without this intervening nonconductor, the glass tube is very often thus broken, especially if it is made of sufficient thickness to sustain the pressure of high steam. The construction of the water gage is in part the same as that of the steam gage but instead of being connected with the top of the boiler, it is connected with a copper box laying in the boiler, and on the top of the flue. This box is filled with water, and has no outlet except through the water gage. As soon as the water falls too low or is driven off from the surface of the flues so that they begin to receive extra heat the pressure of steam from the copper box lying on the flue, will increase rapidly. The water gage will indicate that increase and the alarm above the case containing the gage, will sound a short time before the flues receive sufficient extra heat to become dangerous. When the alarm is sounded the flue caps should be opened immediately, the safety valve of the boiler raised and ten or twenty pounds of the pressure suffered to escape. This will cause the water to rise in foam, wash off and cool the surface of the flues. There will be no danger of collapse from the sudden accumulation of steam by the water thus coming in contact with the heated top of the flue, if the alarm is attended to; but if neglected for any length of time, the safety valve should not be raised but the fires should be partially extinguished and the pumps started. If these precautions are immediately observed when the alarm is sounded no danger need be apprehended in any case.

Several of these gages are now in operation and the above facts, have been proved from experiments repeatedly tried and the following directions have been given for detecting any incorrectness in the gage: 1st. If the steam gage is correct the mercury in the glass tube will fall to 0, every time the steam is down. The only methods of interferring with the correctness of the water gage and preventing the alarm, would be—2d. By drilling or cutting a hole in the box laying on the flue thus giving the water in this box vent into the boiler as soon as the flues receive extra heat. 3d. By fastening down the alarm valves. Now if a hole is made in the box it may be known from the fact that the vibrations of mercury in the water gage would correspond with those of the steam gage. If the valve should be fastened down, the small iron tube conducting the steam from the box to the water gage will burst open at the weld the first time the water falls too low, and suffer the water in the box to escape in the form of steam. This would take place before the top of the flues were heated to the temperature of 450 degs., while it requires about 1,000 degs. to produce a red heat, and would give sufficient warning. If the mercury in the water gage falls considerably lower than that of the steam gage, and is moved by sudden impulses, the box is nearly empty of water, and should be immediately filled; but as the steam escapes from the main boiler and not from the box on the flue in case of an alarm from either low water or high steam, this box never need be emptied unless there is a leak in the tube leading from it to the gage.

Having thus explained my invention, I claim—

The introduction of the tube or box on the flue or other surface exposed to extra heat when water is too low, filled with water or other suitable liquid for the purposes set forth.

AZEL S. LYMAN.

Witnesses:
S. H. Wales,
C. J. De Witt.