

J. AULD & J. GRAHAM.
SAFETY VALVE.
APPLICATION FILED APR. 25, 1911.

1,014,435.

Patented Jan. 9, 1912.
4 SHEETS—SHEET 1.

Fig. 1.

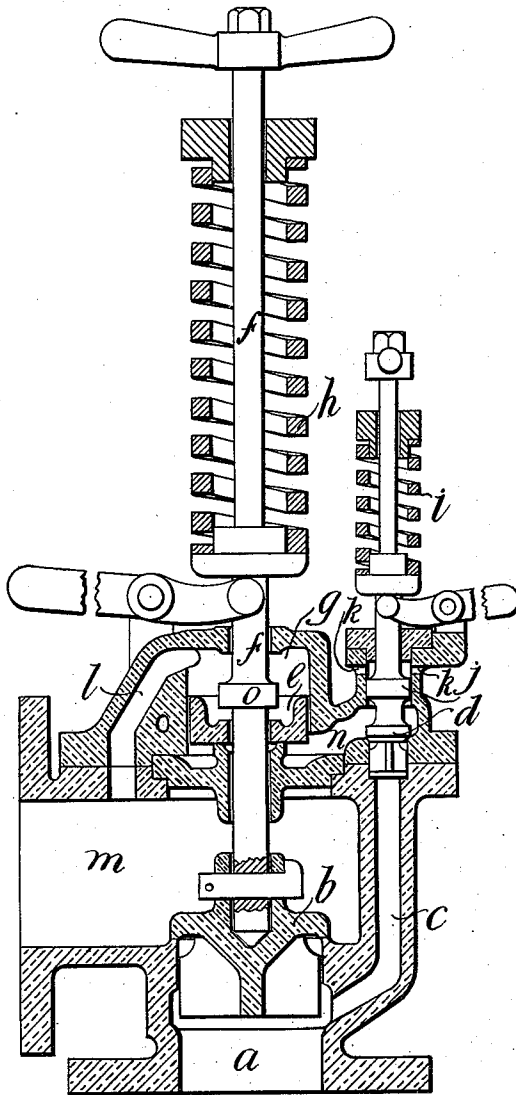
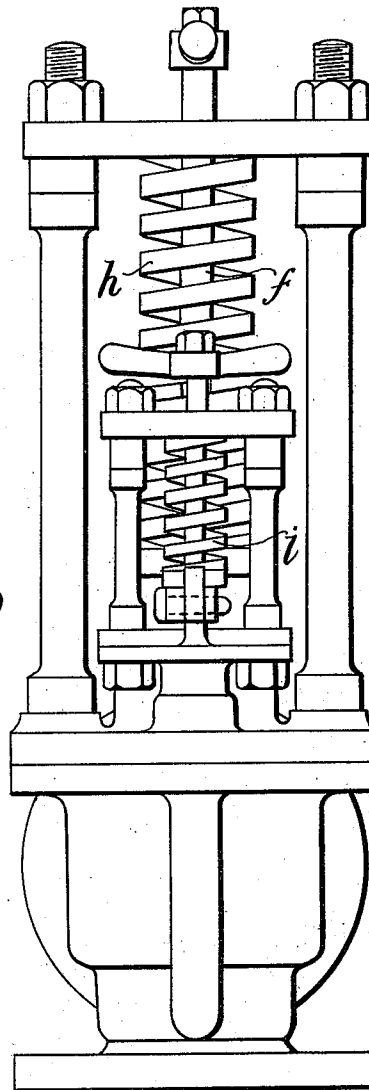


Fig. 2.



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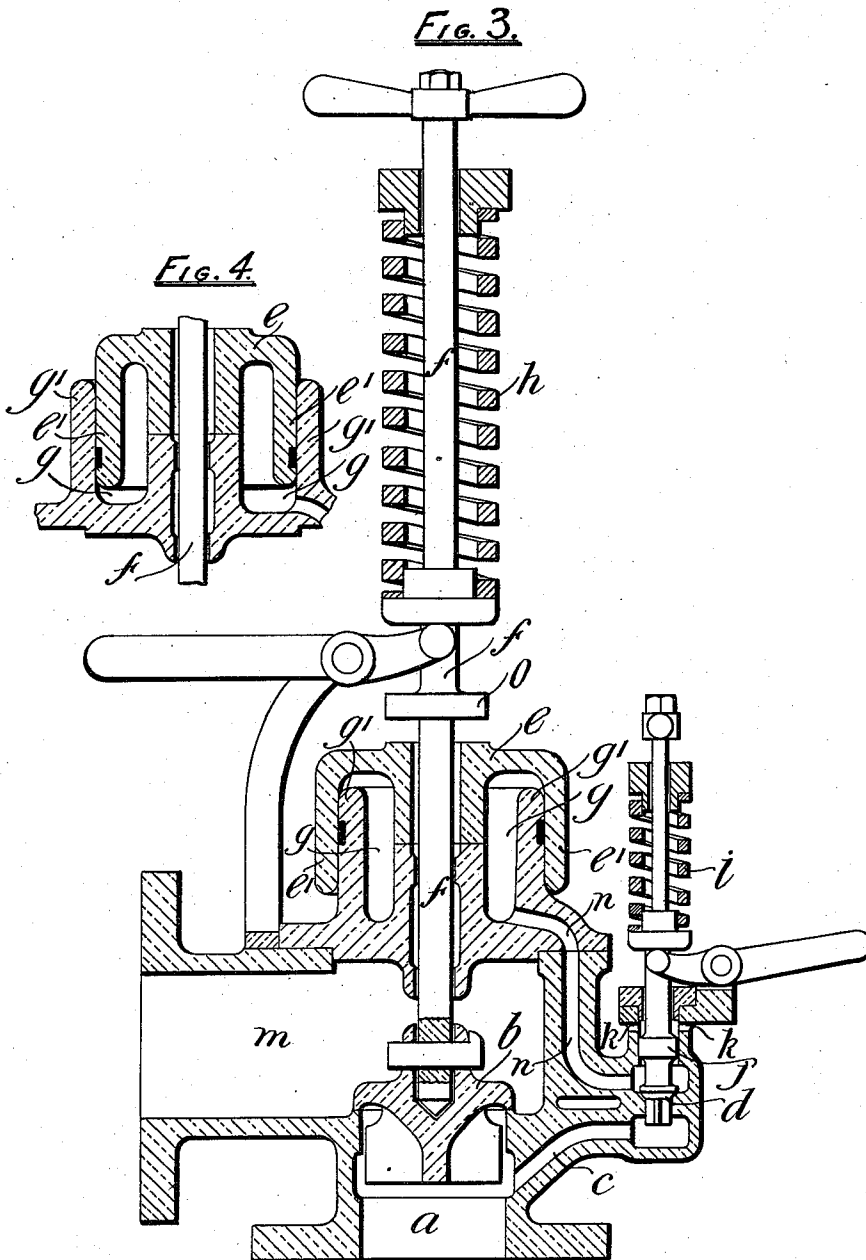
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4 SHEETS—SHEET 2.



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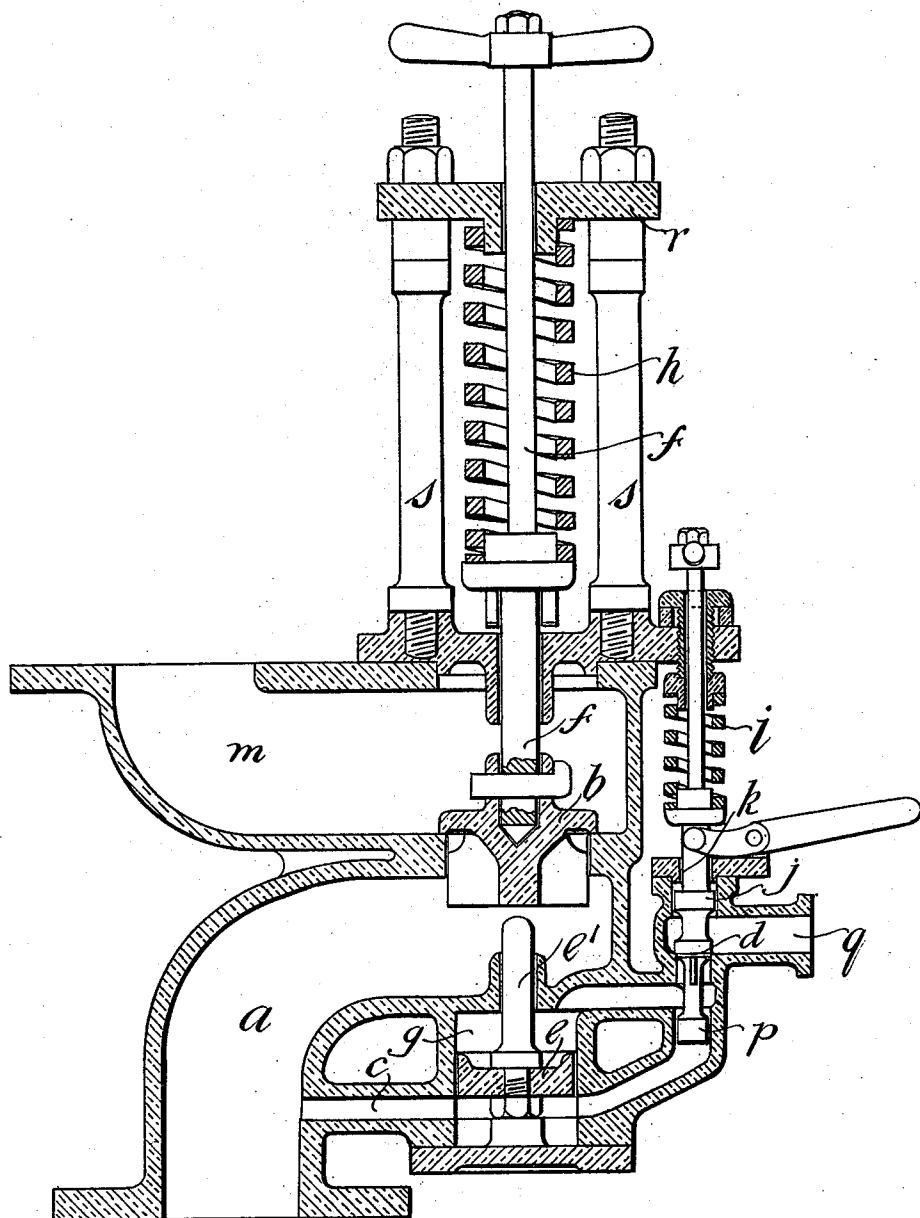
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4 SHEETS—SHEET 3.

Fig. 5.



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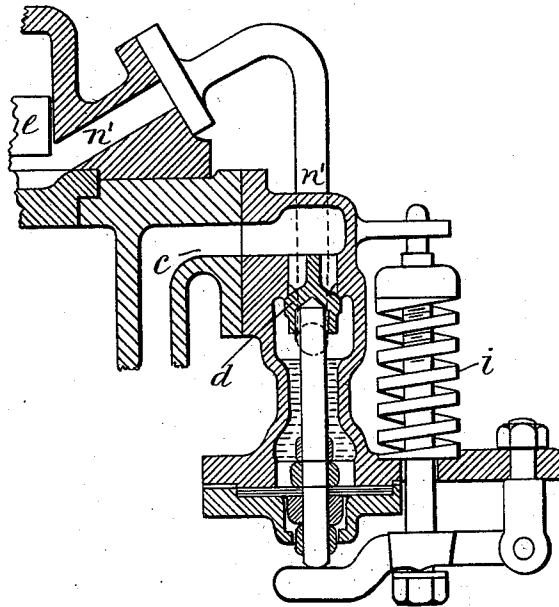
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4 SHEETS—SHEET 4.

FIG. 6.



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UNITED STATES PATENT OFFICE.

JOHN AULD AND JOHN GRAHAM, OF GLASGOW, SCOTLAND.

SAFETY-VALVE.

1,014,435.

Specification of Letters Patent.

Patented Jan. 9, 1912.

Application filed April 25, 1911. Serial No. 623,249.

To all whom it may concern:

Be it known that we, JOHN AULD and JOHN GRAHAM, both subjects of the King of Great Britain and Ireland, and residing at Glasgow, Scotland, engineers, have invented new and useful Improvements in Safety-Valves, of which the following is a specification.

Our invention relates to improvements in and relating to safety valves for steam boilers and the like, of the class in which after the main valve has opened in the usual way, by the increase of steam pressure over that arranged for, or has been assisted to open by an auxiliary valve, the main valve is lifted or opened beyond what is usually the normal lift of boiler safety valves to allow of a fuller escape of the steam, which has been effected by providing an auxiliary valve, which may be so loaded as to open a little later than the main valve, to regulate the supply of steam to a loose or floating piston arranged to act on the main valve to give it the increased lift desired.

In order that our invention may be properly understood we have hereunto appended three sheets of explanatory drawings in which—

Figures 1 and 2 on Sheet 1 are respectively a sectional elevation and an elevation at right angles to Fig. 1 of one construction of valve. Figs. 3 and 4 on Sheet 2, are sectional elevations illustrating modified constructions of the operating piston, while Fig. 5 on Sheet 3 illustrates a modified and equivalent arrangement. Fig. 6, is a sectional view of a modified form of auxiliary valve which we employ.

Referring to these drawings:—in carrying this invention into effect or practice, according to one modification as illustrated by Figs. 1 and 2, the inlet *a* leads the steam to the underside of the main valve *b* and by the passage *c* to the underside of the auxiliary valve *d* which when open allows the steam to act on the underside of the piston *e* placed loose on the valve spindle *f*, as shown. The main valve spindle or rod *f* passes through the center of the loosely fitted piston *e* and is continued through the chamber *g* into the atmosphere where it may be loaded in the usual manner by the spring

h, by deadweights or otherwise as may be found desirable. The auxiliary valve *d* which is balanced on the outlet side by a piston *j* may also be loaded in any suitable manner, by the spring *i* or otherwise. Any steam passing the balancing piston *j* escapes into the atmosphere by ports or ducts *k*. Any steam passing the loosely fitting piston *e* escapes through the port or duct *l* into outlet branch *m*.

As illustrated by Fig. 3, the piston *e*, instead of working within the close cylinder forming the chamber *g* is inverted and has its annular wall *e*¹ made deeper, so as to enable it to work outside the annular wall *g*¹ of the cylinder, or inside of same as shown in Fig. 4. The arrangements of the main valve and the auxiliary valve *d* are similar to those already described.

The action is as follows:—When the main valve *b* and auxiliary valve *d* are loaded respectively so as to open on the steam boiler, steam main or other vessel attaining a given pressure, the steam pressure under main valve *b* would open up said valve and the surplus steam escaping would be discharged through outlet branch *m*. The high pressure steam in inlet branch *a* passing up the duct *c* to the underside of auxiliary valve *d* also opens up said valve and the steam thence flowing through port *n* accumulates pressure under the loose piston *e* which floats up against under face of collar *o* exerting such a lifting force as to further compress main loading spring *h* and give in consequence an increased lift to the main valve *b* over and above the limited opening due merely to the pressure acting under same. Any accumulation of pressure under the loose piston *e* which occurs when the valve is in operation and would tend to exert a back pressure on auxiliary valve *d* is balanced by the balancing piston *j* attached to auxiliary valve.

The object in having piston *e* loose on the valve spindle *f* is to overcome the danger involved in having pistons fixed to valve spindles by which arrangement if the piston jams the safety valve becomes inoperative. On the other hand should the loose piston *e* jam circumferentially the safety valve will operate independently but with the reduced

lift, similar in fact to ordinary standard safety valves. The hole through the center of loose piston *e* is bored with an ample amount of clearance over and above the thickness of valve spindle *f*. It will be evident that any suitable form of auxiliary valve for passing steam to the underside of the piston may be employed such as a valve fitted at the lower end of its spindle with a balancing piston and elastic diaphragm, in which case the steam would not be allowed to escape to the atmosphere. In this case, as shown in Fig. 6, the steam from the boiler passes by the duct *c* to the upper side of the valve *d* which opens when the steam pressure is above a predetermined height, and the steam passes through the duct *n'* to the under side of the loose piston *e*. Such safety valves may be so arranged that one auxiliary valve may operate a nest or two, three or more main safety valves, each main safety valve being fitted with its own loose piston.

Fig. 5 on Sheet 3 illustrates another arrangement whereby the loose or floating piston *e* is placed under the main valve *b* but is not attached thereto. In this arrangement the initial pressure enters by branch *a* to underside of main valve *b* and by duct *c* to underside of loose piston *e* and underside of balancing piston *p*. The object of balancing piston *p* is to maintain a constant operative pressure on auxiliary valve *d* as pressure varies in cylinder *g* with the opening and closing of valve *d*. The piston *j* balances any back pressure on valve *d*. On the steam pressure attaining the maximum pressure it opens up the valve *b* and also auxiliary valve *d*. On the auxiliary valve *d* being opened the steam in cylinder *g* over loose piston *e* is discharged into the atmosphere through the outlet branch *q*. The pressure over piston *e* being thus diminished, the initial pressure on the underside causes said piston *e* to move upward and by its piston rod *e'* to press against underside of main valve *b* and so increase its lift by compressing its loading spring *h* against the crosshead *r* supported by the standards *s* and so obtain a freer and fuller discharge of surplus steam. On the pressure diminishing in steam boiler the regulating or auxiliary valve *d* shuts down and pressure being equalized on both sides of loose piston *e* it drops away from contact with the main valve *b* which is closed by its loading spring *h* shutting it down.

What we do claim as our invention and desire to secure by Letters Patent, is:—

1. The combination of a valve casing having an inlet and outlet port, a main valve for closing and affording communication between the outlet and inlet ports, an auxiliary valve having a passage leading from the inlet port, and means adjacent to and

operable upon the main valve, said means being affected by the opening of the auxiliary valve to increase the amount of opening of the main valve.

2. The combination of a valve casing having an inlet and outlet port, a main valve for closing or affording communication between the outlet and inlet ports, a loose piston mounted on the main valve stem, an auxiliary valve having a passage leading from the inlet port, said casing having a passage extending from the auxiliary valve to the loose piston, said loose piston being affected by pressure when the auxiliary valve is opened to increase the amount of opening of the main valve.

3. The combination of a valve casing for steam boilers or the like, having an inlet and an outlet port, a main valve for closing or affording communication between the outlet and inlet ports, means operative on the main valve stem to normally prevent communication between the inlet and outlet ports, a piston loosely mounted in a guideway adjacent to the main valve stem, said casing having a passage leading from the inlet port to a point adjacent the loose piston, an auxiliary valve stem, means operative upon the said auxiliary valve stem to normally close the passage, the main and auxiliary valve stems being automatically unseated by an abnormal pressure, said unseating of the auxiliary valve stem tending to actuate the loose piston to increase the amount of opening of the main valve stem.

4. The combination of a valve casing for steam boilers or the like, having an inlet and an outlet port, a main valve for closing or affording communication between the outlet and inlet ports, means operative on the main valve stem to normally prevent communication between the inlet and outlet ports, a piston loosely mounted in a guideway adjacent the main valve stem, said casing having a passage leading from the inlet port to a point adjacent the loose piston, an auxiliary valve stem, said casing also having a chamber formed therein and a duct leading from the chamber to the atmosphere, a balanced piston on the auxiliary valve stem and movable in said chamber, means operative upon the said auxiliary valve stem to normally close the passage, the main and auxiliary valve stems being automatically unseated by an abnormal pressure, said unseating of the auxiliary valve stem tending to actuate the loose piston to increase the amount of opening of the main valve stem.

5. In safety valves the combination comprising a main valve, a loaded main valve piston rod, a floating piston adjacent and adapted to move the valve rod, a cylinder within the valve casing containing the

piston, a loaded auxiliary regulating valve, a balancing piston connected to the auxiliary valve, and steam passages leading to the underside of auxiliary valve and through it
5 to the underside of operating piston substantially as set forth.

In testimony whereof, we have signed our

names to this specification, in the presence of two subscribing witnesses.

JOHN AULD.

JOHN GRAHAM.

Witnesses:

JOHN SIME,

THOMAS BENNIE BROWNLIE.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents,
Washington, D. C."