J. Reid,

Steam Safety Valve.

No. 1,607. Patented May 19, 1840.

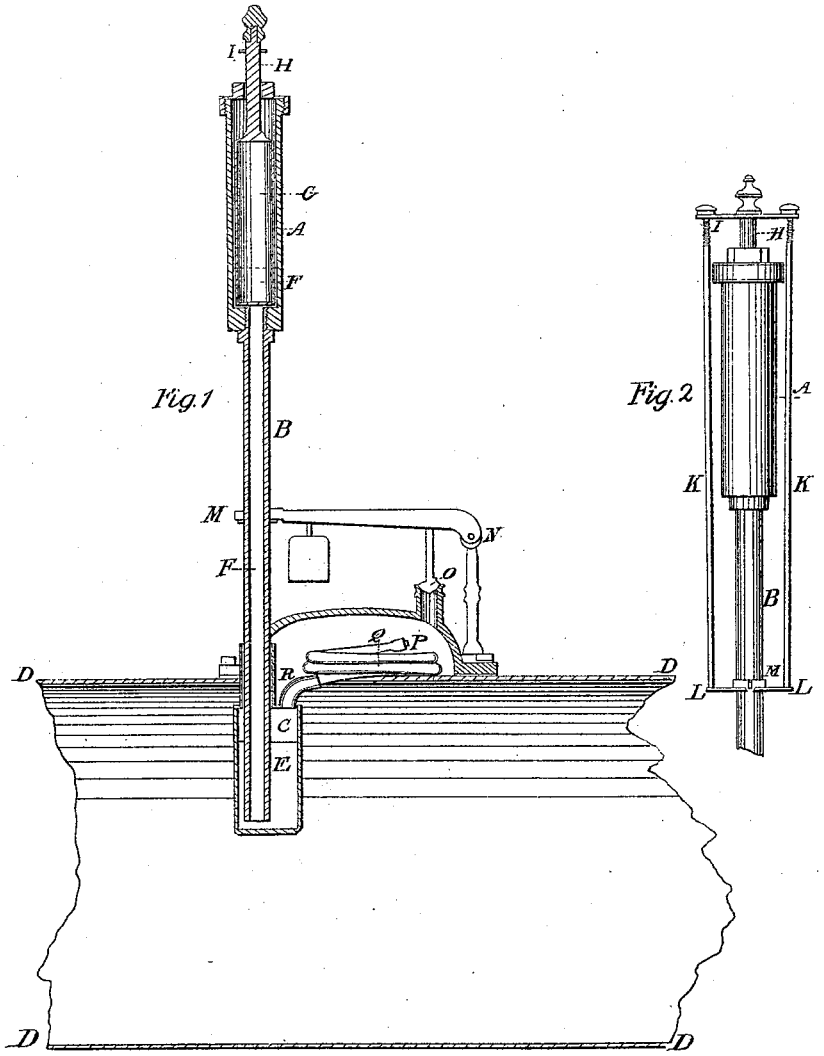

Fig. 1

Fig. 2

A.M. PHOTO-LITHO. CO. N.Y. (OSBORNE'S PROCESS.)

UNITED STATES PATENT OFFICE.

JAMES REID, OF PAWTUCKET, RHODE ISLAND.

MODE OF PREVENTING EXPLOSIONS IN STEAM-BOILERS.

Specification of Letters Patent No. 1,607, dated May 19, 1840.

To all whom it may concern:

Be it known that I, JAMES REID, of Pawtucket, county of Providence, and State of Rhode Island, lately of Scotland, Kingdom of Great Britain, have invented a new and useful improvement in machinery to be applied to steam-boilers to prevent explosions thereof from the cause or causes usually operating to produce such accidents.

The said improvement, the principles thereof and modes in which I have contemplated the application of the same by which it may be distinguished from other inventions of a like character, together with such parts or combinations I claim as my invention and consider original and new, I have herein set forth and described, which description, taken in connection with the accompanying drawings herein referred to forms my specification.

Among all the contrivances which have been resorted to in order to prevent the explosion of boilers the safety valve has always been preëminent in the ranks of discovery. At the period of its invention, and for a long time after, it seemed to possess in a theoretical point of view, all the requisites of safety and simplicity. Provided its operative parts were kept in good working order it was supposed that the only desideratum remaining was strength of the material of which the boiler or steam generator was constructed. These two fatal errors have often been the undoubted causes of the many serious accidents resulting from the effects of the elastic force of steam. That the safety valve is not the protector or security heretofore imagined is now rendered most clearly apparent and it is a singular fact, that it often hastens rather than retards an explosion.

It has generally been noticed that an explosion takes place at the opening of the safety valve and that the same is preceded apparently by a diminution in the elasticity of the steam. It is now well known that the temperature of steam is not the measure of its power which latter is more correctly in proportion to its density. Therefore when the evaporation of water in a boiler reduces the level of the fluid so that the fire acts on the sides where the same are above the water or on those parts which are in immediate contact with the steam, the latter becomes surcharged with caloric, oftentimes heating the upper surface of the boiler to such an extent as to ignite whatever of a combustible nature may be in proximity. The mere addition of water greatly increases the elastic force of steam, its reduction creating a consequent redundancy of heat with little elastic force. To this then must be ascribed the sudden and dreadful explosions both in high and low pressure boilers; as if by any sudden reduction of pressure of the steam on the surface of the water we cause that water to rise in the surcharged element steam of highly elastic force will suddenly be produced and unless the tenacity of the metal of which the boiler is made is sufficient to withstand the pressure thus instantaneously created an explosion must follow.

The object of my invention is to prevent the accumulation of this superabundance of caloric in the steam to such a degree as to produce injury or an explosion.

Figures 1 and 2 of the accompanying drawing exhibit my improvements. Fig. 1 is a section showing the internal arrangement.

A is a hollow cylinder, to the bottom of which a tube B is attached and extends downward through the top of the boiler D D D D into a close receiver or cistern C, as seen in Fig. 1, the lower end of the said tube B reaching very nearly to the bottom of the cistern. The cistern C is placed in the upper part or steam chamber of the boiler or generator and is filled, or nearly so, with mercury, as seen at E, which mercury also extends upward when in action through the tube B a short height into the cylinder A, as represented by F, F, F. A cylindrical float G rests in the mercury in the chamber A. It has an upright rod H attached to the top. To the upper extremity of the rod H a cross head I is fixed, see Figs. 1 and 2, the said cross head being connected to a shelf or cross bar L L by two rods K K. The extremity M of the levers M N of the safety valve O rests on the shelf L L, the said safety valve being constructed in the ordinary manner.

P Q R is a long tube of metal coiled or wound up, as represented in the drawing, or otherwise properly shaped and arranged. One end P is closed, while the other R is attached to and communicates with the cistern C. This tube is filled with water, alcohol or any suitable expansive liquid or gas, but I generally prefer water. It should

be placed as near the upper part of the boiler as possible in order that it may be exposed to the action of the greatest calorific influence, which as heat ascends, must evidently be at the top. The tube P Q R is supposed to be filled with water or other proper fluid and the cistern C with mercury, the latter only rising in the tube B when there is no fire underneath the generator or boiler, to the same level to which it stands in the cistern C. The water will be retained in the tube P Q R by the mercury in the cistern C. Now when the steam becomes surcharged with heat it will, in proportion to the excess of caloric, expand the water or gas in the tube P Q R, which, acting or pressing on the surface of the mercury in the cistern C causes the column in the tube B to rise into the cylinder A and when the expansive force of the liquid in the tube B is sufficient to raise the column of mercury to or near an established height in the cylinder A it will equal the maximum pressure we wish the boiler to sustain—and according to the laws of pressure it will lift, the float G at the same time raising the lever M N of the safety valve by means of the machinery above described which intervenes or connects the same with the float G. Thus the surcharged steam will escape from the valve O until a sufficient quantity is dissipated and the intensity of the caloric reduced to such a degree as to contract the liquid in the tube P Q R, and to suffer the mercury in the chamber A, and consequently the float G, to descend and close the safety valve. Thus the quantity of heat will be regulated and one of the greatest causes of explosions prevented from increasing to a dangerous extent.

It often occurs that adhesion of the safety valve to its seat by reason of oxidation or saline or other matters cementing it thereto produces an explosion. In order to open the same should such occur, the same apparatus as above described may be employed, with the exception of the coiled tube P Q R. The steam of the boiler may be allowed in any convenient manner to have access to the mercury in the chamber C, so that when the safety valve adheres to its seat the elastic force of the steam will operate on the surface of the mercury in the chamber C, forcing it through the tube B into the cylinder A, thus raising the float G and the safety valve O. The proportions of the cylindrical sections of the cylinder A, float G, tube B, with those of other parts of the apparatus, must be regulated according to the maximum of pressure at which we wish the surcharged steam to escape from the safety valve and also to other circumstances, and these will be readily understood by engine makers.

Having thus described and set forth the principles and mode of operation of my machinery I shall now specifically point out such parts thereof I claim as my invention.

I claim—

The coiled or otherwise properly shaped tube or vessel P Q R, chamber C, tube B, cylinder A and float G, in combination with the safety valve, the whole operating together by the surcharged steam acting on and expanding the water or gas in the tube P Q R, thereby forcing the column of mercury to rise into the chamber A, and lift the float G and lever M N of the safety valve thereto connected, thus allowing the escape of steam whenever at such times an accumulation or superabundance of heat therein may be dangerous or tend to produce an explosion of the generator.

In testimony that the above is a true description of my said invention and discovery I have hereto set my hand this ninth day of January, in the year eighteen hundred and forty.

JAMES REID.

Witnesses:
R. H. EDDY,
G. C. SMITH.