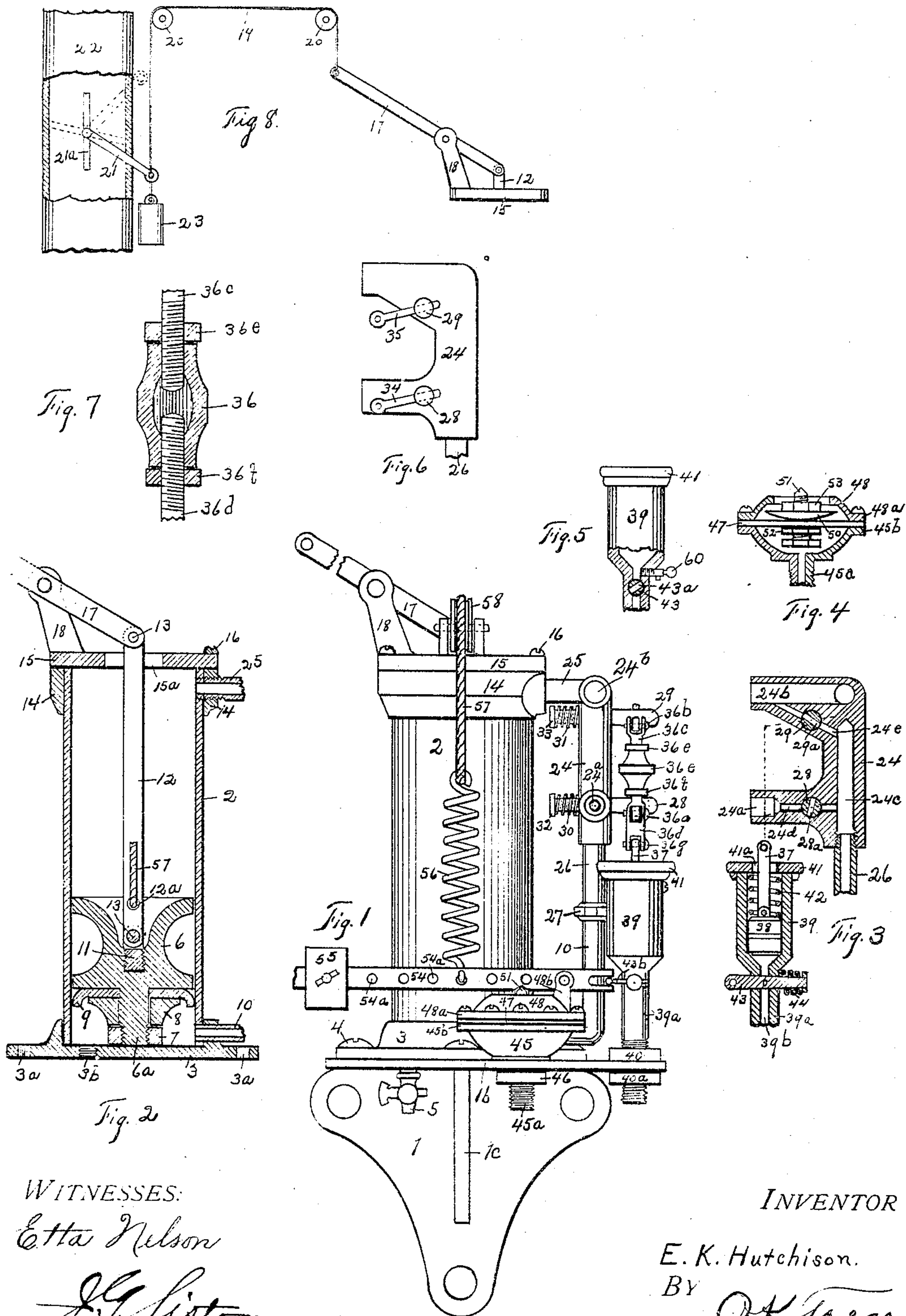


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E. K. HUTCHISON.
DAMPER REGULATOR.
APPLICATION FILED AUG. 3, 1903.

NO MODEL.



WITNESSES:

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DAMPER-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 774,179, dated November 8, 1904.

Application filed August 3, 1903. Serial No. 168,073. (No model.)

To all whom it may concern:

Be it known that I, EPHRAIM K. HUTCHISON, a citizen of the United States, residing at Denver, in the county of Denver and State of Colorado, have invented certain new and useful Improvements in Damper-Regulators, of which the following is a specification.

My invention relates to improvements in steam-boiler-furnace-damper regulators.

The object of my improvements is to provide a compact and inexpensive device of the character hereinafter more fully described, having all its various parts accessible, and which will when used in connection with a steam-boiler automatically operate in accordance with the varying pressure of steam to open or close the damper or dampers in the furnace, smoke-stack, or otherwise, and thereby regulate the draft in such manner as to control the pressure of steam in the boiler.

In the accompanying drawings, Figure 1 is a view in elevation of my improved damper-regulator secured to a bracket; Fig. 2, a vertical section of the main cylinder and piston working therein; Fig. 3, a detail view in vertical section of a casing and an auxiliary cylinder connected therewith; Fig. 4, a view in elevation of the diaphragm and its chamber, the latter being in section; Fig. 5, a view in elevation of the auxiliary cylinder, a lower portion of same being broken away to show its valve in section; Fig. 6, a detail in side elevation of the casing shown in section in Fig. 3; Fig. 7, a view of a turnbuckle, shown in section and on an enlarged scale; and Fig. 8, a view, partly in elevation and partly in section, showing the manner of connecting my device with a damper.

Referring to the drawings in detail, 1 represents a bracket adapted to be secured to a wall or other support and comprising a shelf to which is secured my invention proper. The latter consists, in part, of a main upright cylinder 2, having a base 3, secured to the bracket-shelf 1^b by means of bolts 4. On the under side of the shelf is a cock 5, which is screwed into an opening 3^b in the cylinder-base 3 and through which water may be drained from the cylinder. Within the cyl-

inder is a piston 6, having a lower extension 6^a threaded on its outer end to receive a nut 7, which holds in place the washer 8 and the flexible cup 9, the latter being made, preferably, of leather or rubber, the rim of which is adapted to press closely against the interior walls of the cylinder 2 to prevent water or other fluid which enters the cylinder 2 through pipe 10 from passing the piston 6. In the upper side of the piston is a threaded opening into which is screwed a plug 11, to which is hinged the lower end of a piston-rod 12 by means of a pivot-pin 13, which passes through the end of the piston-rod 12 and the plug 11. Suitably secured to the upper end of the cylinder 2 is a collar 14, to the upper edge of which a cap or head 15 is secured by means of screws 16. Said cap 15 has a central aperture 15^a, through which extends and works the piston-rod 12, to the upper end of which is hinged one end of a lever 17, fulcrumed between two arms or supports 18, projecting from the cap 15. Secured to the outer end of the lever 17 is a cord or chain 19, which passes over the pulleys 20 and has its opposite end secured to the lever 21 of the damper 21^a in the smoke-stack 22. Said damper is normally held in an open position by means of a weight 23, suspended from the outer end of the damper-lever 21. Located adjacent to the upper right-hand portion of the cylinder 2, as shown in Fig. 1, is a casing 24, which has an inlet 24^a, adapted to be connected to any available supply of fluid under pressure, preferably the water or steam in the boiler in which the pressure is to be controlled. Said casing has also an exhaust 24^b and a chamber 24^c, the rear end of the former communicating with the upper end of the cylinder 2 through pipe 25, the chamber 24^c being connected to and communicating with the lower end of the cylinder 2 through pipes 26 and 10, the adjacent ends of which are connected to each other by a union 27. Said chamber 24^c is connected also with inlet 24^a and exhaust 24^b through inlet-passage 24^d and exhaust-passage 24^e, respectively. These passages are controlled by means of an inlet-valve plug 28 and an exhaust-valve plug 29, respectively, which valve-plugs extend

through the casing 24 transversely to and intersect the inlet and exhaust passages 24^d and 24^e, respectively. Said inlet and exhaust valve plugs have, respectively, ports 28^a and 29^a, which are adapted to extend transversely to or to communicate with said inlet and exhaust passages 24^d and 24^e, respectively. Said valve-plugs 28 and 29 and their seats are tapering, the former being held in place by coil-springs 30 and 31, which are held under tension between the exterior of the casing 24 and the nuts 32 and 33, secured to the smaller ends of the valve-plugs 28 and 29, respectively, thus making the valves self-adjustable as to wear. The opposite or large ends of the valve-plugs are provided with transverse arms or levers 34 and 35, respectively, which are adapted to partially rotate the valve-plugs 28 and 29 and which have their outer ends hinged to a turnbuckle by means of the pins 36^a 36^b. Said turnbuckle consists of a sleeve 36, having its ends interiorly threaded with right and left hand threads to receive the threaded ends of the rods 36^c 36^d, carrying lock-nuts 36^e 36^f. The lower end of the turnbuckle is hinged at pin 36^g to the upper end of an auxiliary piston-rod 37, which has its lower end hinged to a piston-head 38, operating in an auxiliary cylinder 39, having a lower tubular extension or stem 39^a, the lower end of which is exteriorly threaded, passed through a suitable opening in the bracket-shelf, and secured thereto by means of lock-nuts 40 and 40^a. Said extension is adapted to be connected with any available supply of fluid under pressure, preferably with the water or steam in the boiler to which the device is attached. The auxiliary cylinder has secured to its upper end a head 41, having a central aperture 41^a, through which extends the auxiliary piston-rod 37, surrounding which, between the cap 41 and the piston 38, is a spiral spring 42, adapted to cause the piston 38 to return to the lower end of its cylinder after the pressure is cut off below the piston. This cutting off is effected by the tapering valve-plug 43, extending transversely through the auxiliary cylinder-stem 39^a, intersecting the passage 39^b in the latter and having a port 43^a, adapted to extend transversely to or to communicate with the said interior passage 39^b in the stem 39^a. Said valve-plug 43 is held in place by a spiral spring 44 in the same manner as are valve-plugs 28 and 29 and is in the same manner adjustable as to wear. The opposite or large end of said valve-plug 43 is provided with a transverse arm or lever 43^b, adapted to partially rotate said valve-plug 43. Located to the left of the auxiliary-cylinder stem 39^a is a diaphragm-casing 45, having an exteriorly-threaded downward extension or tubular stem 45^a, extending through and secured by means of nut 46 to the shelf 1^b and adapted to be connected with the water in the boiler in which pressure is to be maintained.

The casing 45 is provided with a top 48, having a flange 48^a, which is secured to an annular flange 45^b on the upper part of the casing 45. Between these flanges is stretched a diaphragm 47, consisting of a flexible disk of rubber or the like, the edge of which is secured between said flanges 45^b and 48^a. Said diaphragm supports a bearing 50 and an adjustable threaded post 51. The latter passes through said bearing and the diaphragm. Nuts 52 and 53 on the post serve to adjust the latter and hold the bearing in place. The upper end of the post extends above the top of the casing 48 and is borne upon by a horizontal lever 54, which is fulcrumed near its right-hand end on post 48^b, projecting upwardly from the casing. On the said lever to the left of post 51 is placed a slidable weight 55 to regulate the pressure of the lever upon the post. The opposite end of the lever 54 is bifurcated and is adapted to engage and to operate lever 43^b. In lever 54 are several openings 54^a, adapted to receive the hooked lower end of a spiral spring 56, which has its upper end connected with a cord 57, which passes over a pulley 58, supported above the cylinder-cap 15, and has its opposite end secured in the opening 12^a in the piston-rod 12. After my improved damper-regulator has been properly secured in place and suitable connections made as described its operation is as follows: As the pressure in the boiler increases and the water therefrom, acting upon the diaphragm, tends to raise the weighted end of lever 54 the weight 55 is adjusted so as to balance whatever pressure it is desired to maintain—say ninety-five pounds to the square inch. Then any appreciable increase in the pressure—say ninety-six pounds—will lift the diaphragm, raise the weighted end of lever 54, and lower its opposite end and the adjacent end of the lever 43^b, thus turning the valve-plug 43 so that its port 43^a communicates with the passage 39^b in the auxiliary-cylinder stem, thus permitting the fluid to enter the auxiliary cylinder 39 and lift the auxiliary piston 38, which operates to close the exhaust-valve 29 and open the inlet-valve 28. The operation described taking place, the water from the boiler passes through the inlet-passage 24^d into chamber 24^c, thence through pipes 26 and 10 into the lower end of the main cylinder 2 and lifts the main piston 6, which operates the lever 17 and the cord or chain 19 to close or partially close the damper 21^a. As the piston 6 ascends it gradually lessens the tension of spring 56, which is equivalent to increasing the load represented by the weight 55, causing the lever 54 to gradually return to its normal position, and thereby closing valve 43. As there is a slight leakage past auxiliary piston 38, the latter is gradually forced downward by the spring 42, thus gradually closing inlet-valve 28, and thereby arresting motion of the main piston 6, incidentally holding the damper 21^a in its

adjusted position and gradually opening the exhaust-valve 29, thus allowing the water from the main cylinder 2 to escape there-
 5 through as the damper-weight 23, pulling up-
 wardly the outer end of lever 17 and depress-
 ing its opposite end, pushes the main piston
 6 downward and opens the damper. If the
 leakage past auxiliary piston 38 is not rapid
 enough, a small cock 60 (shown in Fig. 5) may
 10 be employed to control said leakage and may,
 if desired, be operated mechanically in such
 manner as to open when valve 43 closes or to
 close when the latter valve opens. By ex-
 15 periment the action of the parts, as above de-
 scribed, takes place with from one to two
 pounds excess pressure above the normal or
 predetermined point. If before piston 6 de-
 scends to bottom of cylinder the pressure
 20 should again increase, the diaphragm will
 again rise and the whole operation be repeat-
 ed, thus lifting the main piston another step
 of its stroke or perhaps to the top of the cyl-
 25 nder and nearly or entirely closing the dam-
 per, after which the pressure will presently
 fall, and as it does so the diaphragm and the
 lever 54 will return to their normal positions,
 opening exhaust-valve 29 and allowing weight
 23 to again open damper, as previously de-
 30 scribed. As the piston 6 descends and dimin-
 ishes the load on the lever 54 by increasing
 the tension of the spring 56 the pressure, if
 still high, may again raise the diaphragm,
 close exhaust-valve 29, and temporarily arrest
 the descent of the main piston 6 until there is
 35 a further fall in pressure. Then the exhaust-
 valve will again open and allow the piston 6
 to continue its descent and the damper to open
 farther until the pressure again rises and the
 operations described will be repeated.

40 The number of pounds the pressure is al-
 lowed to rise after the main piston 6 begins
 to ascend is largely determined by the lifting
 power of the spring 56 on lever 54, said lift-
 ing power varying according to the distance
 45 from the fulcrum-pin 54^b that the spring 56
 is attached to the lever 54. By disconnecting
 the spring 56 from said lever the action is
 positive and on a very fine variation not ex-
 ceeding two pounds of pressure. The lap of
 50 the valves 28 and 29 is adjusted by means of
 the turnbuckle 36. The construction of the
 entire device is such that all working parts
 are accessible for examination or repairs.

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

1. A steam-boiler-furnace-damper regulator
 comprising a main cylinder having therein a
 piston adapted to be connected with and on its
 60 outward stroke to close a furnace-damper, a
 weight adapted to cause the return stroke of
 the piston and to open the damper, a supply-
 pipe adapted to conduct fluid under pressure
 from a boiler to the lower end of the main
 65 cylinder and having an inlet-valve adapted to

control the flow of said fluid, said pipe com-
 municating also with an exhaust-passage hav-
 ing an exhaust-valve adapted to control the
 flow of fluid from said cylinder through said
 exhaust-passage thereby controlling the re- 70
 turn stroke of said piston, each of said valves
 having a transverse arm projecting therefrom,
 a turnbuckle hinged to the outer ends of said
 arms and adapted to adjust the relative posi- 75
 tions of said inlet and exhaust valves, an aux-
 iliary cylinder having therein a piston hinged
 to said turnbuckle and adapted to operate
 said valves, a feed-pipe adapted to conduct
 fluid under pressure from a source of supply 80
 to the auxiliary cylinder and having a valve
 adapted to control the flow of said fluid, a
 pressure-chamber adapted to communicate
 with a boiler and having a flexible diaphragm
 responsive to the pressure of the fluid in the
 boiler, a loaded lever fulcrumed above and op- 85
 erated from said diaphragm and in turn adapt-
 ed to operate the valve of the auxiliary cyl-
 nder, and an adjustable yielding means con-
 necting said loaded lever with the piston in
 the main cylinder. 90

2. A steam-boiler-furnace-damper regulator
 comprising a main cylinder having therein a
 piston adapted to be connected with and to
 close a furnace-damper, means adapted to cause
 the return stroke of the piston and to open 95
 the damper, a supply-pipe adapted to conduct
 fluid under pressure from a boiler to the lower
 end of the main cylinder and having an inlet-
 valve adapted to control the flow of said fluid,
 said pipe communicating also with an exhaust- 100
 passage having an exhaust-valve adapted to
 control the flow of fluid from said cylinder
 through said exhaust-passage, each of said
 valves having a transverse arm projecting
 therefrom, a turnbuckle hinged to the outer 105
 ends of said arms and adapted to adjust the
 relative positions of said inlet and exhaust
 valves, a cylinder having therein an auxiliary
 piston hinged to said turnbuckle and adapt-
 ed to operate said valves, a feed-pipe adapted 110
 to conduct fluid under pressure from a source
 of supply to the auxiliary cylinder, a valve
 adapted to control the flow of the fluid through
 the feed-pipe, a pressure-chamber adapted to
 communicate with a boiler and having a flexi- 115
 ble diaphragm responsive to the pressure of
 the fluid in the boiler, and a loaded lever ful-
 crumed above and operated from said dia-
 phragm and in turn operating the valve of the
 auxiliary cylinder. 120

3. A steam-boiler-furnace-damper regulator
 comprising a main cylinder having therein a
 piston adapted to be connected with and to
 close a furnace-damper, a supply-pipe adapt-
 ed to conduct fluid under pressure from a 125
 boiler to the lower end of the main cylinder,
 an inlet-valve adapted to control the flow of
 said fluid, said pipe communicating also with
 an exhaust-passage having an exhaust-valve
 adapted to control the escape of fluid from 130

said cylinder, each of said valves having a transverse arm projecting therefrom, a turnbuckle connecting the outer ends of said arms, an auxiliary cylinder having therein a piston
 5 connected with said turnbuckle and adapted to operate said valves, a feed-pipe connected with the auxiliary cylinder and adapted to be connected with a supply of fluid under pressure, a valve adapted to control the flow of
 10 the fluid through the feed-pipe, a pressure-chamber adapted to communicate with a boiler and having a flexible diaphragm responsive to the pressure of the fluid in the boiler, and a loaded lever fulcrumed above and operated
 15 by means connecting it with the diaphragm and in turn operating the valve of the auxiliary cylinder.

4. In a steam-boiler-furnace-damper regulator, a main cylinder having therein a piston
 20 adapted to be connected with and to operate a furnace-damper, a supply-pipe adapted to conduct fluid under pressure to the main cylinder, an inlet-valve plug adapted to control the flow of the fluid through the feed-pipe, an
 25 exhaust-passage communicating with the main cylinder, an exhaust-valve plug adapted to control the flow of fluid through the exhaust-passage and consequently the return stroke of the piston, a transverse arm projecting from
 30 each of said valve-plugs, means connecting the arms and adapted to relatively adjust the rotative positions of the valve-plugs, an auxiliary cylinder having therein a piston connected with said means and adapted to partially rotate
 35 said valve-plugs, a feed-pipe adapted to conduct fluid under pressure to the auxiliary cylinder, a valve-plug adapted to control the flow of the fluid through the feed-pipe, a pressure-chamber adapted to communicate with a
 40 boiler and having a flexible diaphragm responsive to the pressure of the fluid in the boiler, and a loaded lever operated by means connecting it with the diaphragm and adapted to operate the valve-plug of the auxiliary cylinder.

45 5. In a steam-boiler-furnace-damper regulator, a main cylinder having therein a piston adapted to be connected with and to operate a furnace-damper, a supply-pipe adapted to conduct fluid under pressure to the main cylinder, an inlet-valve plug adapted to control
 50 the flow of the fluid through the supply-pipe, an exhaust-passage communicating with the main cylinder, an exhaust-valve plug adapted to control the flow of fluid through the exhaust-passage and consequently the return stroke of the piston, means connecting the
 55 valve-plugs and adapted to relatively adjust

their rotative positions, an auxiliary cylinder having therein a piston connected with said means and adapted to operate said valve-plugs, 60 a feed-pipe adapted to conduct fluid under pressure to the auxiliary cylinder, a valve-plug adapted to control the flow of the fluid through the feed-pipe, a pressure-chamber adapted to communicate with a boiler and having a flexible diaphragm responsive to the pressure in the boiler, and a loaded lever operated by means connecting it with the diaphragm and adapted to operate the valve-plug
 70 of the auxiliary cylinder.

6. In a steam-boiler-furnace-damper regulator, a main cylinder having therein a piston adapted to be connected with and to operate a furnace-damper, a supply-pipe adapted to conduct fluid under pressure to the main cylinder, an inlet-valve adapted to control the flow of the fluid through the supply-pipe, an exhaust-passage communicating with the main cylinder, an exhaust-valve adapted to control the flow of fluid through the exhaust-passage
 80 and consequently the return stroke of the piston, means connecting the valves, an auxiliary cylinder having therein a piston connected with said means and adapted to operate said valves, a feed-pipe adapted to conduct fluid
 85 under pressure to the auxiliary cylinder, a valve adapted to control the flow of the fluid through the feed-pipe, and means responsive to the pressure in the boiler and adapted to operate the latter valve. 90

7. In a device of the character stated, a main cylinder having therein a piston, a supply-pipe adapted to conduct fluid under pressure to said main cylinder, an inlet-valve adapted to control the flow of the said fluid through
 95 said supply-pipe, an exhaust-valve adapted to control the flow of fluid from the main cylinder, means connecting the inlet-valve with the exhaust-valve, an auxiliary cylinder having therein a piston connected with said means
 100 and adapted to operate said valves, a feed-pipe adapted to conduct fluid under pressure to said auxiliary cylinder, a valve adapted to control the flow of fluid through said feed-pipe, and means responsive to a supply of fluid under
 105 pressure and adapted to operate the latter valve.

In testimony whereof I affix my signature in presence of two witnesses.

EPHRAIM K. HUTCHISON.

Witnesses:

J. M. BENNETT,

OSCAR P. QUINTRELL.