(No Model.) 2 Sheets—Sheet 1.

G. WESTINGHOUSE, Jr.

BOILER FEEDER.

No. 290,507. Patented Dec. 18, 1883.

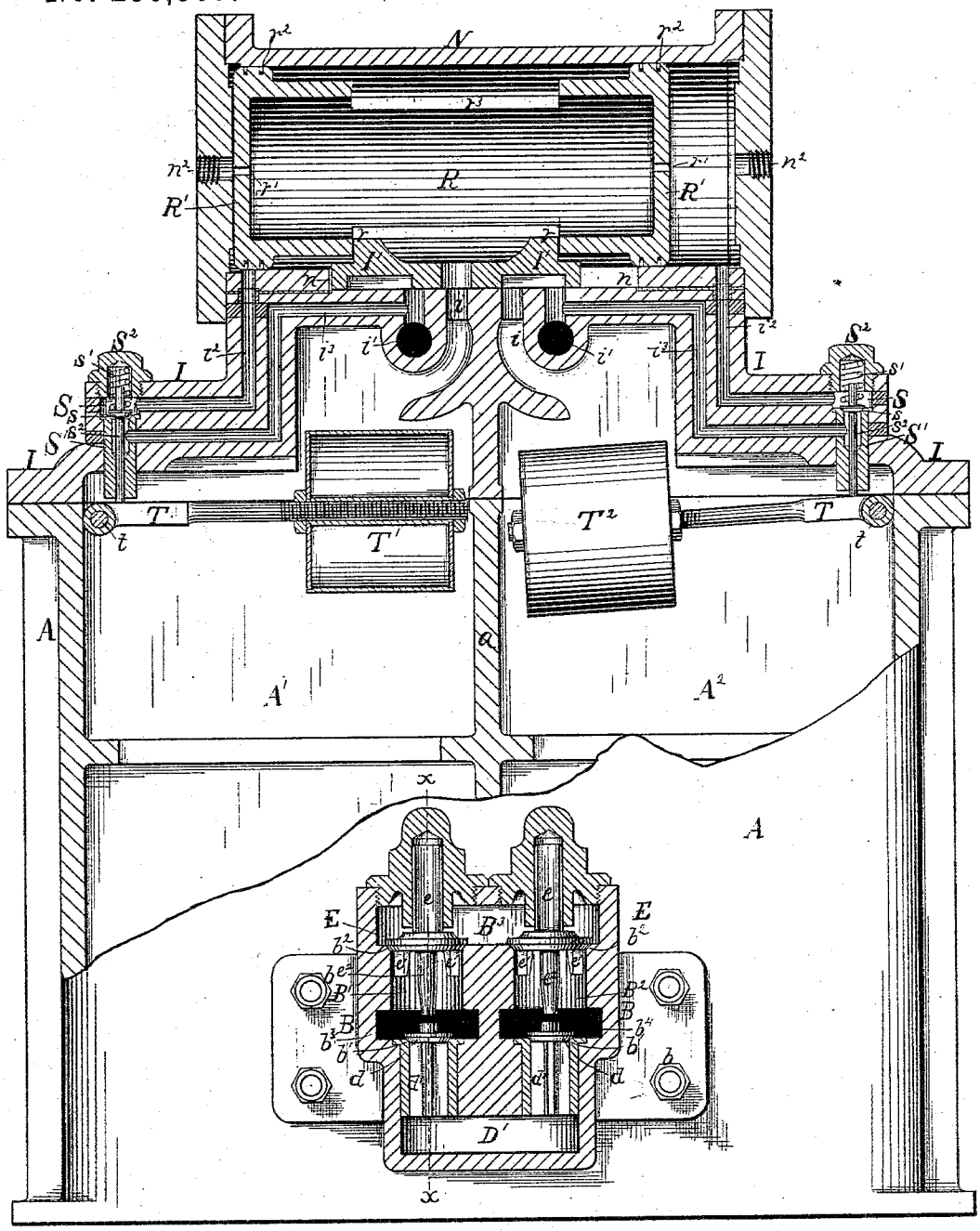

Fig. 1

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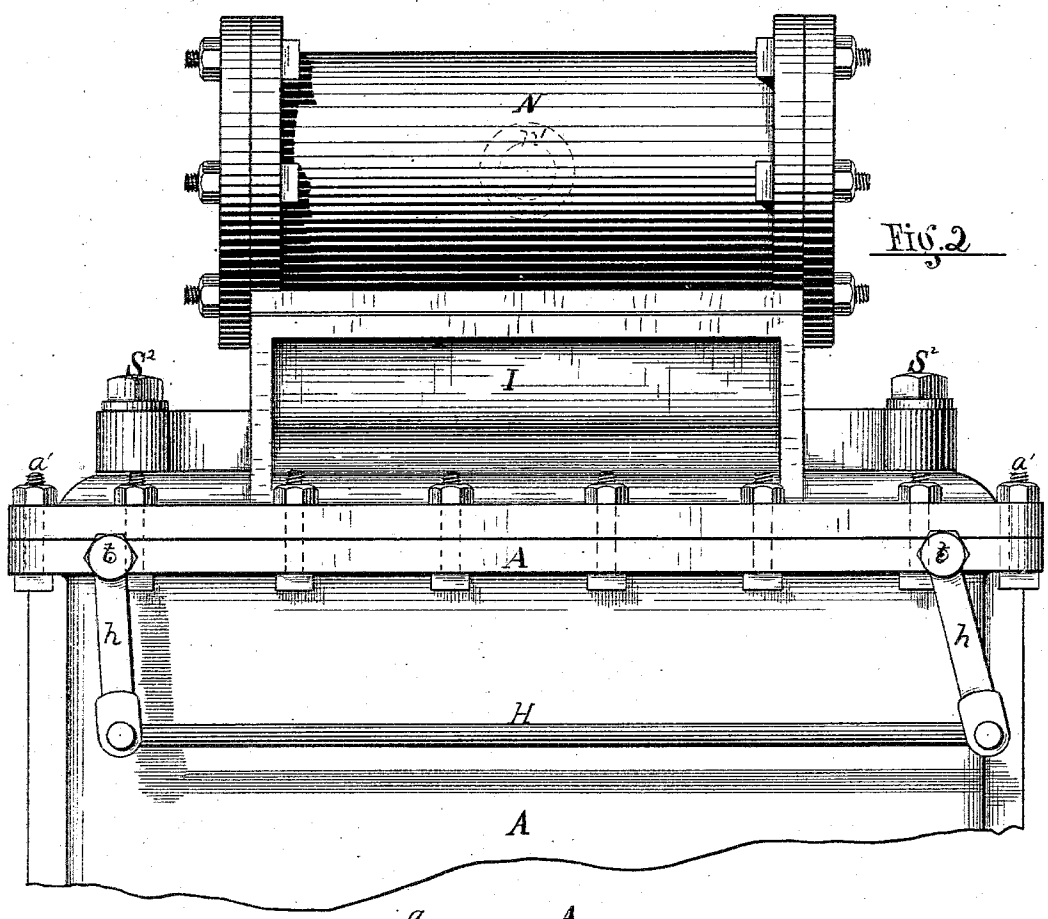

Fig. 2

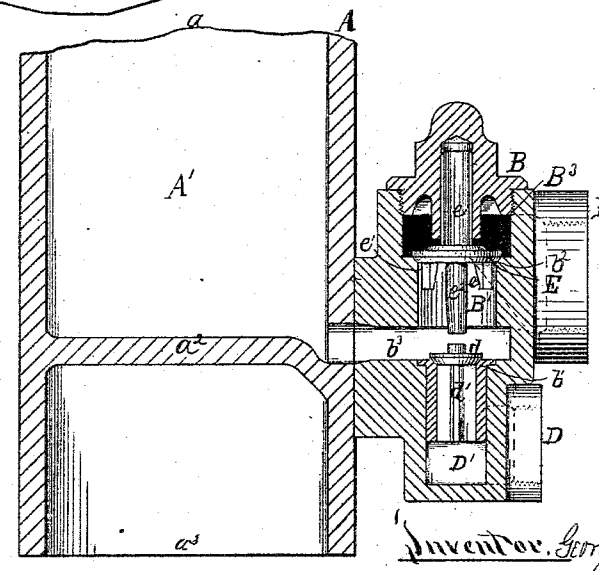

Fig. 3

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UNITED STATES PATENT OFFICE.

GEORGE WESTINGHOUSE, JR., OF PITTSBURG, PENNSYLVANIA.

BOILER-FEEDER.

SPECIFICATION forming part of Letters Patent No. 290,507, dated December 18, 1883.

Application filed September 3, 1883. (No model.)

To all whom it may concern:

Be it known that I, GEORGE WESTINGHOUSE, Jr., a citizen of the United States, residing at Pittsburg, county of Allegheny, State of Pennsylvania, have invented or discovered a new and useful Improvement in Boiler-Feeders; and I do hereby declare the following to be a full, clear, concise, and exact description thereof, reference being had to the accompanying drawings, making a part of this specification, in which—like letters indicating like parts—

Figure 1 is a view in sectional elevation of my improved mechanism. Fig. 2, Sheet 2, is a view in side elevation of the upper portion of the mechanism, and Fig. 3 is a transverse sectional view of the lower portion, the plane of section being indicated by the line $x x$, Fig. 1.

My invention relates to certain improvements in mechanism for automatically supplying water to steam-boilers; and in general terms it consists of certain combinations of two water-chambers having supply and discharge ports, the latter leading to the boiler, with valve mechanism for controlling the flow of water through such ports; valve-governed mechanism for admitting steam-supply automatically from the boiler to the water-chambers in succession, and valve mechanism controlled by water in the chambers for effecting movement of the steam-distributing valve, as hereinafter more fully described and claimed.

In the drawings, A represents a cast-metal shell or case, divided in a transverse vertical plane by a partition, *a*, into two separate chambers, A′ A². Provision is made for water supply to and discharge from each of these chambers, as follows: A valve-case, B, is bolted to the side of shell A, as at *b*, Fig. 1, such case having two valve-chambers, B′ B², therein, one of which, as chamber B′, communicates by passage b^3 with water-chamber A′, and the other, B², communicates by a similar passage, b^4, with water-chamber A². Water-supply to these chambers is from pipe D and common passage D′, by valve-governed ports *b′*, to the lower end of the valve-chambers; ordinary check-valves, *d*, guided by winged stems *d′*, being employed to close the ports *b′* by pressure or flow of water from within, but to open under pressure of the supply. This supply may be from any suitable source, as an elevated reservoir, street-mains, or the waste-water pipes of a steam-heating system, whereby water of condensation may be returned to the boilers, and the pressure of such supply should be sufficient to fill or nearly fill the chambers A′ A². Water-discharge from the chambers is from the upper end of valve-chambers B′ B² by valve-governed ports b^2 and common passage B³ to pipe B⁴, which leads to the boiler or boilers. In order to secure rapid discharge or flow of water to the boiler, this pipe should be comparatively large, and, if desired, any ordinary check-valve may be placed at any convenient point in its length to prevent escape from the boiler in case it may be desired for any cause to disconnect the feed-water mechanism. The ports b^2 are controlled by downwardly-seating check-valves E, adapted to open under pressure of water thereon from the chambers, but to close by pressure in the opposite direction. The valves are guided by stems *e* and wings or guides *e′*; also a downwardly-projecting stem or pin, e^2, from each valve E affords a stop to prevent excessive lift of supply-valves *d*.

In use, this mechanism is placed a little above the level of the boiler, so that water admitted to chambers A′ A², as above described, may flow, by gravity, from the chambers to the boiler. This can take place only when steam-pressure against such inflow is balanced or exceeded by pressure upon the water within chambers A′ A². In order to secure such balance of pressure, provision is made for admitting steam from the boiler to the upper part of each water-chamber, and automatically regulating supply and exhaust for each in succession. This is done as follows: A valve-seat, I, forming also a head or cap for the case A, is bolted to the latter, as at *a′*, Fig 2. Within the body of this seat or cap are made steam-supply ports *i i*, exhaust-ports *i′*, which may unite at one side of the seat, and communicate with a common discharge-pipe at any convenient point. Passages i^2 i^3 are also made in this seat or cap, the course and purpose of which will presently be described.

A slide-valve, I′, controls steam-passage through the ports *i i′*. In order to impart the desired movement to this valve, a cylinder,

N, is secured on the face of seat I, an opening, *n*, being made in the lower side of the cylinder-shell, to uncover the valve-seat proper. The upper part or body of the valve extends upward into this cylinder through the opening *n*, and also through an opening, *r*, in the shell of a tubular stem, R, which stem connects or unites two pistons, R′ R′, formed at either end. These pistons are packed, by preference, as at r^2, though they may be fitted loosely, if so desired. An opening, r^3, in the tubular stem permits steam to fill its interior, such steam being supplied from the boiler by any suitable pipe-connections—for example, as indicated by the dotted lines *n′*, Fig. 2. Small holes *r′* in the piston-heads R′ also provide for passage of steam, in comparatively small quantities, from the interior of stem R to the spaces in cylinder N outside of the pistons. The steam-passage thus afforded will suffice to preserve equilibrium of pressure on both sides of each piston, except when steam-escape may be caused from these end spaces. If such an escape is afforded, a preponderance of steam-pressure on the pistons in that direction will cause them to move toward such escape, thereby shifting the distributing-valve I′. In order to secure such escape and regulate the operation of the same automatically by the water in chambers A′ A^2, passages i^2 are made from either end of the cylinder N, through the body of cap I to valve-chambers S—one at or near either end of the cap. These chambers are closed above by screw-caps S^2, and below by tubular bushings S′, seated in the base of the chambers S, which bushings afford seats for valves *s*, such valves being seated by springs *s′*. Stems s^2 extend downward from the valves through the bushings S′, and rest at their lower ends upon or near pivoted arms T—one in each chamber A′ A^2. Hollow shells T′ T^2, or other form of float or weight, are connected to the free end of each arm T. As water rises in either chamber, these floats will be lifted thereby, thus raising the valves *s* from their seats, and opening steam-escape through the passages i^2 i^3, from the ends of cylinder N to the exhaust *i′*.

In operation, water is permitted to flow into one chamber—say the left-hand chamber A′—until it rises sufficiently high therein to raise the float T′, as represented in Fig. 1. As last above described, this movement of the float raises left-hand valve *s*, and thereby opens passage for escape of steam from left-hand end of cylinder N. Steam-pressure upon pistons R′ will then shift valve I′ to the left, admitting steam from the boiler through port *i* into chamber A′, above the water-level. Pressure of steam upon the water will balance steam-pressure in the opposite direction through pipe B^4. Consequently the water in chamber A′ will flow through the pipe into the boiler. The movement of valve I′ toward the left, as above described, also opens the right-hand chamber A^2 to the exhaust, thereby permitting escape of any steam which may have remained therein from a previous operation. Then, during the discharge of water from the chamber A′, the inflowing water passes through B^2 to chamber A^2. When water rises to a sufficient height in this chamber, the float T^2 will be raised, the right-hand valve *s* be opened, and the distributing-valve I′ will be shifted to the right, thereby admitting steam to chamber A^2 and exhausting it from chamber A′. Water will then flow from chamber A^2 to boiler, and inflowing supply will again be directed to chamber A′. These operations will be repeated through the chambers A′ A^2, in alternating succession, the time for each being determined by the rate of supply or the time required to fill the chambers sufficiently to raise their respective floats. If water-supply is afforded by condensation of steam from the boiler, the rate of flow or return into the boiler will correspond approximately to the rate of consumption or of condensation; or if supply is from other source, the rate of flow may be regulated in any suitable or convenient way.

Under ordinary conditions of use, the movements of the floats T′ T^2 will be free and certain, depending upon the rise and fall of water in their respective chambers. In order, however, to render their operation more uniform and certain, and also to balance the weight of one by the other, the arm pivots *t* are carried through the case A, (see Fig. 2,) and crank-arms *h* are fixed on or rigidly secured to their protruding ends. A rod, H, makes pivot or link connection between the free ends of arms *h*, whereby movement of one float in either direction will necessarily cause movement of the other float in the opposite direction; or, in other words, when one escape-valve is opened the other will be closed. By this provision any desired form of weights T′ T^2 may be used, because, being balanced one by the other, the water will be effective in moving them in like manner, as though they were truly floating bodies. I have referred to them as floats in the foregoing description, simply for convenience, but do not wish to be understood as limiting my invention to the use of a device which will float in water in the proper sense of that term. So long as the escape is held open steam will continue to escape, and the force of such steam or gravity alone may be relied on to close the escape-valves *s* when the floats are lowered. I do not wish, therefore, to limit my invention to the use of springs for seating these valves, because such springs may, if desired, be omitted.

In describing the escape-passages i^2 as communicating with the cylinder N at its ends, I do not wish to be understood as limiting my invention by such specific location, the purpose of such passages being to permit escape of steam from the outer side of the pistons to cause them to be moved toward the escape, and for this purpose the passages may communicate with the cylinder at different points

in its length. For example, they may enter the side of the cylinder far enough from its ends to be covered and closed by the pistons R′ when at the outer ends of their stroke, and thereby arrest escape of steam therethrough after the valve has received its movement. This result might be secured with the location of escape-ports shown, provided the rims of the pistons were full instead of beveled or chamfered, as shown. This feature of construction has reference principally to economy in use of steam, and is not an essential part of the invention.

In Fig. 3, I have shown the bottom a^2 of the water-chambers A′ A² level, or approximately so, with the water-passages b^2 b^4. If desired, this bottom may be lowered any desired distance below the water-passage—say to the bottom or base a^3—and thereby form a dead-water space, in which sediment might settle. I have also shown tapped holes n^2 in the heads or ends of steam cylinder or chamber N. These are designed for attachment of ordinary pet-cocks, in case it is desired to use the same. If they are not desired, the holes may be stopped with screw-plugs or in other convenient way.

Instead of the small vent-holes r' in pistons R′, equivalent grooves may be made in the surface of the cylinder-shell near the ends, which will afford the requisite passage of steam from the inner to the outer sides of the pistons; or, if the pistons are not packed, as above suggested, steam may pass their peripheries in sufficient quantity for the purposes stated; also, instead of the tubular stem R, any suitable or convenient connection may be made between the pistons and the valve, whereby the valve will, in effect, be moved or carried by the pistons and the pistons will be made to move in unison by difference of steam-pressure upon either. These and other like modifications in details of construction I consider and include herein as coming within my invention.

I claim herein as my invention—

1. A case inclosing two separate chambers with valve-governed water supply and discharge passages for each chamber, in combination with a steam-supply cylinder having ports communicating with both water-chambers, a valve for governing supply and exhaust of steam through such ports, two connected pistons movable within the cylinder and carrying the distributing-valve in their movement, and valve-governed passages for escape of steam from either end of the cylinder to effect movement of the pistons and distributing-valve, substantially as set forth.

2. A case inclosing two separate chambers with valve-governed water supply and discharge ports for each chamber, in combination with a steam-cylinder communicating with both water-chambers, a valve governing supply and exhaust of steam to and from each chamber, two pistons carrying the steam-distributing valve, such pistons being movable within the cylinder by unequal steam-pressure thereon, a valve-governed steam-escape passage communicating with each end of the cylinder, and a float or equivalent body in each chamber, such floats connected with and operative in opening the valves in the escape-valves by action of the water thereon, substantially as set forth.

3. The combination of case A′, having water-chambers A′ A² therein, cylinder N, valve I′, pistons R′, connected to and carrying the valve, escape-governing valves *s*, pivoted arms T, and floats T′ T², substantially as set forth.

4. The combination-case A, having chambers A′ A² therein, cylinder N, connected pistons R′, valve I′, escape-valves *s*, arms T, floats T′ T², and connecting-rod H, substantially as and for the purposes set forth.

5. In combination with two water-chambers and a steam-chamber, a valve governing supply of steam to and exhaust from the water-chambers, two pistons for operating the valve, such pistons being movable within the steam-chamber by difference of steam-pressure thereon, valve-governed escape-passages communicating with the steam-chamber, and mechanism for opening the escape-valves automatically by operation of the water in the water-chambers, substantially as set forth.

6. The combination of two water-chambers, A′ A², a distributing-valve governing supply of steam to and exhaust from said chambers, two pistons connected to and operative in moving the valve, a valve-governed escape for effecting unequal pressure upon the pistons, and a weight or equivalent body connected with and operative in opening the escape-valve by increase in the height of water, substantially as set forth.

In testimony whereof I have hereunto set my hand.

GEO. WESTINGHOUSE, JR.

Witnesses:
R. H. WHITTLESEY,
GEORGE H. CHRISTY.