J. HORN.

DAMPER REGULATOR.

APPLICATION FILED MAY 28, 1907.

980,783.

Patented Jan. 3, 1911.

7 SHEETS—SHEET 1.

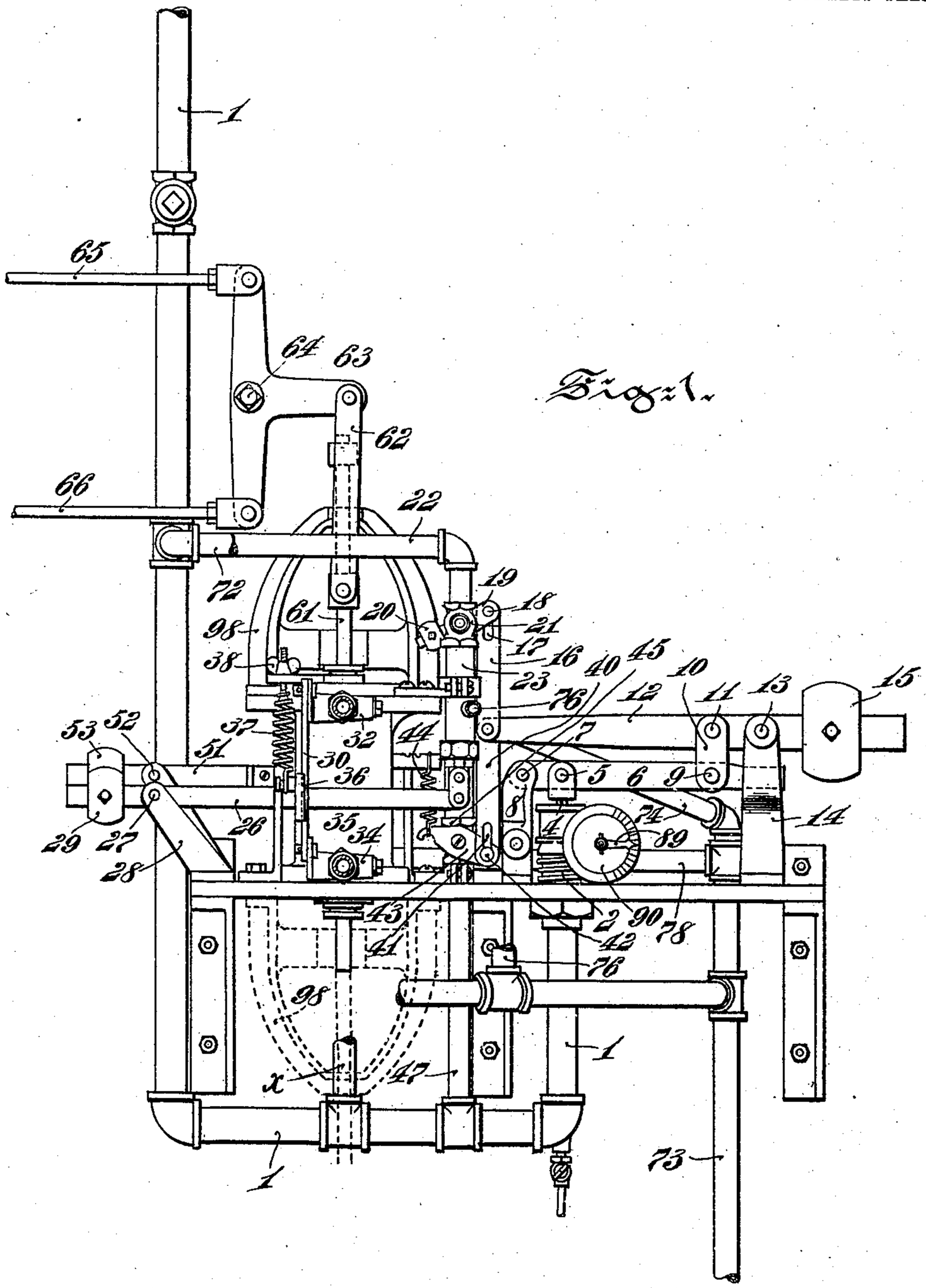

Fig. 1.

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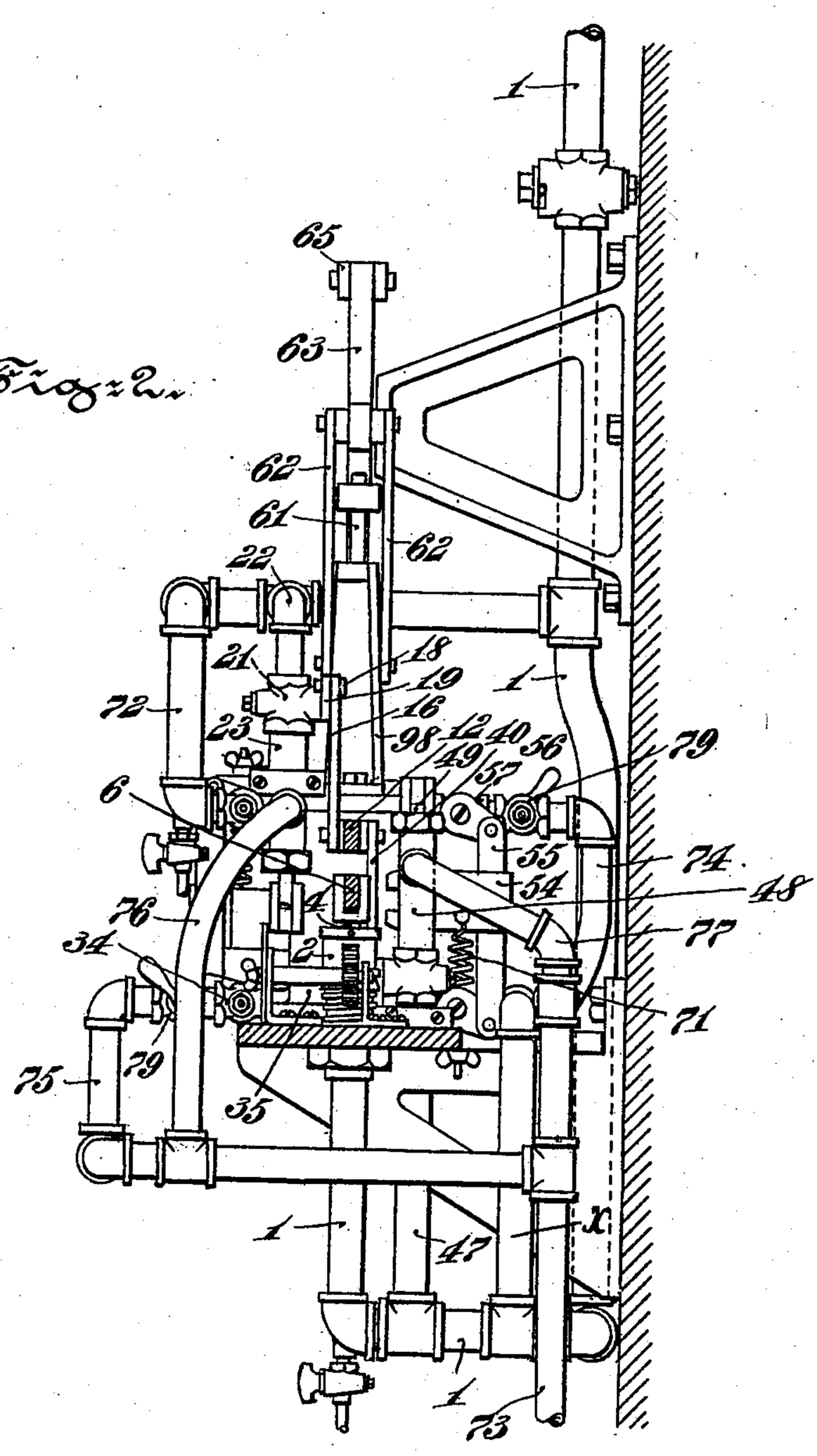
7 SHEETS—SHEET 2.

Fig. 2.



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7 SHEETS—SHEET 3.

Fig. 3.

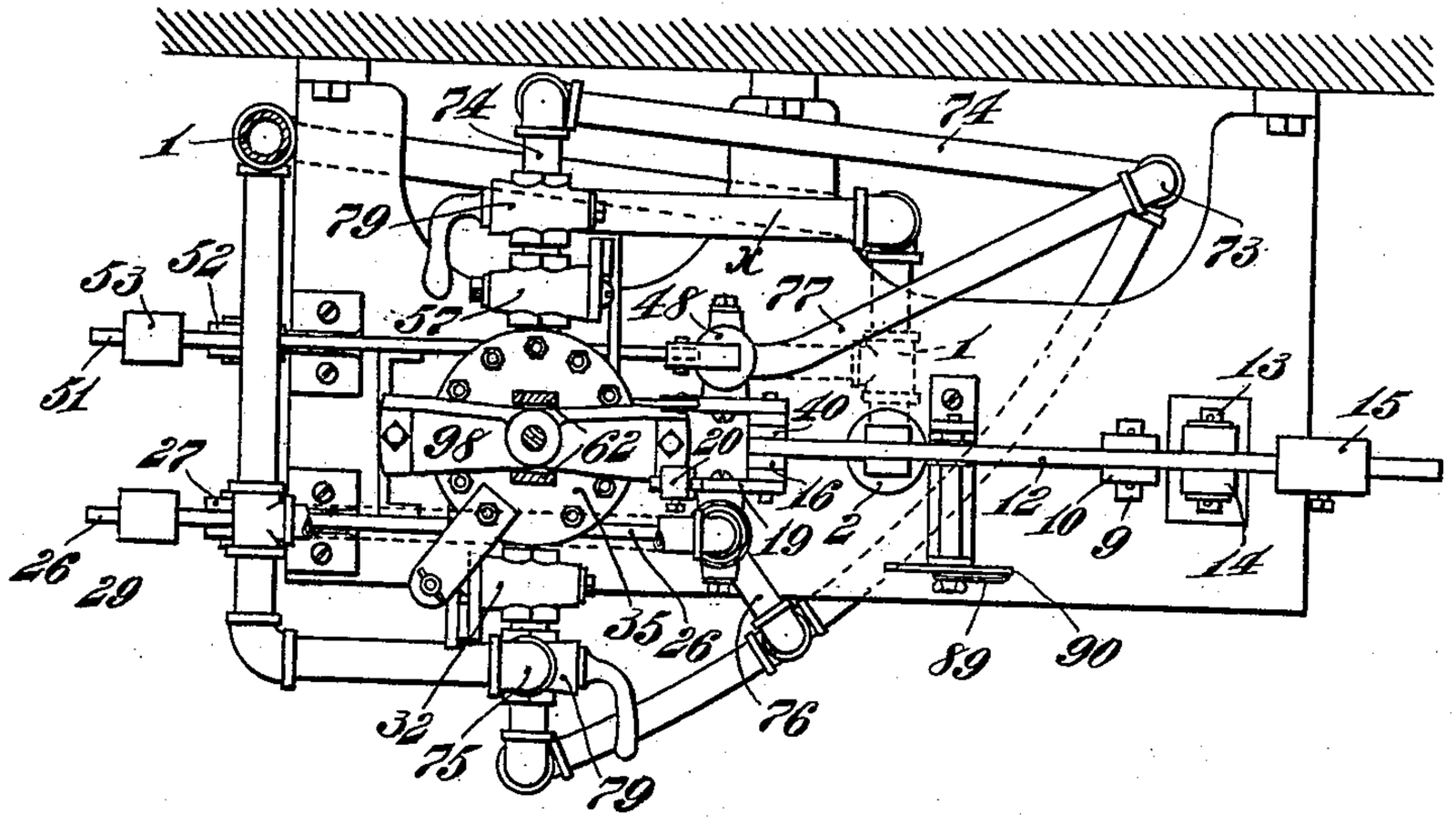
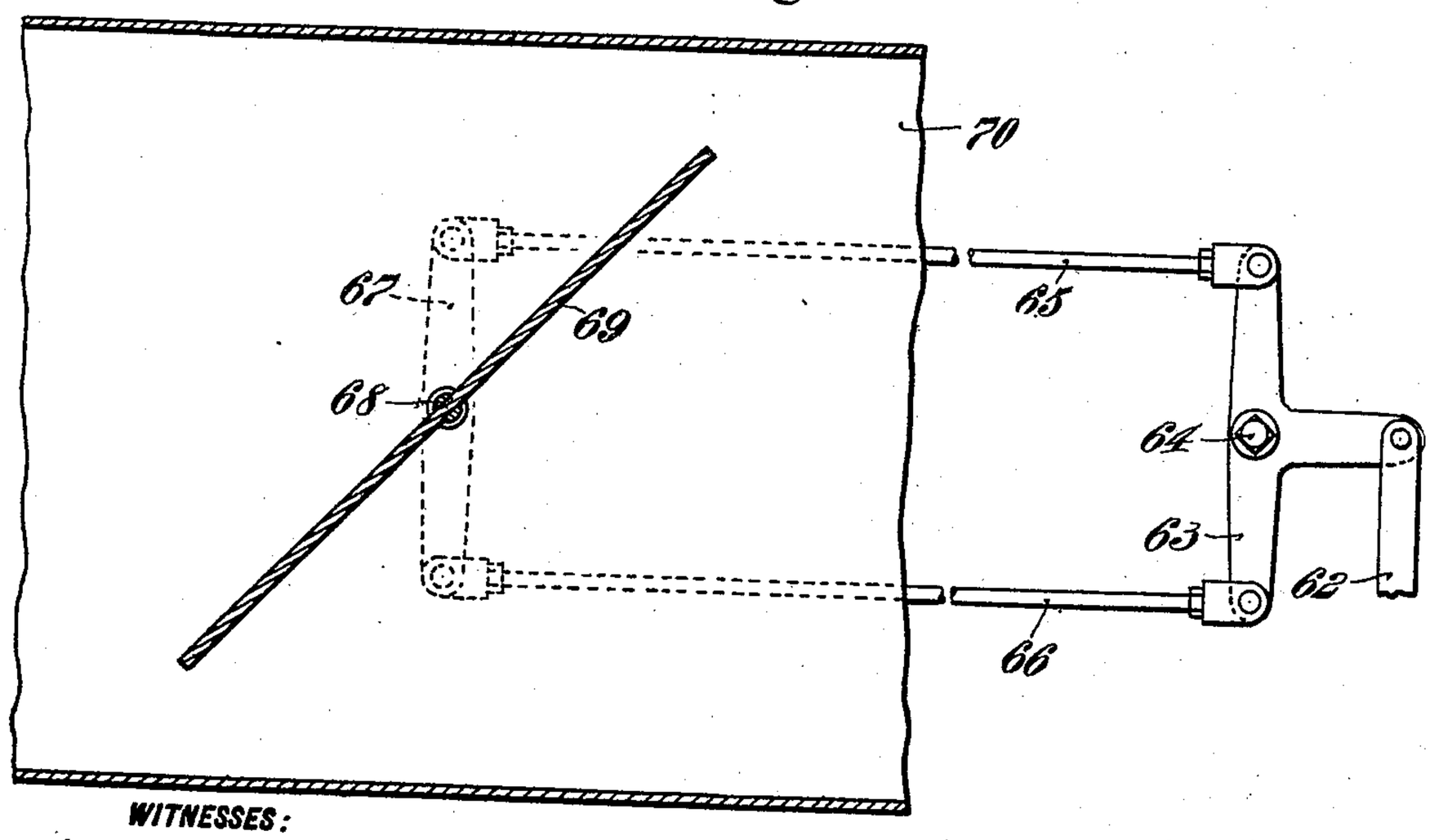


Fig. 4.



WITNESSES:

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7 SHEETS—SHEET 4.

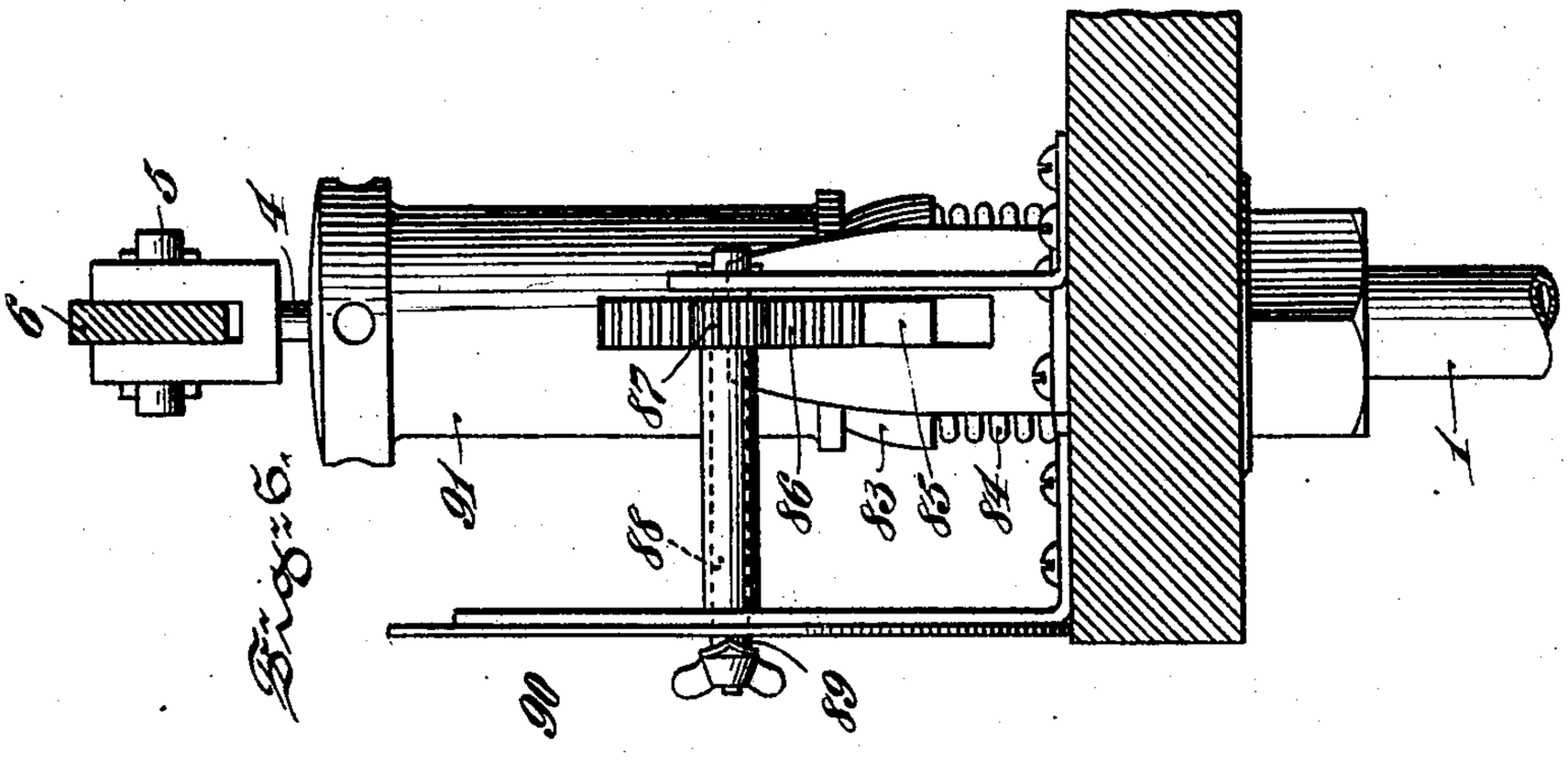

Fig. 6.

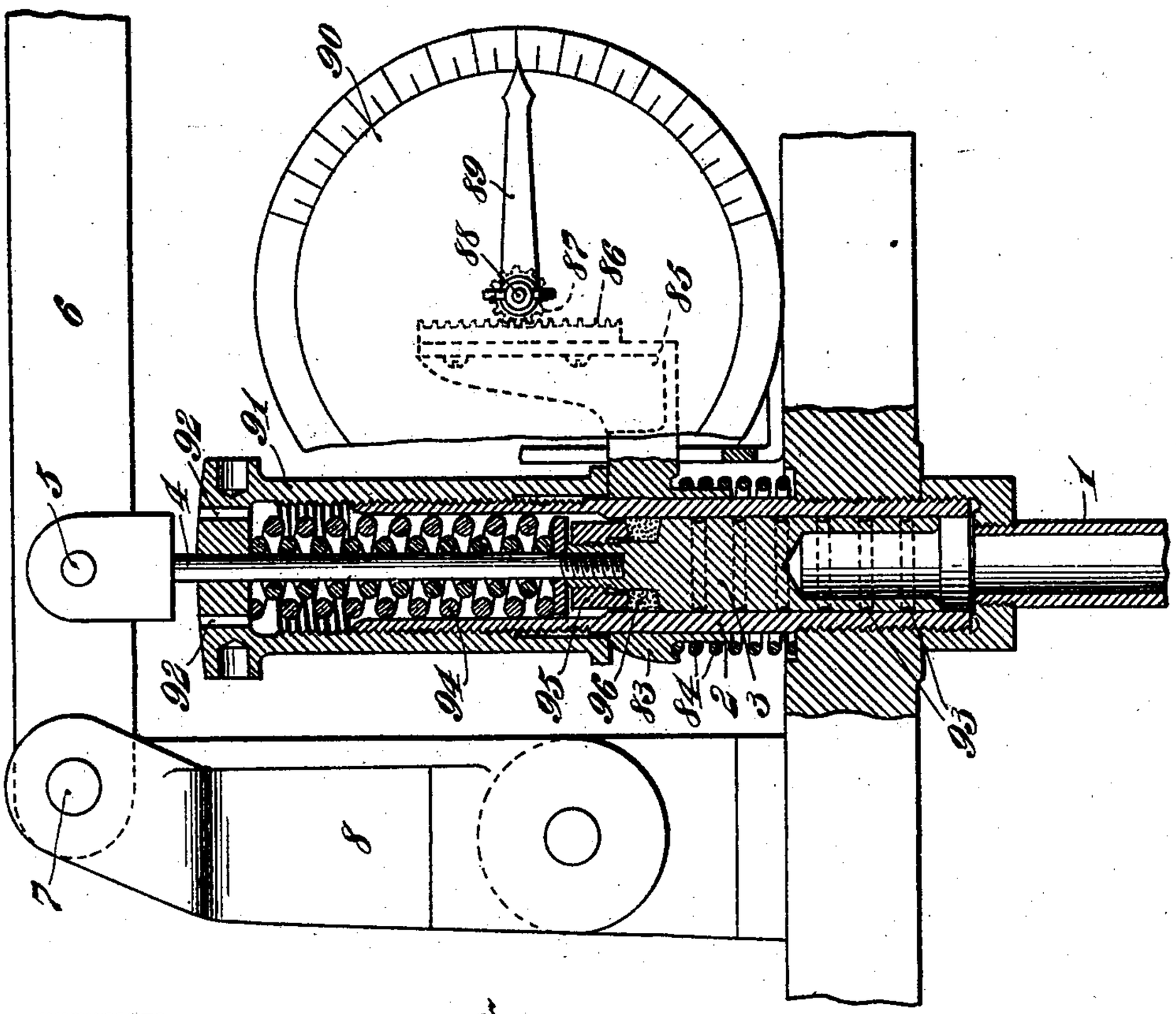

Fig. 7.

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7 SHEETS—SHEET 5.

Fig. 7.

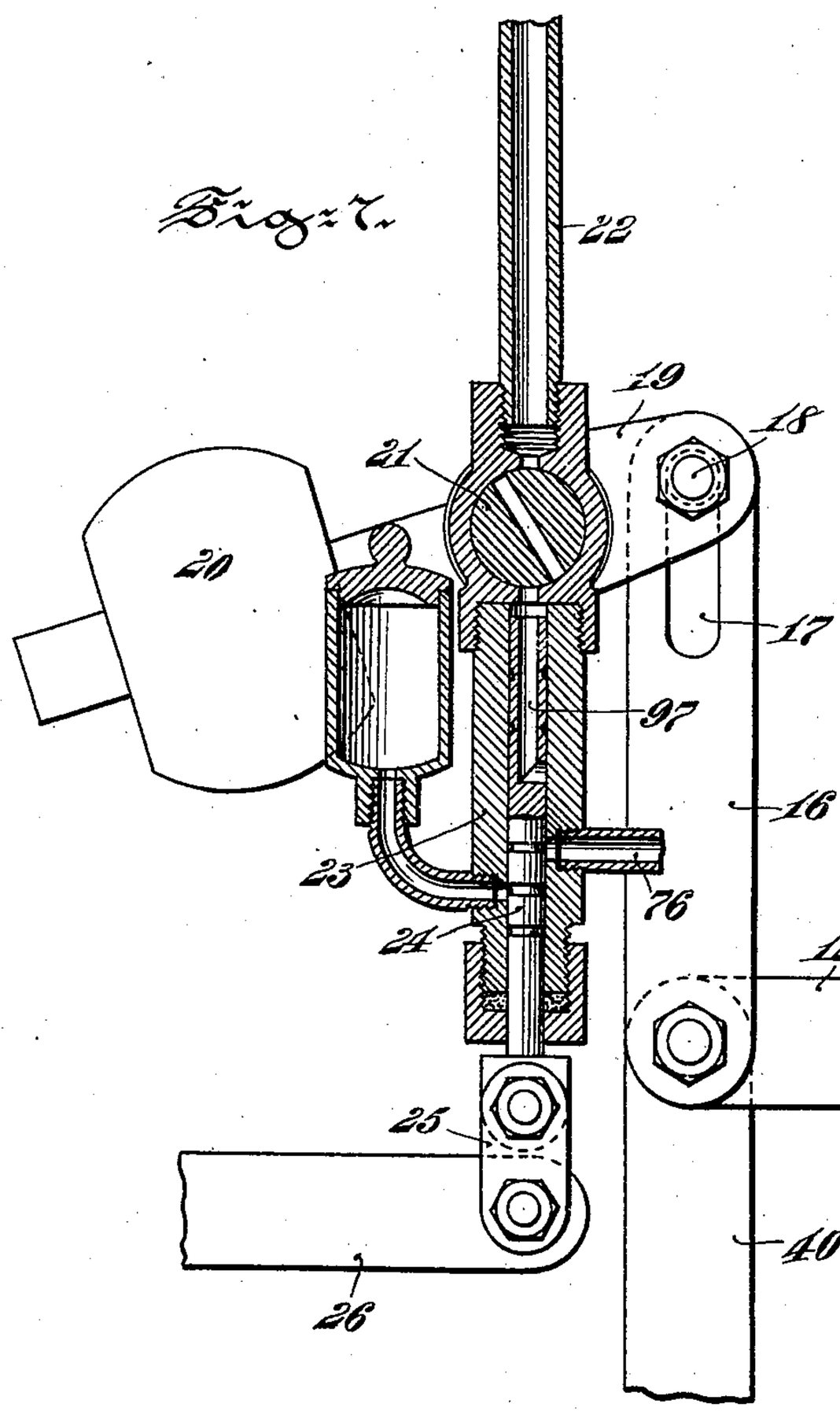
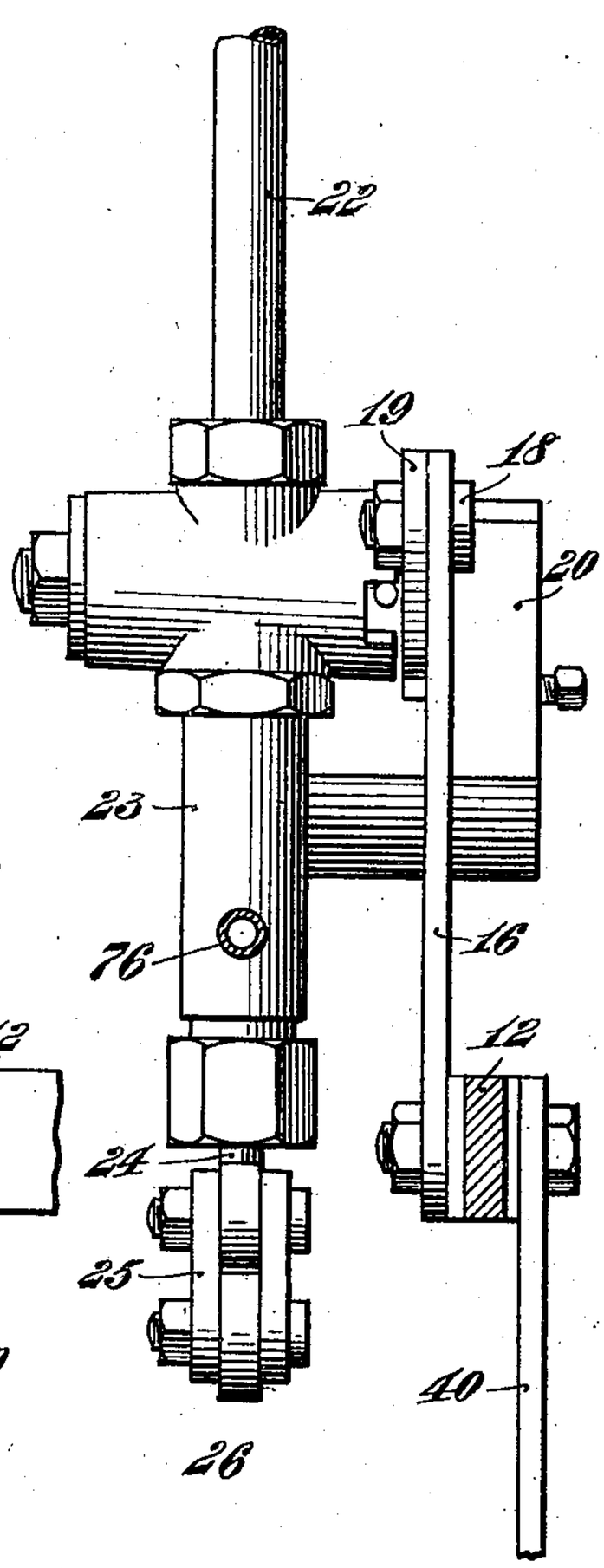


Fig. 8.



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7 SHEETS—SHEET 6.

Fig. 9.

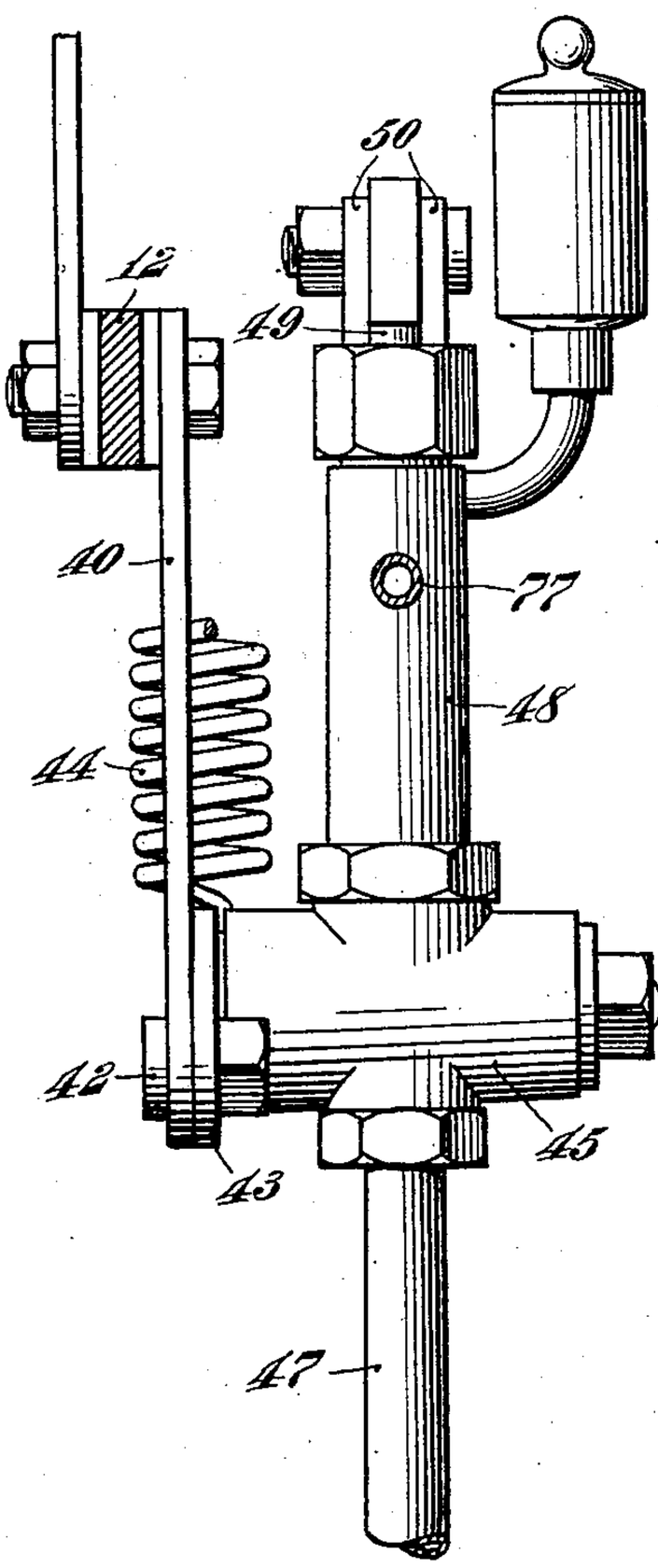
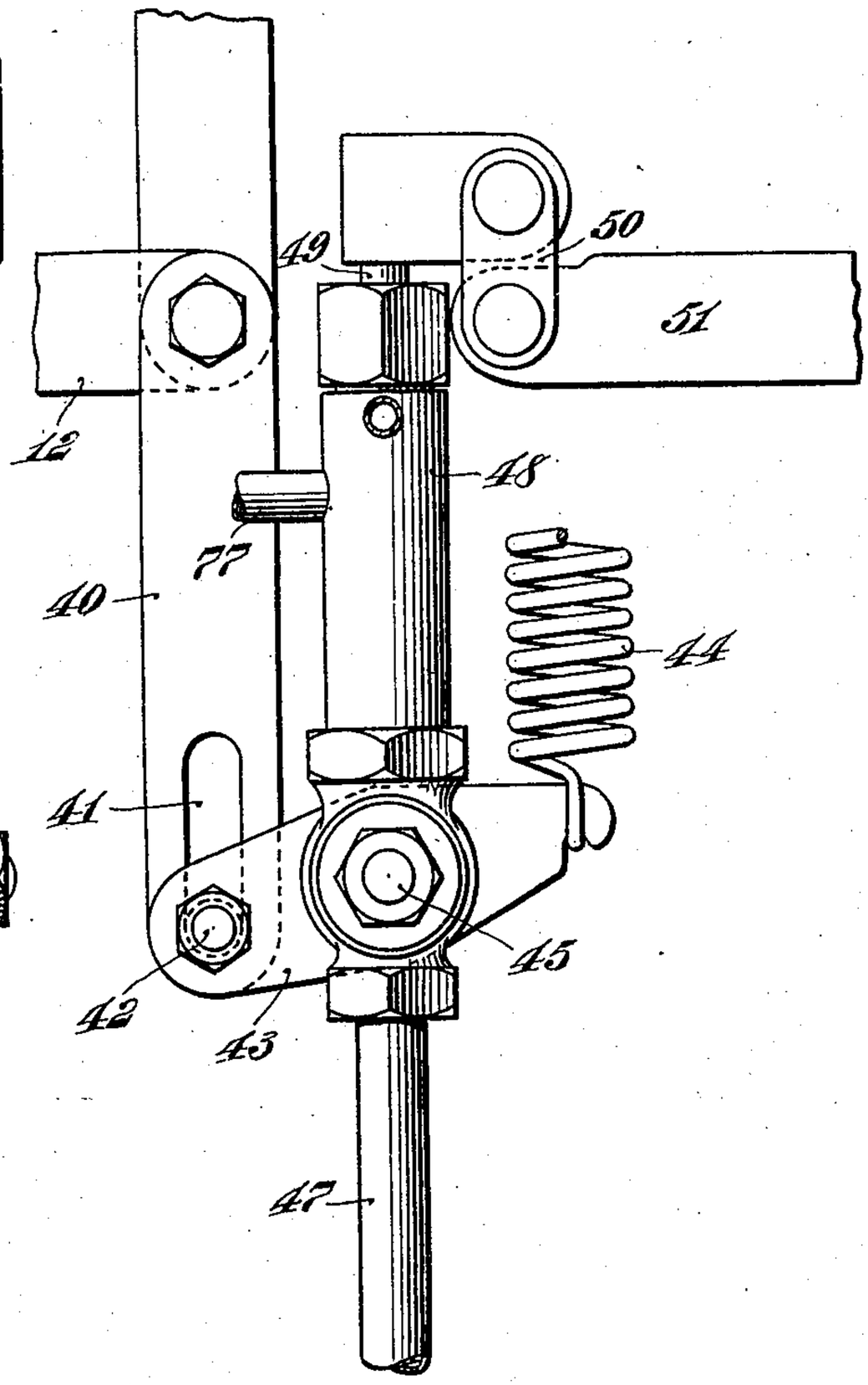


Fig. 10.



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7 SHEETS—SHEET 7.

Fig. 12.

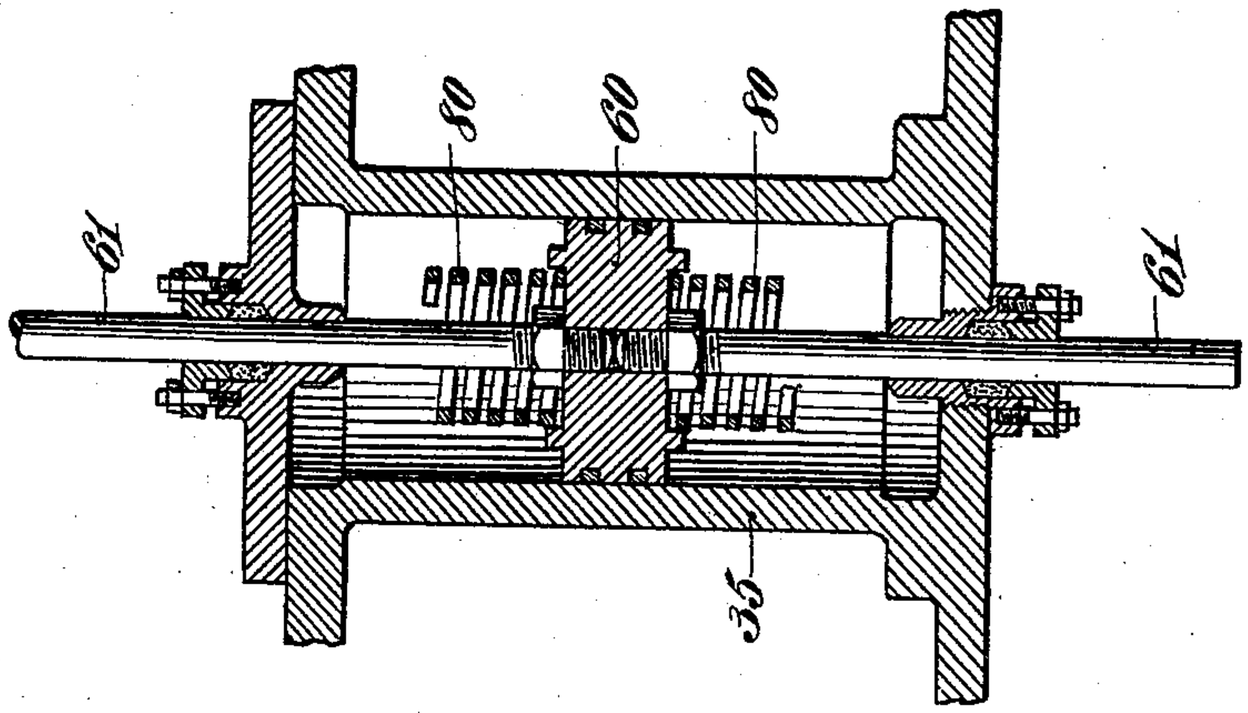
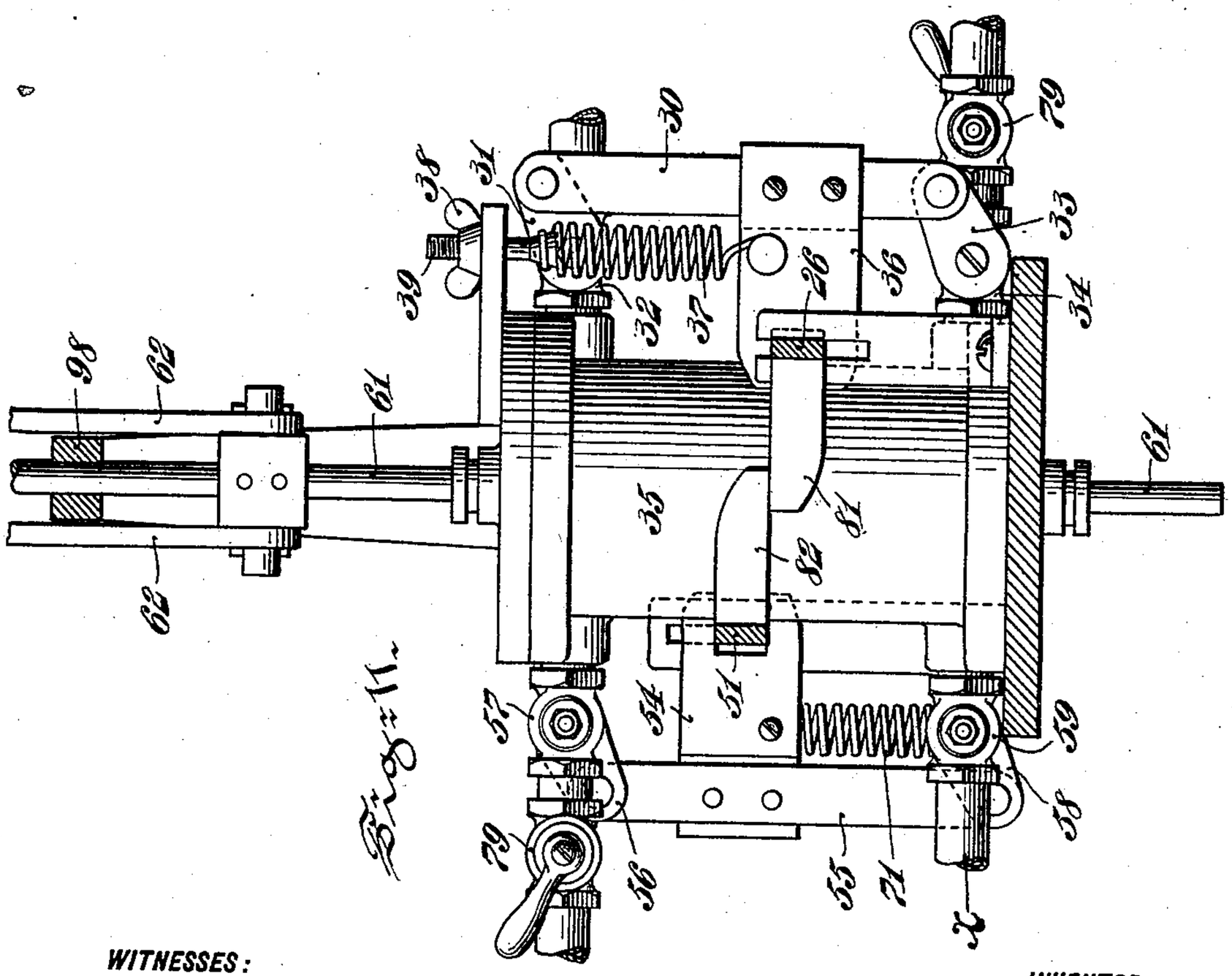


Fig. 11.



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JOSEPH HORN, OF PHILADELPHIA, PENNSYLVANIA.

DAMPER-REGULATOR.

980,783. Specification of Letters Patent. **Patented Jan. 3, 1911.**

Application filed May 28, 1907. Serial No. 376,069.

To all whom it may concern:

Be it known that I, JOSEPH HORN, a citizen of the United States, and a resident of the city and county of Philadelphia, State of Pennsylvania, have invented certain new and useful Improvements in Damper-Regulators, of which the following is a specification.

My invention relates to improvements in means for operating dampers for stacks or chimneys and more particularly to improvements in means for operating dampers automatically by the pressure of steam in a steam boiler, opening the damper to increase the draft upon a lowering of the steam pressure and closing it to reduce the draft when the steam pressure has been raised to a predetermined point, and the object of my invention is to furnish such an apparatus which will, by its delicacy and certainty of operating, maintain the boiler pressure at substantially a constant point.

In the accompanying drawings forming part of this specification and in which similar numerals of reference indicate similar parts throughout the several views:—Figure 1, is a front elevation of my automatic damper regulator; Fig. 2, a side elevation of Fig. 1; Fig. 3, a plan of Fig. 1; Fig. 4, a section of flue or chimney showing damper and rods and levers for operating it; Fig. 5, a central section of elevation through the first steam cylinder, showing also, in side elevation, part of the lever operated through the cylinder, the standard to which one end of this lever is pivoted, and dial and pointer. Fig. 6, a side elevation of Fig. 5; Fig. 7, a central sectional elevation of means for actuating the lever through which one pair of admission and exhaust valves of the damper actuating cylinder are operated; Fig. 8, a side elevation of Fig. 7; Figs. 9 and 10, a front and side elevation, respectively, of the means for actuating the lever through which the second pair of admission and exhaust valves of the damper actuating cylinder are operated; Fig. 11, a side elevation of the main cylinder through which the damper is operated, the valves for controlling admission and exhaust of steam to and from said cylinder, &c. Fig. 12, a central sectional elevation through the main or damper actuating cylinder.

1 is a main steam pipe which is connected with the bottom of the first steam cylinder 2 within which is a piston 3, Fig. 5, the rod 4 of which is pivotally attached at 5 to a lever 6 the inner end of which is pivoted at 7 to a hinged support 8. Pivoted at 9 to lever 6 is a link 10 the other end of which is pivoted at 11 to a lever 12 which is pivotally carried at 13 by a stationary support 14, which serves, also, as a guide for the outer end of lever 6 in its movements. 15 is a counterweight on the outer end of lever 12 and 16 a link the lower end of which is pivoted to the inner end of lever 12.

The upper end of the link 16 is slotted as shown in Figs. 1 and 7 at 17 and through this slot passes a pin 18 which is carried by one end of a valve operating lever 19 the other end of which is furnished with a counterweight 20, or a spring, to normally close the valve which carries the lever 19.

21 is a valve, shown in the drawings as of the ordinary standard construction, which carries the lever 19; this valve is placed in and controls the passage of steam through a steam pipe 22, which connected with the main steam pipe 1, to a cylinder 23 the piston 24 of which is connected, through a link 25, with the inner end of a lever 26 which is pivoted at 27 to a fixed support 28, Fig. 1, and furnished with a counterweight 29.

30 is a link the upper end of which is pivoted to the outer end of an operating lever 31 of a steam valve 32 and the lower of which is pivoted to the outer end of an operating lever 33 of an exhaust valve 34 which valves are connected with the top and bottom, respectively, of the damper operating cylinder 35.

36 is a fork or arm carried by link 30 which is engaged by lever 26; 37 a spring for normally lifting link 30 as to close the valves 32—34. By means of a thumb nut 38 and stem 39 the tension of spring 37 may be regulated.

40 is a link pivoted to the inner end and depending from lever 12. The lower end of this link is slotted as shown in Figs. 1 and 10 at 41 and through this slot passes a pin 42 which is carried by one end of a cock operating lever 43 the other end of which is furnished with a spring 44 to normally close the valve 45 which carries the lever 43. The valve 45 is located on a steam pipe 47, connected with the main steam pipe 1, and controls flow of steam to a cylinder 48 similar in construction, except that its position is reversed, and operation to the cylinder 23 before referred to. The piston 49 of the

cylinder 48 is connected through a link 50 with one end of a lever 51 which is pivoted to a stand at 52 and which is furnished with a counterweight 53. The lever 51 is engaged by a fork or arm 54 which is carried by a link 55 the upper end of which is pivoted to the operating lever 56 of a valve 57 which controls exhaust of steam from upper end of cylinder 35 and the lower end of which is pivoted to the operating lever 58 of a valve 59 which controls admission of steam to the lower end of cylinder 35.

The cylinder 35 is fitted with a piston 60, Fig. 12, and with piston rods 61 passing one out of the top of the cylinder the other out of the bottom. To one of the rods 61, in the present case the upper one, is pivoted one end of a link 62 the other end of which is pivoted to the middle arm of a T shaped lever 63 which is pivoted at 64. To the other arms of this lever 63 are pivoted, respectively, the connecting links 65—66, Figs. 1, 2, 4, which are pivoted, the former, to the top of a lever 67, Fig. 4, the latter to the bottom of this lever which is itself fast to a pivot 68, Fig. 4, which carries the damper 69 which is located in a chimney or flue 70.

I will now proceed to describe the operation of the device and later will describe some of the details of construction which I believe to be novel. In the several general figures of the drawings the device is shown in a neutral position. If, now, the boiler pressure falls, the steam pressure against the lower end of piston 3 in the first cylinder 2, this cylinder being connected with the boiler by the steam main 1 as before described, is reduced and this piston falls a very small distance the result of which is that the lever 6 falls and through link 10 causes the inner end of lever 12 to fall. Owing to the arrangement of levers 6 and 12 a very small movement of the piston 3 is greatly magnified at the inner end of lever 12. As the inner end of lever 12 falls it moves down links 16 and 40, the slot 41 in the latter inoperatively passing the pin 42 on the operating lever 43 of the valve 45, and the link 16 draws down the operating lever 19 of the valve 21 opening this valve and admitting steam through pipe 22 to the top of the piston 24 in the cylinder 23 as best shown in Fig. 7. As the piston 24 is lowered it lowers the inner end of the lever 26 which through the fork or arm 36 best shown in Fig. 11, lowers the link 30 which opens the steam valve 32 in the top of cylinder 35 and the exhaust valve 34 in the bottom of this cylinder the result being that the piston 60 of this cylinder falls and through rod 61 and connected parts opens the damper 69.

As the steam pressure in the boiler rises it lifts the piston 3 in the first steam cylinder 2 and the operation is reversed. The inner end of the lever 12 rises and lifts links 16—40; the valve 21 is closed by the counterweight (or spring) 20 and the lever 26 by the counterweight (or spring) 29 lifting the piston 24 and through the connections previously described (fork 36, which is lifted by spring 37 as soon as the downward pressure of link 26 is removed and link 30) the valves 32—34 are closed.

Should the boiler pressure rise beyond a predetermined point the piston 3 will be lifted and will lift the levers 6 and 12 which latter will lift links 16—40, the former of which, owing to slot 17, will inoperatively pass the pin 18 on the operating lever 19 of valve 21, but the latter of which will engage the pin 42 on the operating lever of valve 45 which will be opened admitting steam from pipe 47 which is connected with steam main 1, to the bottom of the piston within cylinder 48. The upper end of this piston (which is similar to the piston within cylinder 23) will now lift the inner end of lever 51 which engages a fork or lever 54, best shown in Fig. 11, which is carried by a link 55, which is pivoted to the operating levers 56—58 of the valves 57—59 opening these valves, the latter of which is in a steam pipe 47 connected with steam main 1 and admitting steam to the bottom of the piston 60 in the cylinder 35 causing this piston and its rod to rise and through link 62, lever 63, rods 65—66 and lever 67 and pivot 68, the damper 69 to close.

Upon a falling of the boiler pressure the action is again reversed, the lever 51 is lifted by the counterweight 53 and the valves 57—59 are closed by the spring 71, Fig. 11 acting through the fork or arm 54 and the link 55.

The steam for lifting the piston within cylinder 35 is taken from the steam main 1 through a pipe x, for lowering this piston through a pipe 72.

The exhaust from all of the cylinders is carried to a common exhaust pipe 73. From the top of cylinder 35 the exhaust passes to pipe 73 through a pipe 74, from the bottom of this cylinder through a pipe 75. From cylinder 23 the exhaust passes to pipe 73 through a pipe 76; from cylinder 48 through a pipe 77; from cylinder 2 through a pipe 78.

In the exhaust pipe 74, leading from the top of cylinder 35, and 75, leading from the bottom of this cylinder I place hand operated valves 79 which can be regulated to choke the exhaust so as to prevent a too quick movement of the piston 60 and of the damper, which latter is sometimes a very heavy affair with great momentum when it starts moving. As an additional check upon the movements of the piston I propose to furnish it with springs 80, Fig. 12, which engaging the piston heads upon the up and down movements of the piston and connected parts act as buffers to prevent a shock in case of a too greatly accelerated movement of the

piston and at the same time act after a throw of the piston to assist the next movement of the same by their elasticity. If the damper be thrown too rapidly it is apt to oscillate violently and checking the exhaust from the cylinder 35 will to a great extent, or entirely, prevent this movement.

From Fig. 11 it will be seen that upon the levers 26—51 are arms 81—82 which act as indicators to show which of the cylinders 23—48 may be in action, as shown in the drawings they indicate a neutral position of the mechanism; if the arm 81 be lowered it shows that the cylinder 23 and connected parts are in operation, and if the arm 82 be lifted it indicates the same thing for cylinder 48 and connected parts.

The instrument may be set to maintain any predetermined pressure in the boiler by means of the device shown best in Figs. 5 and 6. 83 is a sleeve surrounding the cylinder 2 and 84 a spring carrying this sleeve. 85 an arm forming part of or secured to sleeve 83 and carrying a rack 86 which gears with a pinion 87 carried on an arbor 88 which carries a pointer 89. 90 is a graduated dial for the pointer 89. 91 is a long sleeve which surrounds the upper part of cylinder 2 and which is secured thereto by screw threads; the under part of this sleeve bears against the top of the spring supported sleeve 83 and by setting this sleeve 91 up or down the sleeve 83, the arm 85 and rack 86 may be set up or down to adjust the pointer 89 in reference to the graduations on the dial 90. The upper end of the sleeve 91, which forms a continuation of the cylinder 2, is furnished with perforations 92 to permit the escape of any steam which may leak past the grooves or rings 93 of the piston 3. Bearing against the top of the piston 3 and against the under side of the top of the sleeve 91 is a spring 94 and carried by the reduced top of the piston 3 is a nut 95 which holds in place a packing ring 96. In order to lift the piston 3 the steam from the steam main 1 has to compress the spring 94 therefore by loosening or tightening this spring the effective throw of the piston is made greater or less for any given steam pressure. The graduations on the dial 90 are made to correspond with the boiler pressures as indicated upon a steam gage, this being done in the first place experimentally and afterward it is only necessary to bring the pointer to any one of the graduations upon dial 90, by setting the sleeve 91 up or down as may be required, to have the apparatus operate to open or close the damper as may be necessary to maintain the boiler pressure at substantially the point indicated.

From Fig. 7, which shows the arrangement of the interiors of the cylinders 23—48 and their pistons, it will be seen how I take care of any condensed water therein. The pistons are hollow, as shown at 97 and at the end of their stroke this hollow part connects with the exhaust steam pipe through which any water held in the hollow may escape.

98, Figs. 1, 2, 3 and 11, is a yoke carried by one of the heads of the damper actuating cylinder 35 which forms a guide for the piston rod 61; as shown in the drawings this yoke is on top of the cylinder 35, the damper being placed above the cylinder, but if it were necessary to place the damper below the cylinder the yoke would be secured to the lower cylinder head as shown in dotted lines Fig. 1.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. In a damper regulator, in combination, a main steam cylinder and piston the rod of which is adapted to be connected to a damper, a steam inlet and a steam exhaust port at the top and a steam inlet and a steam exhaust port at the bottom of said cylinder, two port operating cylinders the piston rods of which are adapted the one to operate means for opening and closing one set of steam and exhaust ports in said main cylinder and the other to operate means for opening and closing the other set of steam and exhaust ports in said cylinder, operative connections between said steam and exhaust ports in said main cylinder and the piston rods of said port operating cylinders, and means, operated by the fluctuations of the boiler pressure, for operating the admission valves in said port operating cylinders.

2. In a damper regulator, in combination, a steam cylinder connected with the boiler, a piston, a series of levers for multiplying the movements of said piston, a damper, a steam cylinder, steam inlet and exhaust valves at the top of and steam inlet and exhaust valves at the bottom of said cylinder, a piston within said cylinder adapted to operate said damper, links connecting in pairs each of said inlet and exhaust valves, a pivoted lever connected to each of said links, pistons connected with the free ends of said levers, cylinders carrying said pistons, valves for controlling the admission of steam to one of ends of said cylinders, operative arms carried by said valves, slotted links carried by free end of the last multiplying lever adapted on a movement of said multiplying arm in one direction to open the steam valve on one cylinder and on a movement in the opposite direction to open the steam valve on the other cylinder, and means for normally closing said steam valves.

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