J. R. Robinson,

Steam Safety Valve,

No. 32,206, Patented Apr. 30, 1861.

Fig. 1.

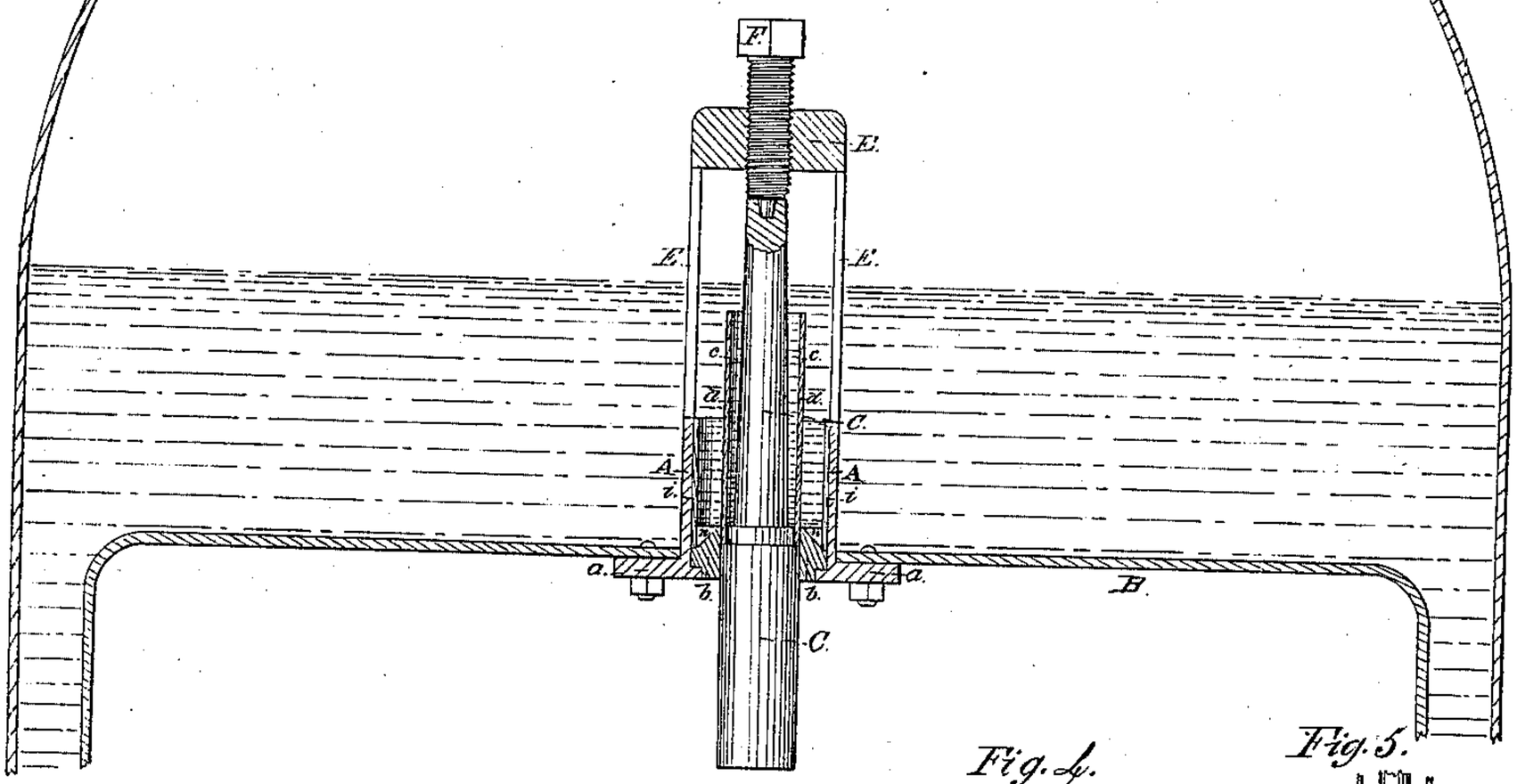


Fig. 3.

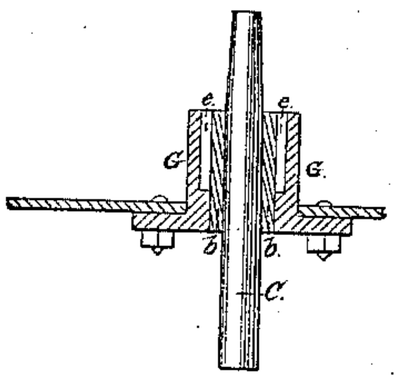


Fig. 2.

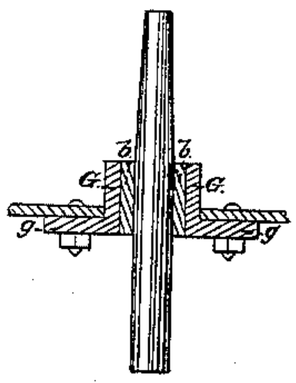


Fig. 4.

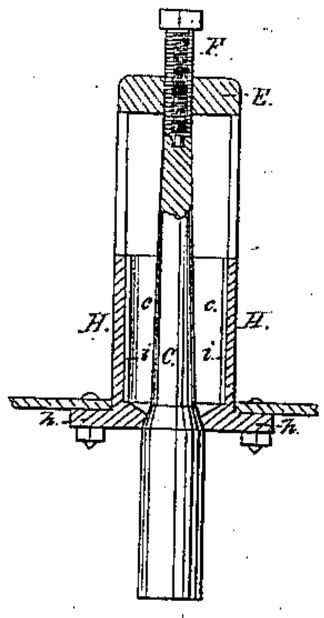
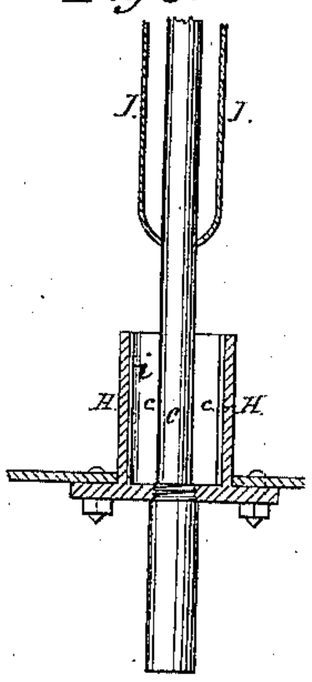


Fig. 5.



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UNITED STATES PATENT OFFICE.

J. R. ROBINSON, OF BOSTON, MASSACHUSETTS.

SAFETY-PLUG FOR STEAM-BOILERS.

Specification of Letters Patent No. 32,206, dated April 30, 1861.

To all whom it may concern:

Be it known that I, J. R. ROBINSON, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Safety-Plugs for Steam-Boilers; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1, represents a transverse vertical section of the upper part of a horizontal boiler in which is applied a safety plug in which all the features of my invention are embodied. Figs. 2, 3, 4, and 5, are sectional views exhibiting different applications of certain features of my invention.

Similar letters of reference indicate corresponding parts whenever they occur in the several figures.

The principal objects of my invention are, 1st, to cause the plug to take effect while the crown sheet or that plate of the body of the boiler in connection with which the plug is placed, is still covered with sufficient water to prevent injury to the boiler; 2nd, to cause the heat to be rapidly transmitted from the plug to the water until the water gets below a safe level and then to be retained in and around the plug for the purpose of melting a ring of fusible metal by which the plug is held in place, or of making the plug by its longitudinal expansion operate an alarm device or tear itself from the boiler.

To enable others skilled in the art to make and use my invention I will proceed to describe the construction and operation of the several improvements with reference to Fig. 1, in which all are combined and then briefly explain the different applications of the separate improvements with reference to Figs. 2, 3, 4, and 5.

A, (Fig. 1,) is a short upright cast iron tube inserted in an opening in the crown sheet B, of the fire box and bolted to the said sheet through a flange *a*, with which the said tube is provided around its bottom. This tube extends upward a few inches above the crown sheet and is open at the top.

C, is the safety plug made of copper, or other good conducting metal arranged in the center of the tube A, in which it is secured by a ring *b*, of lead, or other metal or alloy which is a poorer conductor than the plug C, and fusible at a low, but not too low temperature, said ring fitting steam tight between the said plug and the lower part of the tube A. This plug is long enough to reach downward some distance below the crown sheet and may extend upward any distance within the boiler. The portion of the plug above the ring *b*, is sufficiently smaller than the portion below to enable an annular cavity *c*, *c*, to be formed between the exterior of said plug and the interior of a tube *d*, the exterior of which is not larger than the portion of the plug which fits the leaden ring *b*. This tube *d*, may be screwed, soldered, or otherwise securely and permanently attached at its lower end to the plug C, its lower end being thus closed; but its upper end is left open. The said tube *d*, extends above the larger tube A, to a little higher than the lowest level to which it is intended to permit the water in the boiler to arrive.

E, is a bridge cast with or firmly secured to the tube A, for the purpose of carrying a screw F, the point of which enters a cavity in the top of the plug C. This screw, which screws through the bridge, is adjusted so that it cannot press downward upon the plug until the latter has become heated by the water in the boiler having got too low, and until that takes place it simply steadies the upper part of the plug to prevent it from being displaced by any accidental blow on the lower part which protrudes below the crown sheet into the fire box. The cast iron tube A, is lined with copper *i*, *i*, above the ring *b*, to prevent corrosion.

The operation of this plug is as follows: While the water continues above the level of the top of the tube *d*, the cavity *c*, remains full of water and nearly all of the plug C, that is within the boiler below the water level is surrounded by water and hence the heat which is absorbed by the lower part of the plug C, from the fire is, owing to the good conducting quality of the said plug and of the water, so rapidly given off to the water that the ring *b*, does not get hot enough to melt, and the plug C, remains undisturbed, but when the water in the boiler gets below the top of the tube *d*, and the water outside the said tube is separated from that within the cavity *c*, within the said tube, the heat transmitted by the plug C, to the water in the cavity *c*, very quickly subjects that water to such intense ebullition that it flies out of the tube and leaves the portion of the plug C, within the tube sur-

rounded by steam which being a poor conductor of heat does not carry off the heat from the plug fast enough to prevent the ring *b*, being quickly melted, and when this has taken place the plug being unsupported drops into the fire place and all the water remaining in the boiler above the level of the top of the tube A, runs through the said tube into the fire place; but all the water below the level of the top of the tube A, is retained in the boiler. The above operation is aided by the screw F, for as the heat of the plug increases after the expulsion of the water from the cavity *c*, takes place, the expansion of the plug causes its upper end to press against the screw F, so that as soon as a thin film of the lead ring *b*, next the plug has melted the continued expansion of the plug against the screw causes it to be forced downward from the said ring and drop. In order to enable the plug to drop freely the tube *d*, should be slightly tapered in an upward direction. To prevent the plug C, being lost or injured by dropping into the fire, the said plug may have ears on its upper part to catch on the tube A, and cause the arrest of the plug before it can reach the fire. The action of the plug will be expedited when the water gets low by having the upper surface of the leaden ring *b*, covered, or nearly covered with plaster-of-paris, or other poor conducting material, as shown at *n*, *n*, in Fig. 1, such material preventing the heat being carried off so rapidly from the said ring by the water in the tube A, will cause the said ring to melt more rapidly.

Fig. 2 exhibits a simple copper plug C, passing through the center of a plug *b*, of fusible metal fitted tightly into a tube G, said tube passing through the crown sheet B, and being bolted thereto through a flange *g* at its bottom. The plug C, is like that represented in Fig. 1 and the fusible plug *b*, being annular, corresponds with the fusible ring *b*. The tube G, differs from both A, and *d*, shown in Fig. 1, in its containing no water. While water is above the tube G, the heat absorbed by the lower part of the plug is conducted upward through the plug C, and transmitted to the water surrounding the upper part of the said plug so rapidly that the fusible plug or ring *b*, does not get heated to the fusing point, but when the water falls below the top of G, and leaves the upper part of the plug C, surrounded by steam the fusible plug or ring quickly melts and the plug C, drops out. The action of this modification depends upon the good conducting quality of the central plug C, and the poor conducting quality of the leaden plug or ring *b*.

The subject of Fig. 3, only differs from that of Fig. 2, in having the upper part of the fusible plug or ring *b*, surrounded by plaster of paris, or other non-conducting material as shown at *e*, in order to confine the heat around and within the plug or ring *b*, that when the water gets below the tube G, the said plug or ring may be the more quickly melted.

In Fig. 4, the plug C, is represented as soldered with hard solder at *h*, *h*, into the bottom of a tube H, which performs the same function as the tube *d*, in Fig. 1, as well as that of the tube A, which it most resembles in construction, being bolted in a similar manner to the crown sheet B, and having attached a similar bridge E, and screw F. The screw F, in this example is screwed down so that it will just bear upon the top of the plug C, when the boiler is in operation and the upper part of the said plug is surrounded by water. When the water is above the tube H, the cavity *c*, *c*, in the said tube is full and the plug being thus surrounded by water has its heat carried off rapidly, but as soon as the water gets below the top of the tube the quantity remaining in the cavity *c*, is quickly expelled by rapid ebullition and the part of the plug within the boiler being then surrounded by steam quickly becomes so heated that the solder at *h*, *h*, which attaches it to the tube H, though not melting, becomes so hot as to lose its tenacity, and the expansion consequent upon the increased heat of the plug causes its upper end to be subject to so great pressure from the screw F, that the solder joint at *h*, *h*, is forced apart and the plug drops through the bottom of the tube letting steam escape but retaining all the water remaining in the boiler.

Fig. 5, only differs from Fig. 4, in having the plug C, permanently secured into the bottom of the tube H, and extended upward to connect with an alarm device. When the water in the boiler gets below this tube H, and that in its cavity *c*, *c*, boils out, the upward expansion of the plug C, or as it may be in this case more properly termed the expanding rod, causes the alarm to be given, and as soon as the proper level is restored in the boiler and the cavity *c*, *c*, filled again with water the plug or rod C, cools again and contracts and the alarm is stopped. In this figure, I, is a tube attached to and surrounding that part of the plug or rod C, above the highest water level and filled with plaster of paris, or other poor conducting material to prevent as far as possible the heat of the said rod or plug being given off in a lateral direction to the steam and thereby interfering with its longitudinal expansion.

What I claim as my invention and desire to secure by Letters Patent, is—

1. The combination of the ring or plug *b*, of fusible metal of inferior conducting capacity and a central plug C, of infusible

metal of superior conducting capacity substantially as herein specified.

2. The tube *d*, combined with the plug C, substantially as and for the purpose herein specified.

3. The combination with the safety plug, of a tube open at the top for the reception of water, closed at the bottom by the plug, and permanently attached to the boiler, substantially as illustrated by A, and H, Figs. 1 and 4, and herein specified.

4. The combination of the tube *d*, attached to and surrounding the plug C, and the fixed tube A, surrounding the said tube *d*, and the plug substantially as and for the purposes herein specified.

5. The screw F, applied in combination with the plug C, substantially as and for the purposes herein set forth.

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