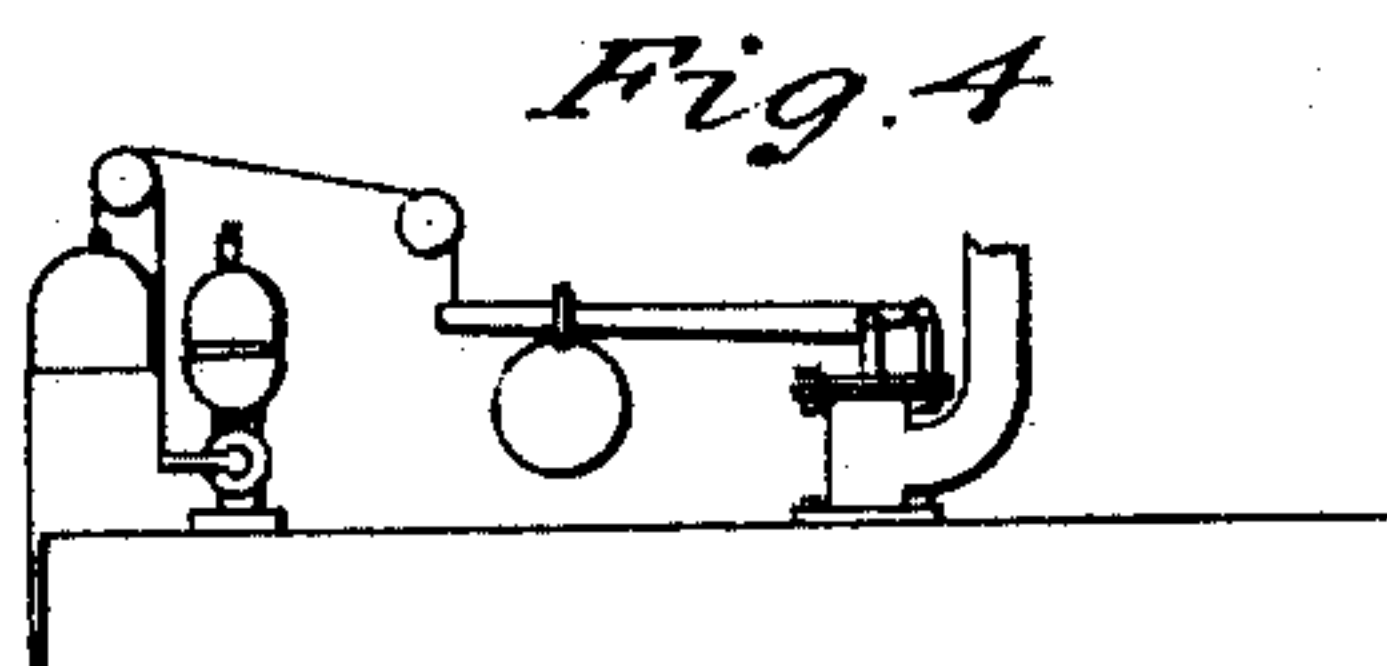


R. SAVAGE.  
Thermo-Alarm Gage.

No. 62,371.

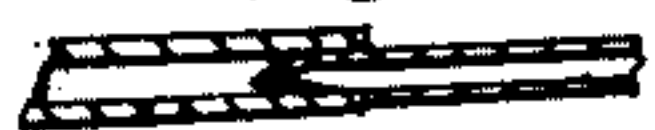
Patented Feb. 26, 1867.



*Fig. 3*

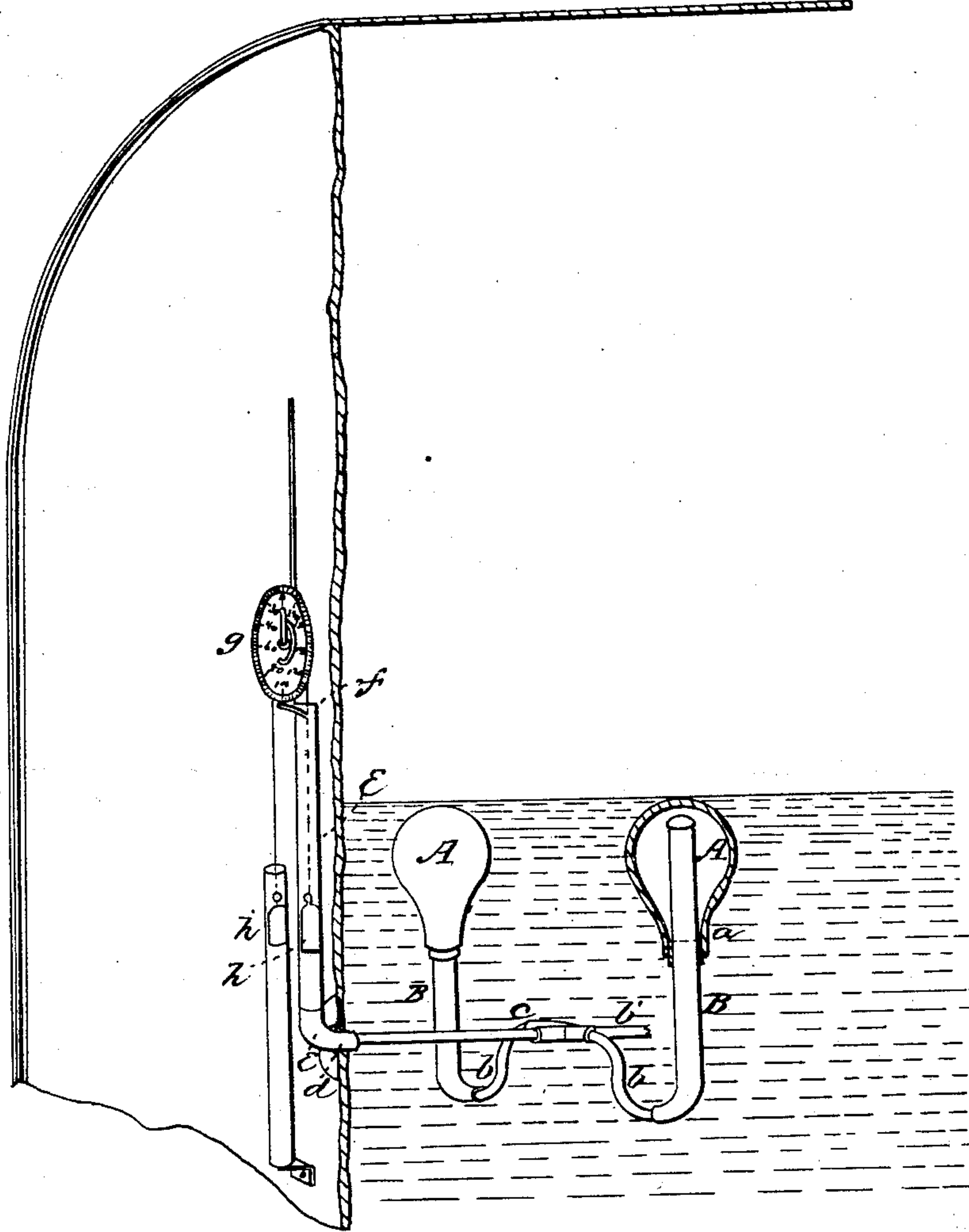


*Fig. 2*



Witnesses  
M. G. King  
C. W. Smith  
Geo. H. Strong

*Fig. 1*



Inventor  
Richard Savage

# United States Patent Office.

RICHARD SAVAGE, OF SAN JOSE, CALIFORNIA.

*Letters Patent No. 62,371, dated February 26, 1867.*

## IMPROVEMENT IN THERMO-ALARM GAUGES.

The Schedule referred to in these Letters Patent and making part of the same.

### TO ALL WHOM IT MAY CONCERN:

Be it known that I, RICHARD SAVAGE, of San Jose, county of Santa Clara, State of California, have invented a certain new and useful "Indicator and Alarm" for indicating the temperature and heat in steam boilers, called Savage's "Thermo-Alarm Gauge;" and I do hereby declare the following description and accompanying drawings are sufficient to enable any person skilled in the art or science to which it most nearly appertains to make and use my said invention without further invention or experiment.

The nature of my invention relates to the expansion of air, so confined in hollow bulbs or vessels and pipes, in which mercury is introduced, and placed in boilers, that the expansion of the air, which has been kept in place by the mercury, will, by means of heat, force out the column of mercury, and elevate a weight or float outside of the boiler, which sounds an alarm, or raises the valves, the temperature of the boiler being indicated or ascertained by an indicator. The drawings represent, by

Figure 1, an elevation of my machine in position, with a portion of boiler removed.

Figure 2, section of pipes, showing manner of connection.

Figure 3, indicator.

Figure 4, simple mode of attachment to valves.

The internal pressure required to rend a steam boiler may be very closely calculated for a boiler of any known size or thickness of plates, and every engineer has constantly at hand the means of ascertaining with a very great precision the amount of pressure that he may have upon his boiler from time to time; yet it often happens that even when these conditions of safety are fully complied with the most terrible and destructive explosions occur. Cases are well authenticated where they have occurred when but a moment before the gauges have most unmistakably indicated both an ample supply of water and a safe degree of steam pressure. These facts fully justify the assumption of some violent internal action too rapid and sudden to admit of any notice thereof being given by the usual indicators, and that the explosion which occurs is the consequence of such action. Various theories have been assigned for the effects produced, among which may be enumerated the following: a sudden production of steam from causes not dependent upon the regular indication of heat from the furnaces; decomposition of steam, and subsequent explosion of hydrogen in the presence of oxygen; a spheroidal condition of a portion of the water in the boiler; electrical action. Engineers and learned men are everywhere much more ignorant with regard to these things than they should be. But experimental science has, within a few years, brought many things to light, the practical value of which, however, is but little known. The inventor having had much practical experience in the use of steam, has recently conducted various experiments, which have fully satisfied him that, in ninety-nine cases out of every one hundred, explosions occur from the too great accumulation of heat in the boilers; and hence to this cause almost entirely is to be attributed those fearful and disastrous explosions that are often so destructive to life and property. We have "steam gauges" for ascertaining the pressure of steam and quantity of water in boilers, but none that I am aware of for ascertaining the amount of the active agent for producing the steam, and consequently the only really dangerous element or condition in the boiler, heat. This I propose to supply, and have invented what I call a "thermo-alarm gauge," an instrument that cannot be surpassed, as in construction it may be applied to any description of boiler, and can be extended to any or all parts of it, so that in case it is liable to become over hot in one or more places the alarm will be sounded in time to avoid an explosion; and if the water gets low, and there is an increase of heat, as there undoubtedly is, notice of the fact is given; or if the fires are forced, as in case where great speed or power is required, and the steam is used as fast as generated, and heat is constantly on the increase in the boiler, the gauge may be set so as to give the alarm at any given temperature known to be safe, and the drawing or slackening of the fire prevents the impending disaster.

For the accomplishment of this object I employ hollow bulbs or vessels A A, as many as desired—I think two would be sufficient for a small boiler—and place them in any part of the boiler most liable to become overheated. To these bulbs I attach pipes B B, by means of thread and screw *a*, which pipes extend up to near the top of the interior of the bulb, and are flaring at the top, similar to a funnel. These pipes are curved near their base, and may rest on the side or bottom of the boiler. To the curved end I attach a pipe, *b*, of smaller diameter, which enters a T-joint, *b'*, through which a pipe, C, passes, which may be extended through the



entire boiler longitudinally, if need be, as in case more bulbs are desired. This longitudinal pipe, which extends nearly to the boiler head, is throttled, (shown at fig. 4,) and to which is attached an elbow-joint, *d*, extending out of the boiler head, to the end of which is secured a glass or metal tube, *E*, placed upon the top of which is a standard, *f*, which affords a stand for the dial *g*.

The operation of my machine is as follows: The bulbs or vessels being placed in the boiler at any position where the greatest amount of heat is likely to occur, and the tubes filled with mercury, the height of which is indicated by the blue lines in the drawings in the ordinary boiler, when the fire is applied, and as the water is heated, the expansion of air in the bulbs will cause the mercury to descend in the tubes *B*, flowing through small pipe *C* into the tube *E*, which will lift the float *h* in said tube, attached to a cord which passes over a pulley connected to the dial back of it, turning the hand of said dial, showing the amount of pressure or heat in figures, and throwing down a weight, *h'*, that touches a spring, which will sound an alarm that will attract the attention of the engineer, either by lifting the valves, and sounding a whistle, striking a bell, or any other sound or sign desired, no matter what; or the indicator may be placed back of the glass tube, and the weight *h* indicate the amount of heat, also sending up a rod that will strike a bell, or sound a whistle, or open the escape valve, as shown in fig. 2.

It may be asked, Will not the mercury in the tubes volatilize and escape outwardly, by reason of the excessive heat in the boilers? I answer emphatically, No; for if the mercury in the tube should become heated to that extent, and pass out toward the tube *E*, it will meet with resistance by coming in contact with the bath of cold metal contained in the tube in such quantity as to be condensed, and prevented from escaping. Neither will the expanded air escape, for the column of mercury will prevent it. And thus I have a constant and reliable means of ascertaining the active destructive agent in any boiler where steam is used.

Having thus described my invention for preventing explosions in steam boilers, I claim—

The above-described thermo-alarm gauge, in combination with a steam generator.

RICHARD SAVAGE. [L. s.]

Witnesses:

C. W. M. SMITH,

GEO. H. STRONG.