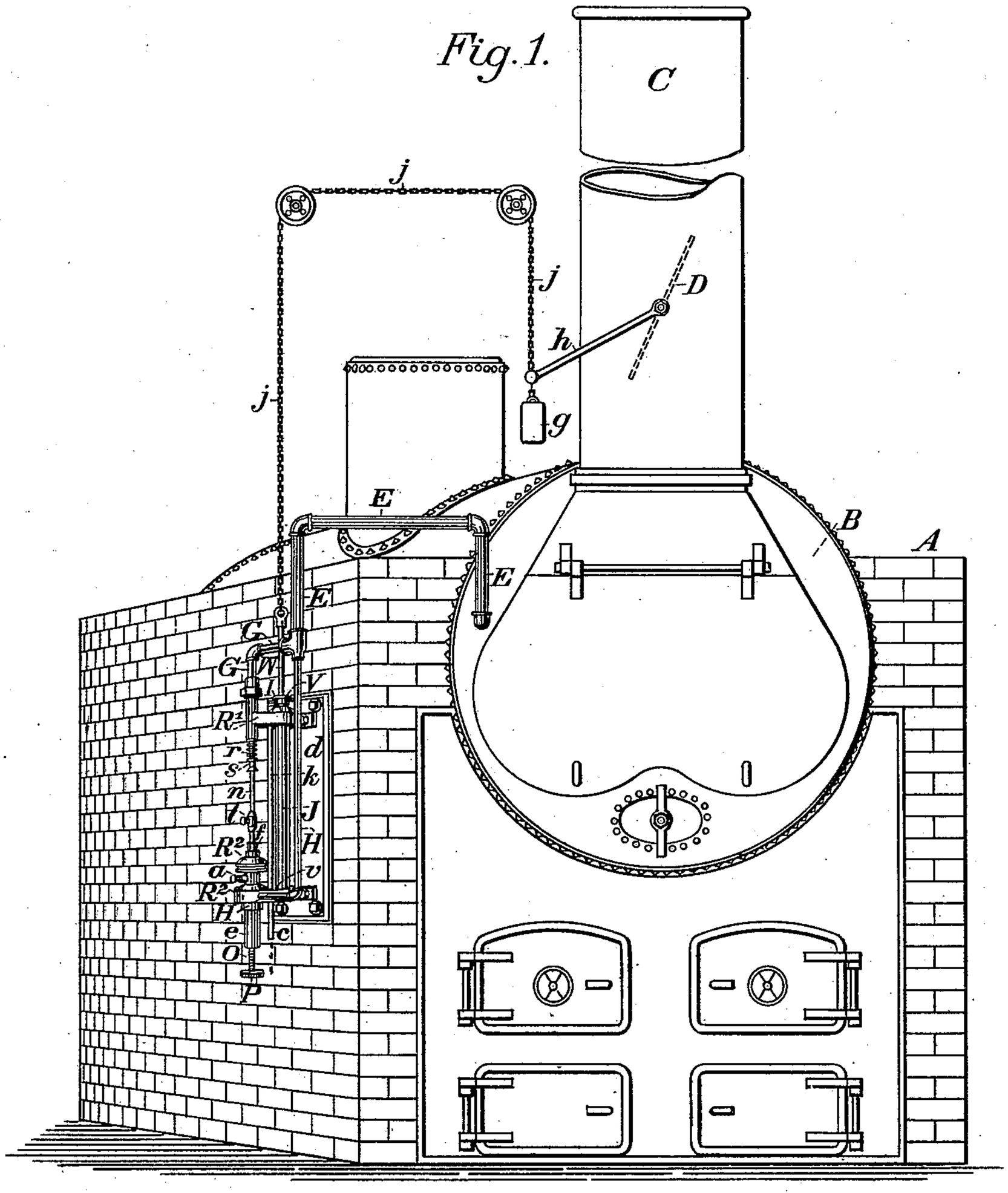
(No Model.) 2 Sheets—Sheet 1.

A. P. BURNHAM.

DAMPER REGULATING APPARATUS.

No. 538,150. Patented Apr. 23, 1895.

Fig. 1.



Witnesses:

E. A. Brandau

Nelson D. Bentz Jr.

Inventor:

Allen P. Burnham

By John Richards

Atty

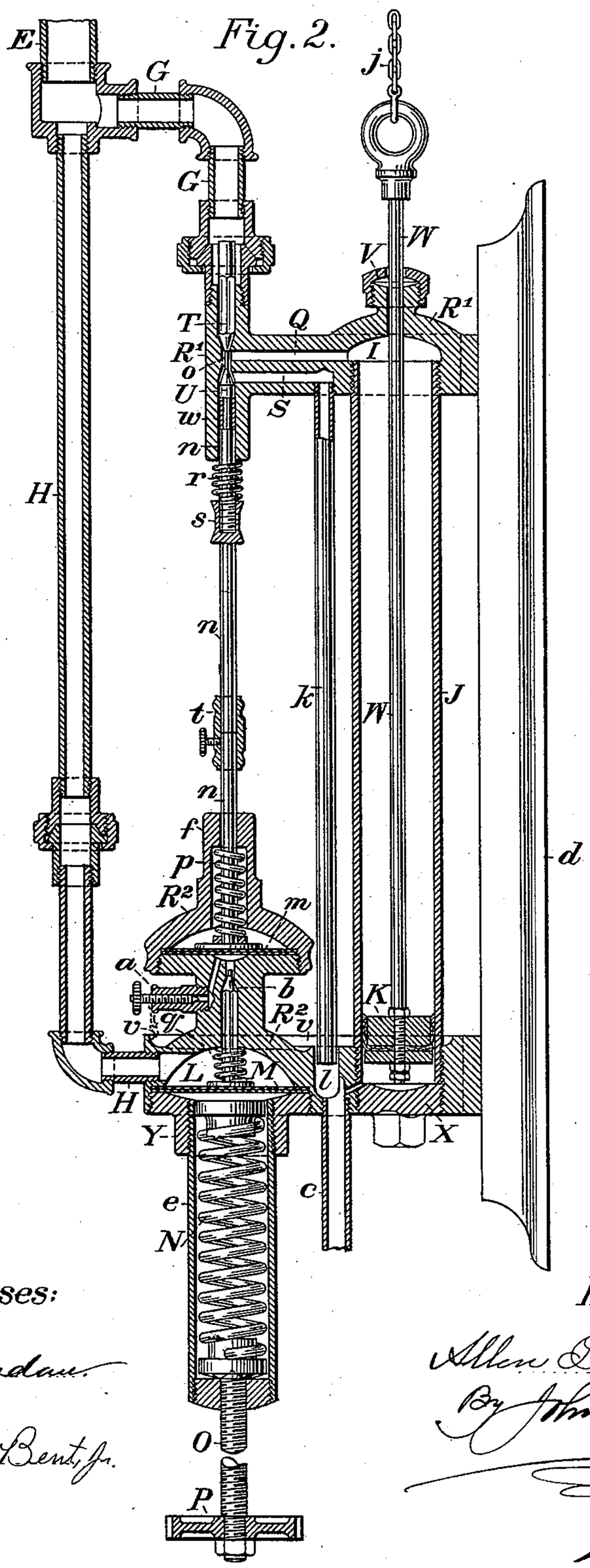
(No Model.) 2 Sheets—Sheet 2.

A. P. BURNHAM.

DAMPER REGULATING APPARATUS.

No. 538,150. Patented Apr. 23, 1895.

Fig. 2.



Witnesses:

E. A. Brandow.

Nilson D. Bent, Jr.

Inventor

Allen P. Burnham

By John Richards

Atty

UNITED STATES PATENT OFFICE.

ALLEN P. BURNHAM, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR TO WILLIS G. DODD, OF SAME PLACE.

DAMPER-REGULATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 538,150, dated April 23, 1895.

Application filed April 30, 1894. Serial No. 509,572. (No model.)

To all whom it may concern:

Be it known that I, ALLEN P. BURNHAM, a citizen of the United States, residing in the city and county of San Francisco, State of California, have invented certain new and useful Improvements in Damper-Regulating Apparatus; and I hereby declare the following specification and drawings therewith to be a full description of my improvements.

My invention relates to apparatus whereby the draft of steam furnaces is automatically controlled by the pressure of steam in the boiler, or by variations thereof, acting upon the valves controlling a piston that operates a damper in the chimney or flue.

My invention consists of a steam or water piston connected to the damper by suitable gearing, and controlled by valves deriving their action or motion from flexible diaphragms and a spring or springs, so a slight increase or decrease of boiler pressure at once opens or closes the damper accordingly.

The objects of my invention are to secure an automatic regulation of the fires, and consequent uniformity of steam pressure without the usual dependence upon a fireman or attendant, also to attain a more economic consumption of fuel, especially such as requires a measured amount of air for combustion.

Referring to the drawings: Figure 1 is an elevation of a common steam furnace with my improved damper-regulating apparatus applied thereto. Fig. 2 is an enlarged vertical section through the actuating apparatus for moving and controlling the damper and draft of the furnace.

Similar letters of reference indicate corresponding parts in both figures of the drawings.

Referring first to Fig. 1, the steam furnace A, boiler B, chimney C, and damper D, being of the usual construction and arrangement do not require further description here.

The damper-regulating apparatus, constituting the main part of my invention, is shown on the left, connected by the pipe E with the boiler B below the water line.

Referring to Fig. 2, the pipe E supplies water under boiler pressure to the two pipes G and H, the former leading when open to the passage Q, chamber I, and to the piston K in the cylinder J. The pipe H leads to the chamber L at the bottom, the water therefrom pressing continually on the flexible diaphragm M.

Opposing the diaphragm M, and the pressure thereon, is a coil spring N, the force of which is regulated by a screw O and the hand wheel P, so the action of this diaphragm, and consequent opening and closing of the damper D, can be adjusted to any desired point of pressure in the steam boiler, by means of the screw O and hand-wheel P, compressing or releasing the spring N accordingly.

Water or steam is admitted to the cylinder J and piston K, through the passage Q in the member R′, this latter forming integrally the upper head of the cylinder J, inlet passage Q, outlet passage S, seats and guides for the valves T and U and the gland V around the rod W, as seen in the drawings.

The member R^2 at the bottom forms a support for the lower end of the cylinder J, sockets or seats for the plug X, flange Y of the spring containing tube *e*, waste valve *a*, guide and seat for the valve *b*, waste pipe *c*, housing *f* and other connected details, the two members R′ R^2 constituting a supporting frame for the several parts, and are connected by flanges to a wall plate *d* to permit convenient erection, as shown in Fig. 1.

Referring now to the manner of operating, and supposing the pipes E, H and G to be filled with water at the same pressure as the boiler B, and that the spring N is so adjusted that the diaphragm M is in the position shown in Fig. 2; the valves T and *b* will then be closed and the valve U opened. The weight *g*, acting on the lever *h*, chain *j* and rod W, raises the piston K, opening the damper D and increasing the draft in the furnace.

When piston K rises, the water contained in the cylinder J is forced out through the passage Q, passes the valve U, into the passage S, and down the pipe *k*, escaping at the waste pipe *c*. The damper D remains open until the steam pressure so increases that the pressure in the chamber L and on the diaphragm M exceeds the force of the spring N. Then the diaphragm M, to which is attached the valve *b*, sinks, opening this valve *b*, permitting water to enter beneath the second diaphragm *m*, raising that, and with it the

stem or rod *n* and the valve U. When this valve U is raised and seated, it closes the exhaust passage S, and at the same time, by reason of the abutting extensions *o* on the inner ends of the two valves U and T, raises the latter, admitting steam or water from the pipe G through the passage Q and chamber I into the cylinder J and to the piston K, forcing that down, and by the connecting gearing before described raises the weight *g*, turning the lever *h*, closing the damper D. Instead of the weight *g*, a coil or other spring can be employed, a weight being preferable because of simplicity.

When the steam pressure falls the diaphragm M rises, because of the force of the spring N exceeding the steam pressure on top of the diaphragm, the valve *b* is closed, and the water contained beneath the diaphragm *m* escapes through the adjustable waste cock *a*, permitting the diaphragm *m* to sink, opening the valve U and closing the one T, so the weight *g* again acting as before described, opens the damper D.

The leak-off valve *a* is open continually, but wastes only an inconsiderable amount of water when the valve *b* is open and as the cavity or chamber beneath the diaphragm is small but a short time is required to empty the chamber beneath this diaphragm *m* and permit the latter to sink when the valve *b* closes. This valve *a* is adjusted so as to permit the escape of water and resulting movement of the diaphragm *m* and of the valves U and T in some predetermined period of time and as the circumstances of use may demand.

The diaphragms M and *m* are provided with springs *p* and *q* to assist in the downward or closing movement, and a spring *r* is applied on the rod or stem *n* for the purpose of forcing downward and opening the valve U when the lower section of the rod descends by means of the diaphragm *m*.

The rod *n* is in three sections, the upper section made integral with the valve U, being separable at the socket *s*, which also answers as a means of adjustment for length; and the middle section is removable by means of the sliding sleeve or coupling *t*. By loosening the screw socket *s* and sliding the coupling downward, the middle and upper sections of this rod *n* can be removed without disturbing other parts.

To prevent the escape of water or steam from the valve U downward around the stem *n*, I provide a packing *w*, inserted in a channel around the stem in the usual manner.

The waste water escaping from beneath the piston K, the valve *a*, or from leaks in any part, is caught by the cup-flange *v*, extending around the member R^2, connecting with the waste pipe *c* by means of a space left around the bottom of the pipe *k*, and a chamber or pocket *l*, as shown in the drawings Fig. 2.

As the actuating pressure in the cylinder J has no relation to the boiler pressure, requiring only force to operate the damper D and the connecting gearing, the supply in the pipe G instead of being taken from the pipe E and the boiler B can be drawn from any source of water under pressure, the operation remaining the same so long as the area and consequent force of the piston K is in proportion to the pressure and work performed.

The effective area of the valves T, U, and *b*, is made small so as to offer no considerable resistance in opening or closing, and to produce a tardy flow and action which is desirable in apparatus of this kind.

Having thus described the nature and objects of my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a damper regulating apparatus, the combination of a damper, a fluid pressure motor connected thereto, inlet and outlet valves for said motor, the fluid passages in which the valves are situated, a flexible diaphragm which is subjected to steam or water pressure, and is connected to the stem of said valves, a second flexible diaphragm exposed to the boiler pressure, intermediate valve means between the diaphragms so that they may act interdependently, and means for automatically opening the damper when required, substantially as described.

2. In a damper regulator, the combination of the damper, a fluid pressure motor connected thereto, inlet and outlet valves for said motor, the pipes or passages in which the valves are situated, two flexible diaphragms, one of which is connected with and operates intermittently to actuate the valves, and the other of which is subjected continually to boiler pressure on one side and to an adjustable pressure on the other side, so that it may move with the variations of steam pressure, an inlet valve between the diaphragms and operated by one of them for the purpose of admitting steam or water to the other, substantially as described.

3. In a damper regulator, the combination of a damper controlling the draft of a steam furnace, an actuating piston or diaphragm connected thereto, a cylinder containing the piston, separate outlet and inlet valves therefor, consisting of vertically-aligned abutting pointed plugs, passages in which they are located, a valve stem, a flexible diaphragm which operates said valve-stem and valves in one direction and a spring or springs arranged to operate in the other direction, and a second diaphragm exposed constantly to the boiler pressure and carrying a valve device for admitting pressure to the other diaphragm, substantially as described.

4. In a damper regulator, a damper controlling the draft of a steam furnace, a fluid pressure motor connected to and controlling the damper, inlet and outlet valves for said motor, passages in which the valves are located, a flexible diaphragm moved in one direction by steam or water pressure for operating said valves, said diaphragm being moved in the other direction by the thrust of

the valve-stem an adjustable waste valve or cock to permit the escape of water or steam from beneath the flexible diaphragm when the supply is cut off, and means for controlling the supply of fluid pressure to the said diaphragm, substantially as described.

5. In a damper regulator, the combination of a damper to control the draft of a steam furnace, a fluid pressure motor connected thereto, inlet and outlet valves for controlling said motor in the manner described, fluid passages controlled by said valves, a flexible diaphragm which is subjected to steam or water pressure for operating said valves, an adjustable waste valve or cock to permit the escape of water or steam from beneath said flexible diaphragm when the supply is cut off, a second flexible diaphragm exposed to the boiler pressure and an intermediate valve between the two diaphragms for permitting the fluid pressure to pass from one to the other, substantially as described.

6. In a damper regulator, the combination of a damper to control the draft of a steam furnace, a fluid pressure motor connected thereto, inlet and outlet valves controlling it in the manner described, passages in which the valves are situated, two flexible diaphragms superimposed one above the other and communicating through an intermediate passage, a valve in said passage connected to and operated by the lower diaphragm, a valve stem for the aforesaid inlet and outlet valves which is operated by the upper diaphragm, and means for supplying steam or water at boiler pressure to the lower diaphragm, substantially as described.

7. In a damper regulator, the combination of a damper to control the draft through the furnace, a fluid pressure motor connected thereto, inlet and outlet valves for said motor, passages in which the valves are situated and which they control, two flexible diaphragms one of which actuates the valves, and the other of which is exposed continually to boiler pressure on one side, an adjustable spring device for applying pressure to the other side of said diaphragm, an inlet valve between the two diaphragms, an escape valve for the actuating diaphragm, means for automatically opening the damper, and passages leading from the boiler to the diaphragm and also to the motor, substantially as described.

8. In a damper regulator, the combination of a damper to control the draft through the furnace, a cylinder, a piston moving therein and connected with the damper, a diaphragm to be affected by variations in the boiler pressure, a valve actuated thereby to admit motive fluid to the cylinder a second valve also actuated by the diaphragm to release the motive fluid from the cylinder, and means for communicating the variations of boiler pressure to the diaphragm, consisting essentially of a second diaphragm and an inlet valve operated thereby, substantially as described.

9. The combination of a damper for controlling the draft of a steam furnace, a fluid pressure motor connected thereto and having inlet and outlet passages, the inlet and outlet valves controlling said passages, a diaphragm movable in one direction by steam or water pressure and connected to the stem which operates said valves, said diaphragm being moved in the other direction by yielding devices on the stem, a chamber for said diaphragm having an escape valve, another diaphragm exposed constantly on one side to boiler pressure, a passage leading thereto from the boiler, a yielding mechanical device on the other side of said diaphragm, and a spring-provided valve carried thereby and situated in a passage between said diaphragm and the other diaphragm, substantially as described.

In testimony whereof I have hereunto affixed my signature in the presence of two witnesses.

ALLEN P. BURNHAM.

Witnesses:
ALFRED A. ENQUIST,
JAS. C. H. FERGUSON.