No. 776,608. PATENTED DEC. 6, 1904.

J. MILTON.

STEAM BOILER FURNACE.

APPLICATION FILED JULY 7, 1903. RENEWED MAY 9, 1904.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1

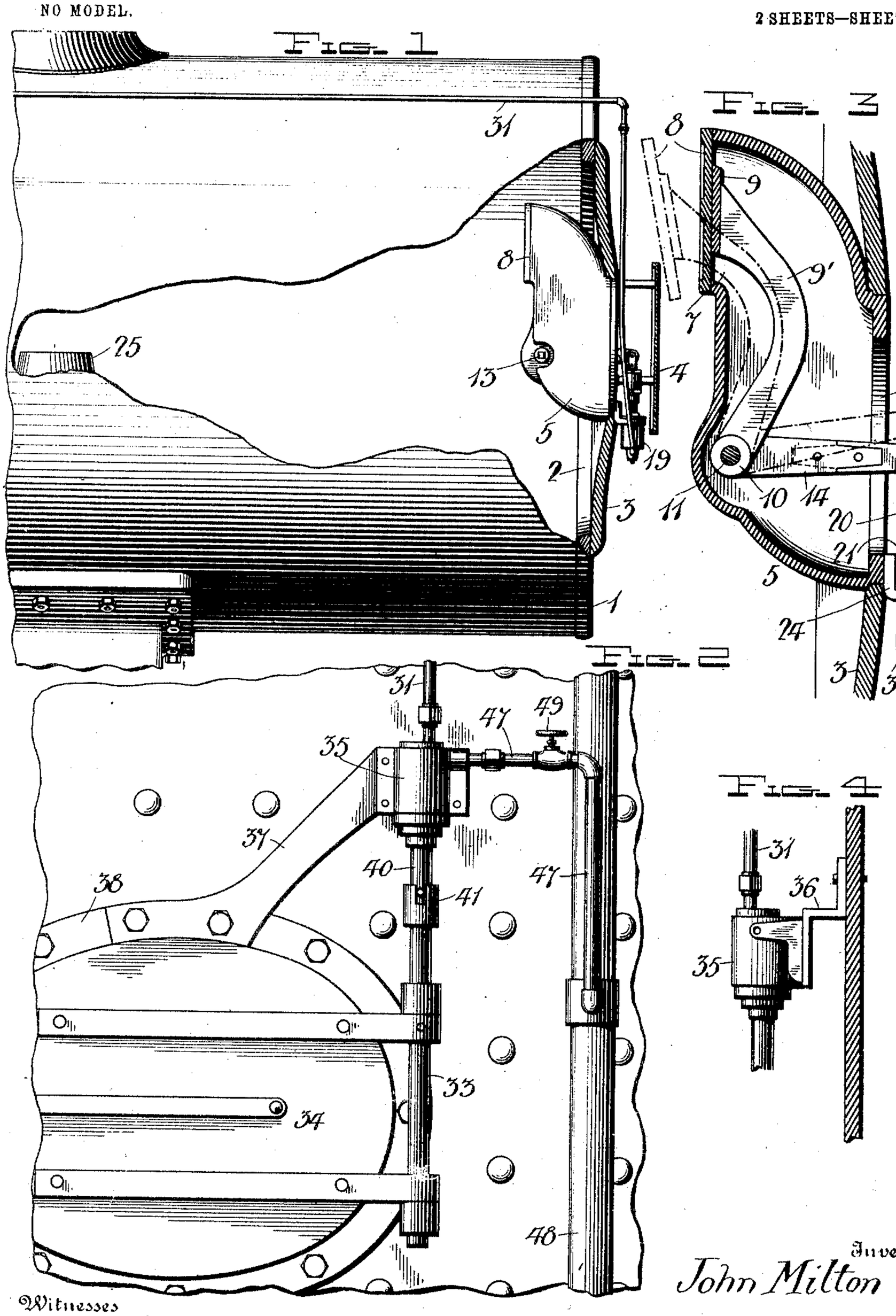

Fig. 3

Fig. 2

Fig. 4

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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 9

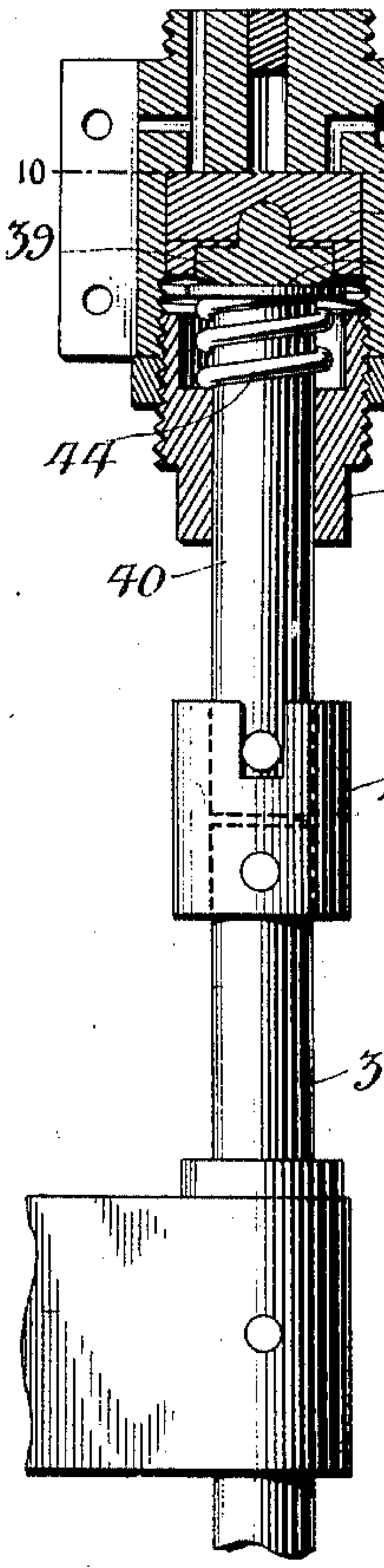


Fig. 7

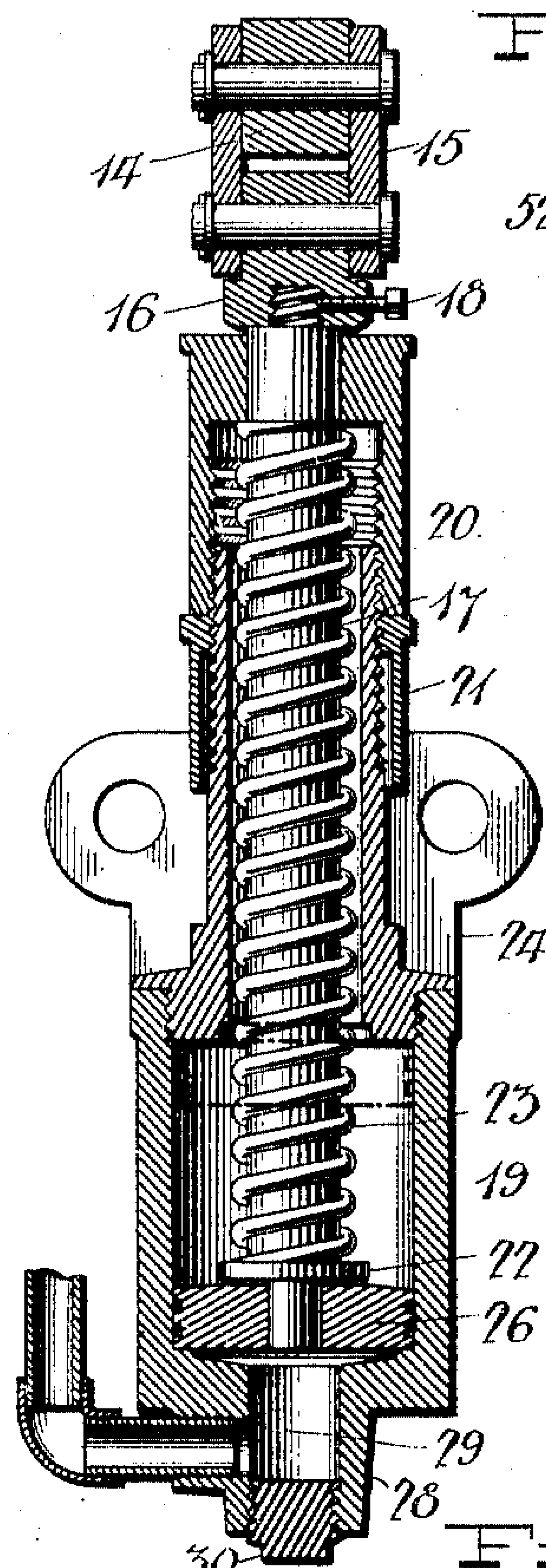


Fig. 11

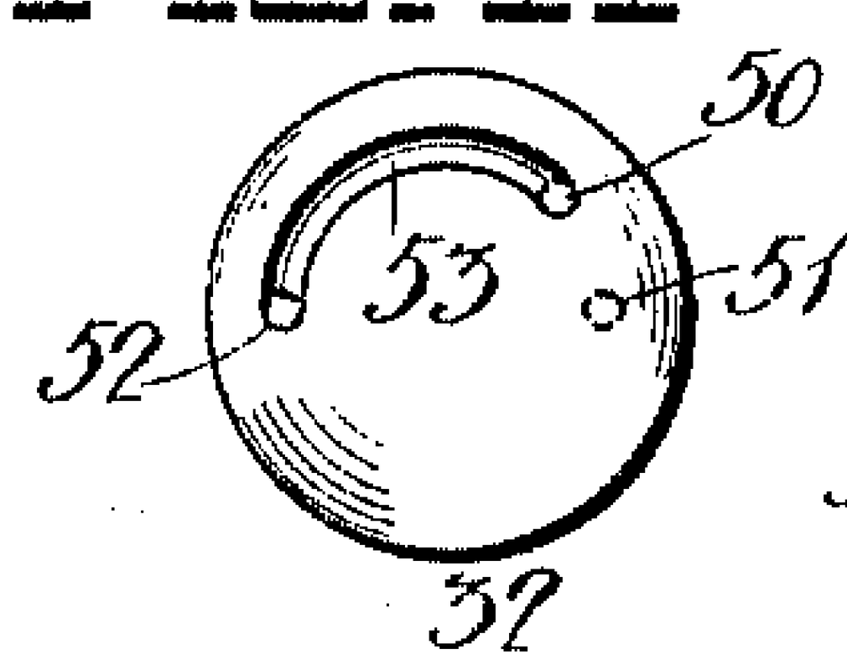


Fig. 12

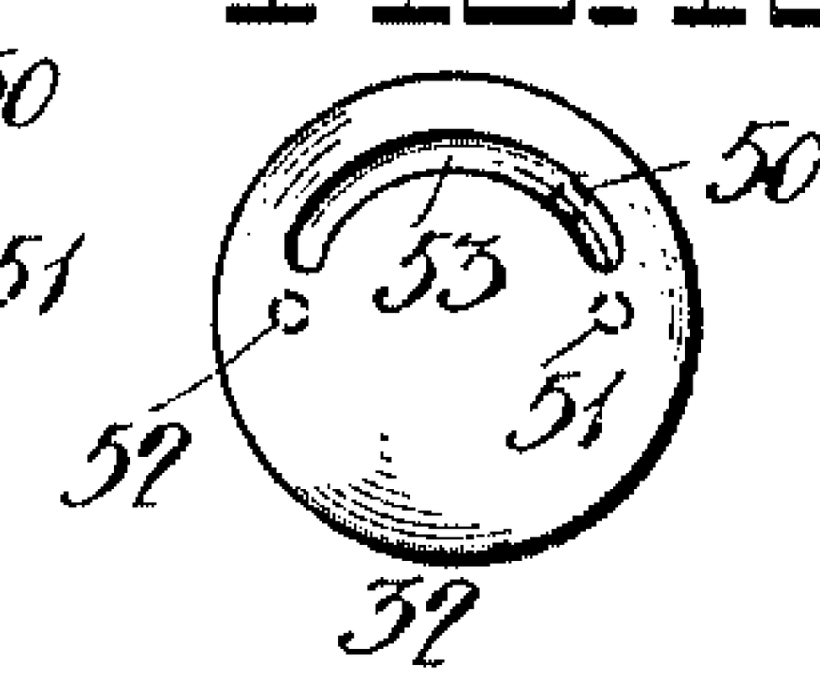


Fig. 13

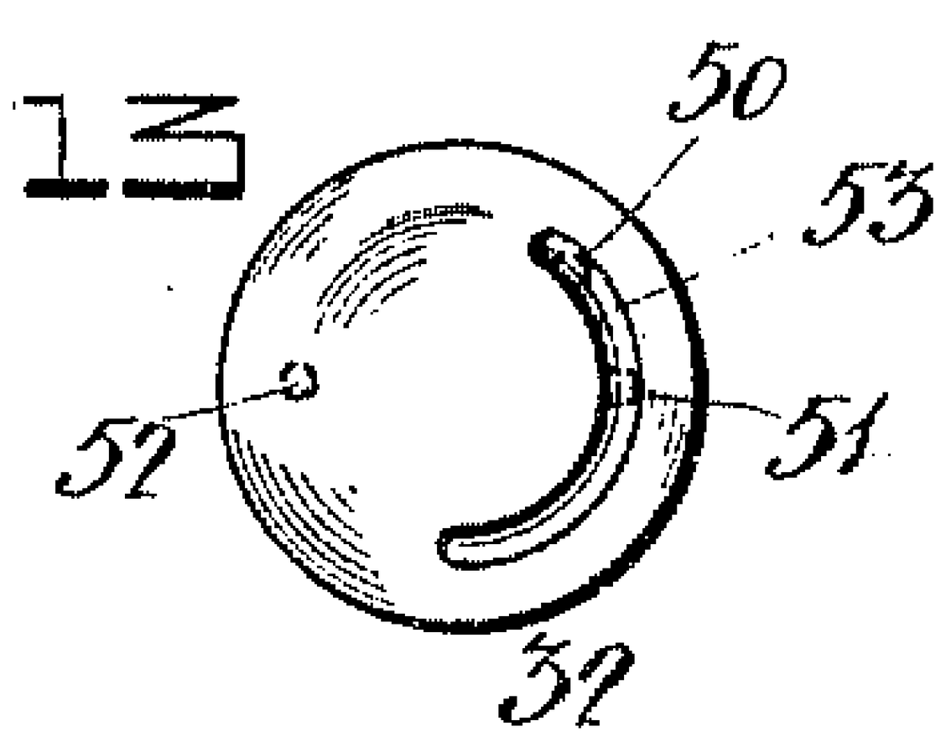


Fig. 8

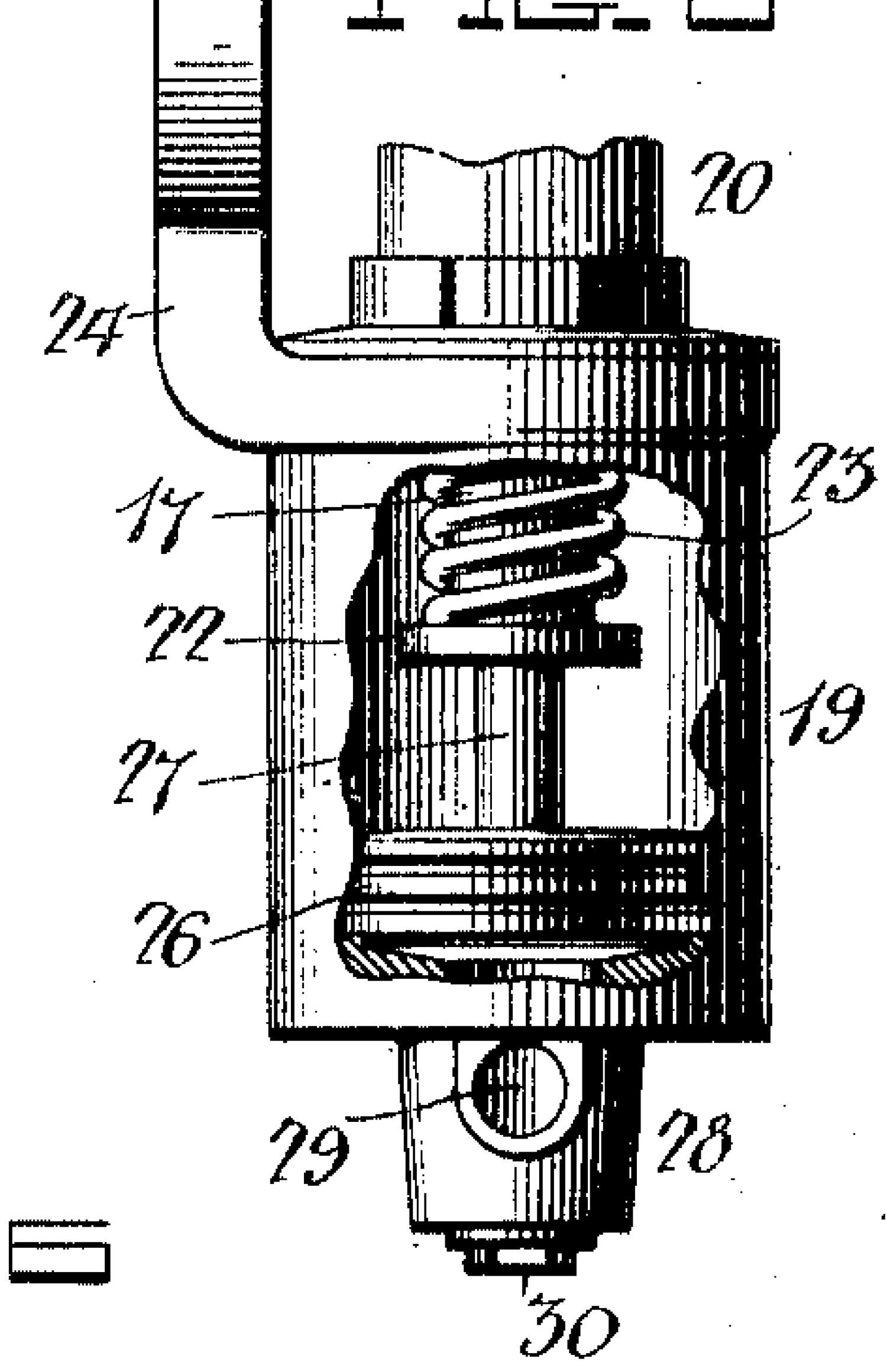


Fig. 5

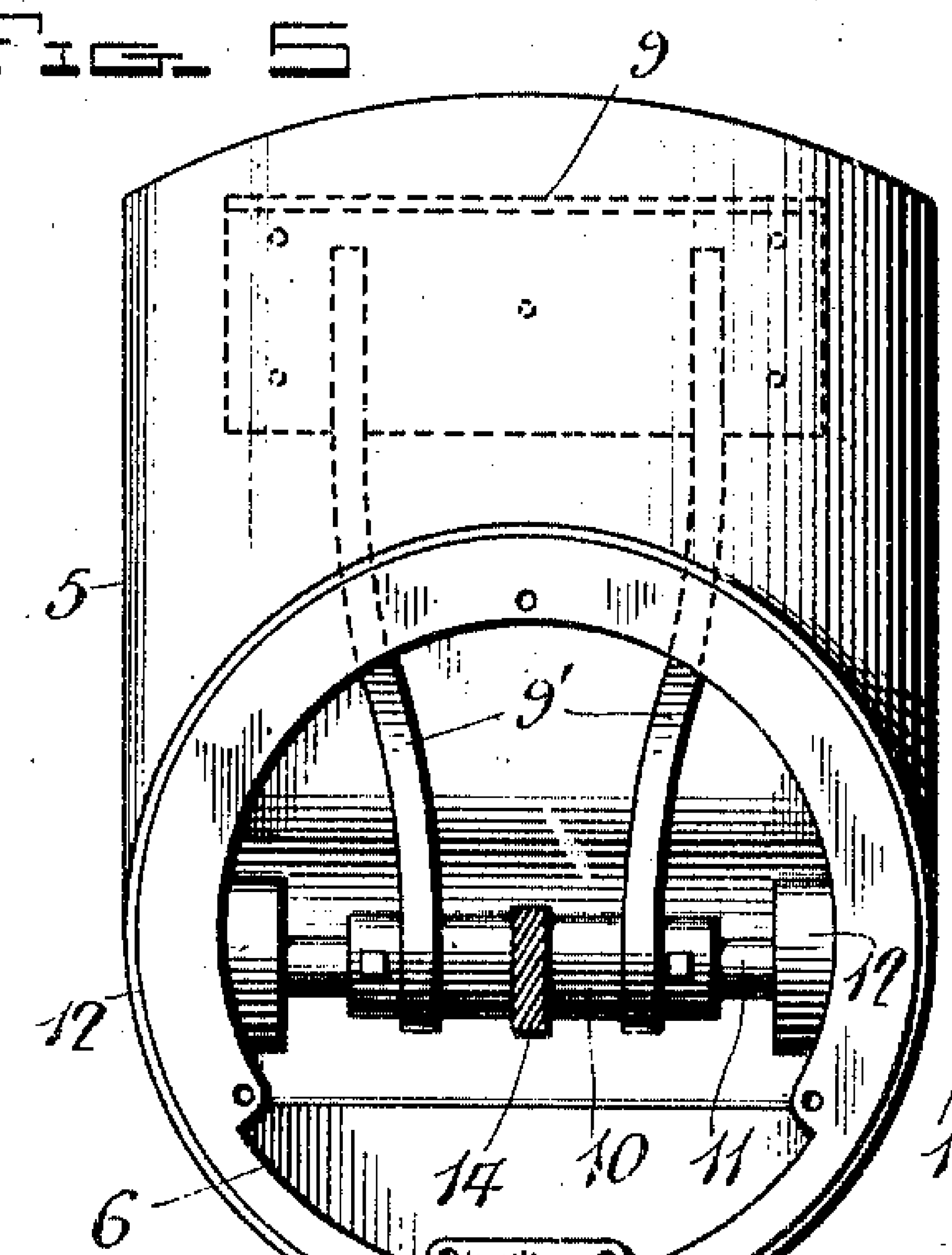


Fig. 6

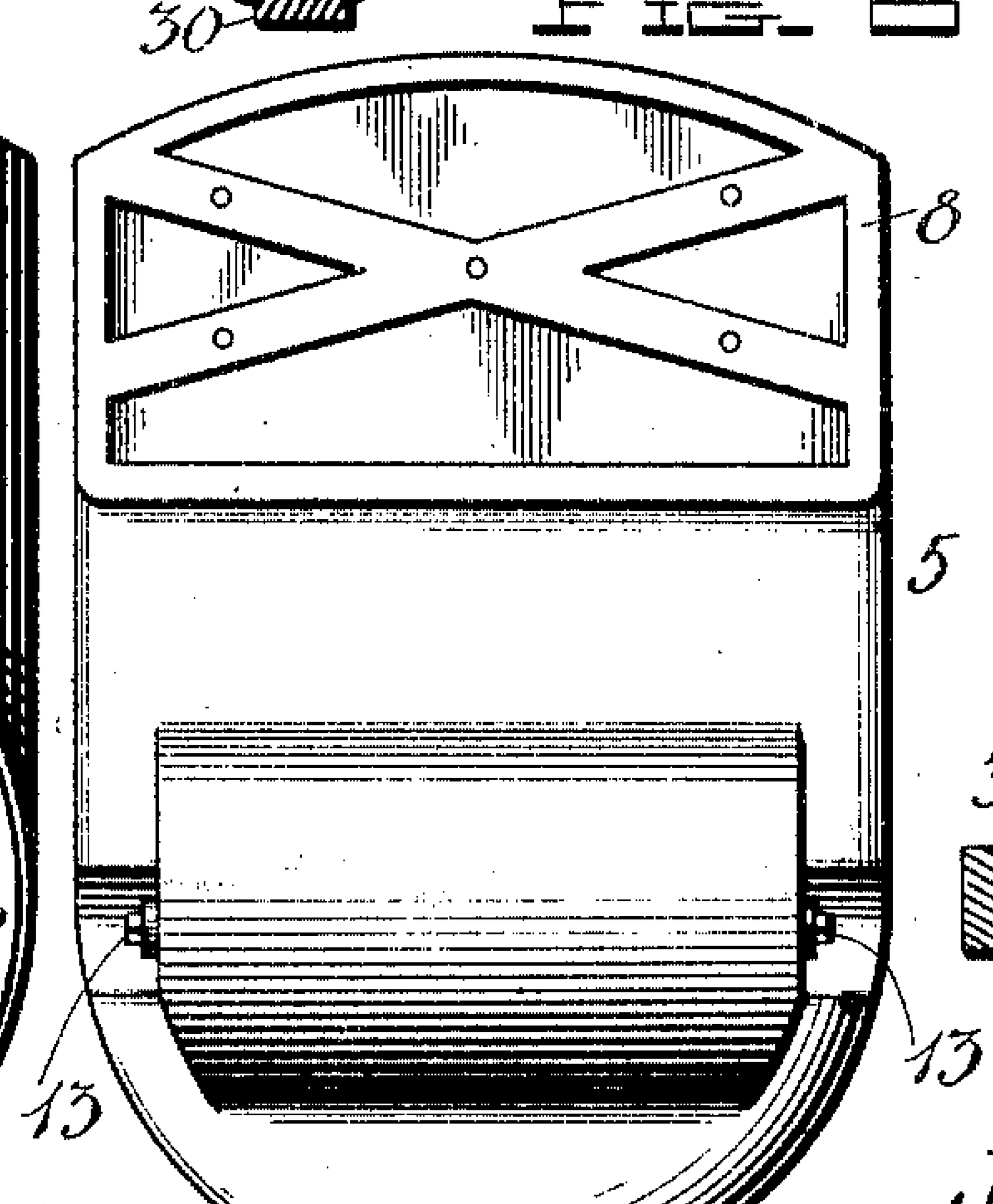
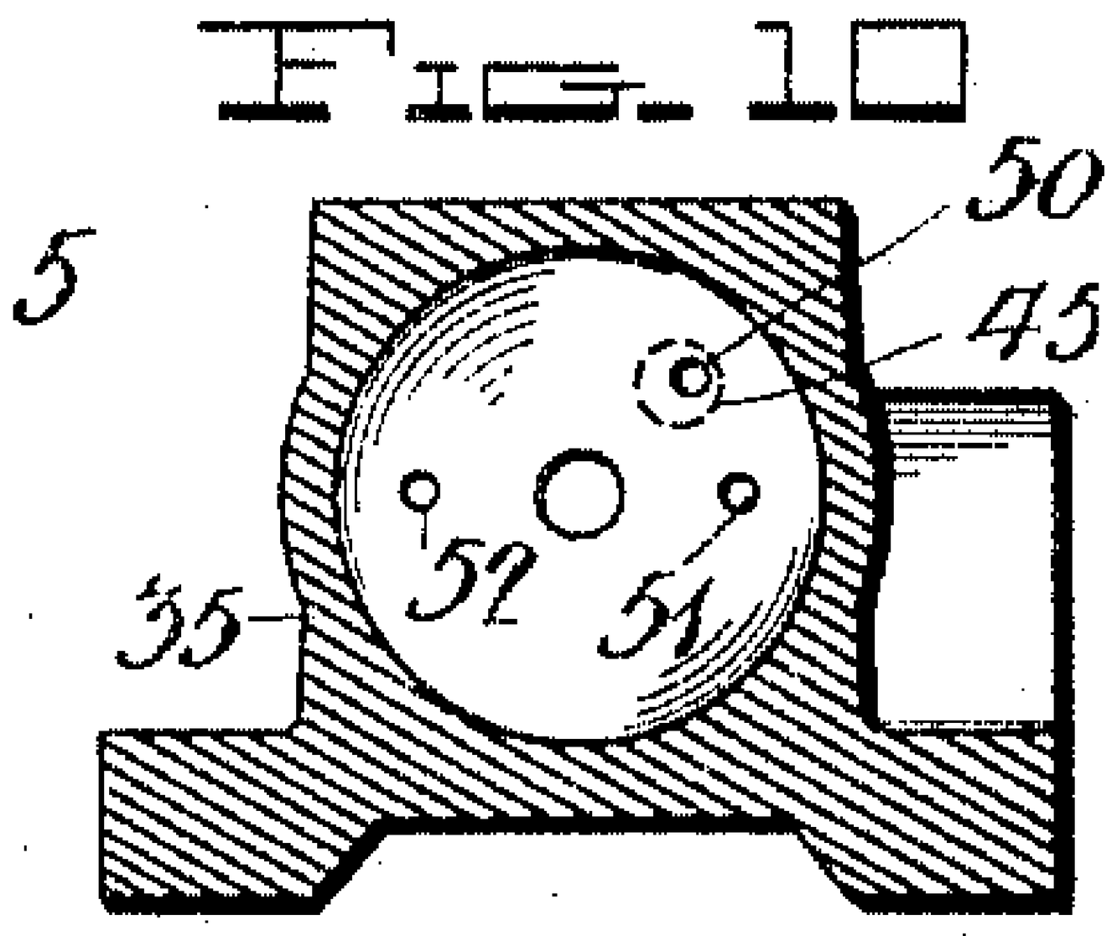


Fig. 10



Inventor
John Milton

Witnesses
[signatures]

By [signature] his Attorneys

No. 776,608. Patented December 6, 1904.

UNITED STATES PATENT OFFICE.

JOHN MILTON, OF WASHINGTON, DISTRICT OF COLUMBIA.

STEAM-BOILER FURNACE.

SPECIFICATION forming part of Letters Patent No. 776,608, dated December 6, 1904.

Application filed July 7, 1903. Renewed May 9, 1904. Serial No. 207,169. (No model.)

To all whom it may concern:

Be it known that I, JOHN MILTON, a citizen of the United States, residing at Washington, District of Columbia, have invented certain new and useful Improvements in Steam-Boiler Furnaces; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to steam-boiler furnaces, and is directed to improvements in the draft-regulating attachments for which I have obtained Letters Patent of the United States, as follows: No. 590,846, dated September 28, 1897; No. 631,528, dated August 22, 1899; No. 661,066, dated November 6, 1900, and No. 676,959, dated June 25, 1901.

The nature of the present improvements, the mode of operation, and the results accomplished are fully and clearly set forth in the following detailed description, and in connection therewith attention is invited to the accompanying drawings, illustrating the present improvements in their preferred form of embodiment, it being understood that various modifications may be made therein without exceeding the scope of invention defined by the concluding claims.

In the drawings, Figure 1 is a side elevation, partly broken away, of the extension-front or smoke-box of a locomotive-engine equipped with a draft-regulating attachment embodying my present invention. Fig. 2 is an elevation of the rear end of the locomotive fire-box, showing the stoking-door, air-brake pipe, and an air-pressure-controlling valve operated by the movement of said door. Fig. 3 is an enlarged detail sectional view of the air-inlet, its controlling-valve, and the means for operating said valve. Fig. 4 is a detail view of the air-controlling-valve casing and its support. Figs. 5 and 6 are respectively front and rear views of the air-inlet casing and controlling-valve. Fig. 7 is an enlarged detail view in section of the means for operating the inlet-valve. Fig. 8 is a detail view, enlarged and partly broken away, showing the inlet-valve-operating means in a different position. Fig. 9 is an enlarged detail view of the compressed-air-supply valve and means for operating it. Fig. 10 is a sectional view on line 10 10 of Fig. 9. Figs. 11, 12, and 13 are detail views showing the three positions of the compressed-air-supply valve.

My present improvements, as well as the constructions covered by my patents hereinbefore enumerated, are especially designed for employment in connection with locomotive-engines, with the object of counteracting the tendencies of excessive exhausts produced in starting the engine in mounting heavy grades and when slipping of the wheels occurs, the effects of such excessive exhausts being the tearing and disintegration of the bed of fuel, which results in exposure of the grates; the creation of intermittent air-drafts of excessively-high velocities, which, in addition to the described effect on the fuel, operate to convey unconsumed fuel particles from the fire-box through the flues and thence into the smoke-box or extension-front, and to project cinders and sparks from the stack, with consequent danger and discomfort; a diminution in the steaming capacity of boiler, with consequent loss of motive power; a waste of fuel and injury to the boiler and fire-box sheets and flues by reason of the variable heat temperatures to which they are subjected when the stoking-door is opened for the purpose of adding fuel or manipulating the fuel-bed or when the steam-pressure is excessive. To overcome these stated tendencies and effectually prevent the enumerated difficulties attending the operation of locomotive-engines, I provide for an admission of air at the extension-front coincidently with the formation of the exhausts, which air admission is accomplished automatically, and also provide for an admission of air at said point coincidently with the opening of the stoking-door, which may be said to be accomplished manually, although it will be understood that the connection between said door and the air-inlet-controlling means is such as compels the air admission whenever the door is opened. The constructions heretofore patented by me operate upon a principle similar to that just described, and in my later patents the means set forth contemplate the employment of compressed air as the power-trans-

mitting medium, as distinguished from the mechanical connections covered by my earlier patents.

The present invention is directed to improvements in the general structure of attachment which have been suggested by repeated trials, and in the following description and concluding claims these improvements are specifically set forth.

Referring to the drawings, 1 designates the smoke-box or extension-front, the usual opening 2 of which is covered by a door 3 on which is fixed the number-plate 4. In said door behind the number-plate is provided a preferably cylindrical opening at which is secured a casing 5, having in its lower portion an inlet-opening 6 of circular form, and in its upper portion an approximately rectangular outlet-opening 7, the edge of which forms the seat for a valve 8. The valve is fastened on a plate 9, carried by two arms 9′ 9′, the latter being integral with a sleeve 10, which encircles a short shaft 11, mounted at its ends in bearing-bosses 12 12 on the inner casing-wall. Set-screws 13 13, inserted from the outside of the casing through said bosses and bearing against the shaft ends, serve to center the parts carried by said shaft. Extending forwardly from the sleeve 10 is an arm 14, which with the arms 9′ constitute a bell-crank lever to effect the seating and unseating of the valve. The arm 14 is made in sections, whereby its outer section, which projects beyond the opening 6, is detachable and is joined to the inner section after the casing is removed from the planer, in which the outer face of the plate 9 and the valve-seat are dressed to coincide as to plane, whereby the valve 8 and seat uniformly contact. The edges of the casing at the openings 6 and 7 are preferably parallel to each other, as shown, to facilitate the mounting of the casing in the planer and lathe.

The arm 14 is connected at its outer end, through the medium of a link 15, with a head 16 in a threaded aperture in which is inserted the reduced and threaded upper end of a rod 17, the joint being maintained by a set-screw 18. (See Fig. 7.) The rod 17 is slidably arranged in a piston-cylinder 19 and in a tubular extension 20 of said cylinder, which extension has at its lower end a threaded head inserted in and forming the upper end of the cylinder 19. Said extension is preferably formed of two sections screwed together, and 21 is a tubular jam-nut for maintaining the joint. The rod 17 is provided at its lower end with an annular flange 22, and coiled around the rod and confined between the flange 22 and the upper end of the extension 20 is a spring 23, the tension of which is regulated by turning the upper section of the extension 20 on the lower section. The cylinder and extension are supported from the casing below the inlet 6 through the medium of a bracket 24, which may be integral with the cylinder.

The steam-exhausts which occur at the nozzle 25 produce in the extension-front a partial vacuum, which is filled by the air and products of combustion issuing from the fire-box, and when these exhausts are excessive as to power the effects are the tearing of the fire and the ejection from the stack of cinders and sparks, as above stated. The valve 8 opens inwardly and the tension of the spring 17 is sufficiently strong to resist the tendency of exhausts of normal power to unseat said valve. Upon the creation of a vacuum produced by an exhaust of excessive or abnormal power the air-pressure against the inner face of the valve is sufficient to overcome the power of the spring and effect the unseating of the valve, whereupon the partial vacuum produced in the extension-front is filled by air admitted through the opening 7, which air-supply tends to neutralize the effect of the exhaust in the fire-box. The result is that the air-draft of the fire-box, which is produced both by natural causes and by the exhausts, is rendered uniform and of fixed maximum power, and the difficulties attending the operation of engines under existing conditions are completely overcome, the effects of the excessive exhausts being entirely neutralized by the admission of air at the front coincident with such exhausts.

In the cylinder 19 is slidably arranged a piston 26, having an upwardly-extending stem 27, loosely occupying a recess in the lower end of the rod 17. The piston normally rests upon shoulders provided in the lower end of the cylinder, and in an extension 28 of said cylinder is an aperture 29, closed by a screw-plug 30, and to which is connected a compressed-air-supply pipe 31. By reason of the slidable connection between the rod 17 and piston-stem 27 said rod is movable with the valve, and the latter unseats without communicating movement to the piston. Consequently the latter is at rest throughout the operation of the valve by the excessive exhausts and wear on the same is reduced to the minimum. It will be noted that by the peculiar construction of the piston and operating-rod the necessity for a stuffing-box at the cylinder is avoided and there is no liability to leakage of the air, which insures economy in the compressed-air supply.

The unseating of the valve to admit air in the extension-front coincident with the opening of the stoking-door is effected through the medium of compressed air supplied by the pipe 31 to the piston. Compressed air being admitted to the cylinder, the piston is raised and carries with it the rod 17, whereupon the valve is unseated and air is admitted to fill the vacuum created by the normal pressure-exhaust, which air admission neutralizes the effect of the exhaust in the boiler-flues and fire-box. The air-draft of the fire-box is mainly created by the action of the exhausts,

and the neutralization of the latter results in an interruption of the draft and produces practically a state of quiescence in the fire-box while the stoking-door is open. Any air entering the fire-box through the door-opening is deprived of velocity and its volume is insufficient to materially lower the temperature. Consequently the steaming capacity of the boiler is maintained and the sheets and flues are subjected to a uniform degree of heat.

The means for operating the valve by movement of the stoking-door consists of a rotary valve 32 in the pipe 31, which valve is connected with the pintle-rod 33 of the door 34. The valve is inclosed by a casing 35, supported from the front sheet of the fire-box through the medium of a bracket 36, secured to said sheet, as shown in Fig. 4, but preferably by a bracket 37, secured to the door-flange 38. By the employment of the bracket 37 the necessity for drilling the sheet is avoided. The valve 32 is of disk form and is mounted on the upper end of a rod formed of flexibly-connected sections 39 40, whereby the upper face of the valve uniformly contacts with its seat, regardless of the proper alinement of the rod-section 40. Said rod-section 40 is detachably connected with the pintle-rod 33 by a coupling 41, and on its upper end is a flange 42, between which and a stuffing-box 43, inserted in the lower end of the casing 35, is confined a coiled spring 44, the function of which is to press the valve to its seat. The pipe 31 connects with the valve-casing at an aperture 45 therein, and connected with a lateral aperture 46 in said casing is a pipe 47, leading from the reservoir-pipe 48. In the pipe 47 is a hand-valve 49, by which the supply of compressed air to the pipe 31 is controlled.

The valve-casing contains three ports, one of which, 50, communicates directly with the aperture 45, and the others, 51 52, are respectively the inlet and exhaust ports. The upper face of the valve 32 has a groove 53, curved in a line concentric with the center of the valve, the groove being located to coincide with the ports 50, 51, and 52. With the door in closed position the valve assumes the position shown in Fig. 11, the inlet-port 51 being closed and the ports 50 52 being connected by the valve-groove to exhaust the pipe 31 and cylinder. In the opening movement of the door the valve is rotated to carry its groove from the exhaust-port 52 to close the latter and to connect the inlet-port and the port 50, whereby to open communication between the piston-cylinder and the compressed-air reservoir. The compressed air entering the cylinder forces the piston upwardly, and through the medium of the rod 17 and bell-crank lever the valve is opened to admit air in the manner and for the purpose above described. In the closing movement of the door the inlet-port is closed and the cylinder and pipe 31 exhausts at the port 52.

I claim as my invention—

1. In a steam-boiler furnace, an air-inlet in proximity to the engine-exhaust, a valve openable by external air-pressure upon the creation of excessive exhausts, a slidable rod connected with said valve, a piston below and independent of said rod, and means for admitting compressed air beneath the piston to raise said piston and rod to unseat the valve independently of excessive exhausts.

2. In a steam-boiler furnace, an air-inlet in proximity to the engine-exhaust, a valve at said inlet, a bell-crank lever on which said valve is fixed, a piston-cylinder, a piston in the cylinder having a stem, a rod in the cylinder having link connection at its upper end with the lever and having a recessed lower end slidably receiving said stem, and a retracting-spring at the rod.

3. In a steam-boiler furnace, an air-inlet in proximity to the engine-exhaust, a valve at said inlet, a bell-crank lever having one of its arms connected with the valve, a piston-cylinder having a tubular extension formed of two screwed-together sections, a piston having a stem, a rod in the piston having link connection at its upper end with the other arm of the lever and having a recessed lower end slidably receiving said stem, and a spring coiled on the rod between the upper cylinder-extension end and a shoulder on the rod.

4. In a steam-boiler furnace, an air-inlet, an air-conduit at said inlet having entrance and exit openings in offset relation, the exit-opening being in proximity to the engine-exhaust and the edges of the openings being parallel to each other, a bell-crank lever pivoted in the casing having one arm formed in sections and carrying at its other arm a plate the outer face of which is normally in the plane of the edge of the exit-opening, and a valve secured to said plate and seating against the edge of the exit-opening.

5. In a steam-boiler furnace, an air-inlet in proximity to the engine-exhaust, a valve at said inlet, fluid-pressure means including a piston for unseating said valve, a fluid-pressure-supply pipe leading to the piston-cylinder, a rotatable valve controlling said pipe and a rod formed of flexibly-joined sections connecting said valve with the pintle-rod of the stoking-door.

6. In a steam-boiler furnace, an air-inlet in proximity to the engine-exhaust, a valve at said inlet, fluid-pressure means including a piston for unseating said valve, a fluid-pressure-supply pipe leading to the piston-cylinder, a casing to which said pipe is connected having a port connected with said pipe and inlet and exhaust ports, a supply-pipe connected with the inlet-port, a rotatable valve having a groove adapted in the movement of the valve

to control said ports, an upper rod-section connected with said valve, a lower rod-section flexibly joined to the upper rod-section and connected with the pintle-rod of the stoking-door, and a coiled spring at the lower rod-section for pressing said valve against its seat.

7. In a steam-boiler furnace, an air-inlet in proximity to the engine-exhaust, a valve at said inlet, fluid-pressure means including a piston for unseating said valve, a fluid-pressure-supply pipe leading to the piston-cylinder, a casing to which said pipe is connected having a port connected with said pipe and inlet and exhaust ports, a supply-pipe connected with the inlet-port, a rotatable valve having a groove adapted in the movement of the valve to control said ports, an upper rod-section connected with said valve, a lower rod-section flexibly joined to the upper rod-section and connected with the pintle-rod of the stoking-door, a coiled spring at the lower rod-section for pressing said valve against its seat, and a bracket supporting the valve-casing, said bracket being secured to the stoking-door-opening frame.

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

JOHN MILTON.

Witnesses:
W. T. NORTON,
IVAN HEIDEMAN.