April 17, 1928.

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COMPENSATION FOR REGULATION

Filed July 6, 1925

Fig. 1.

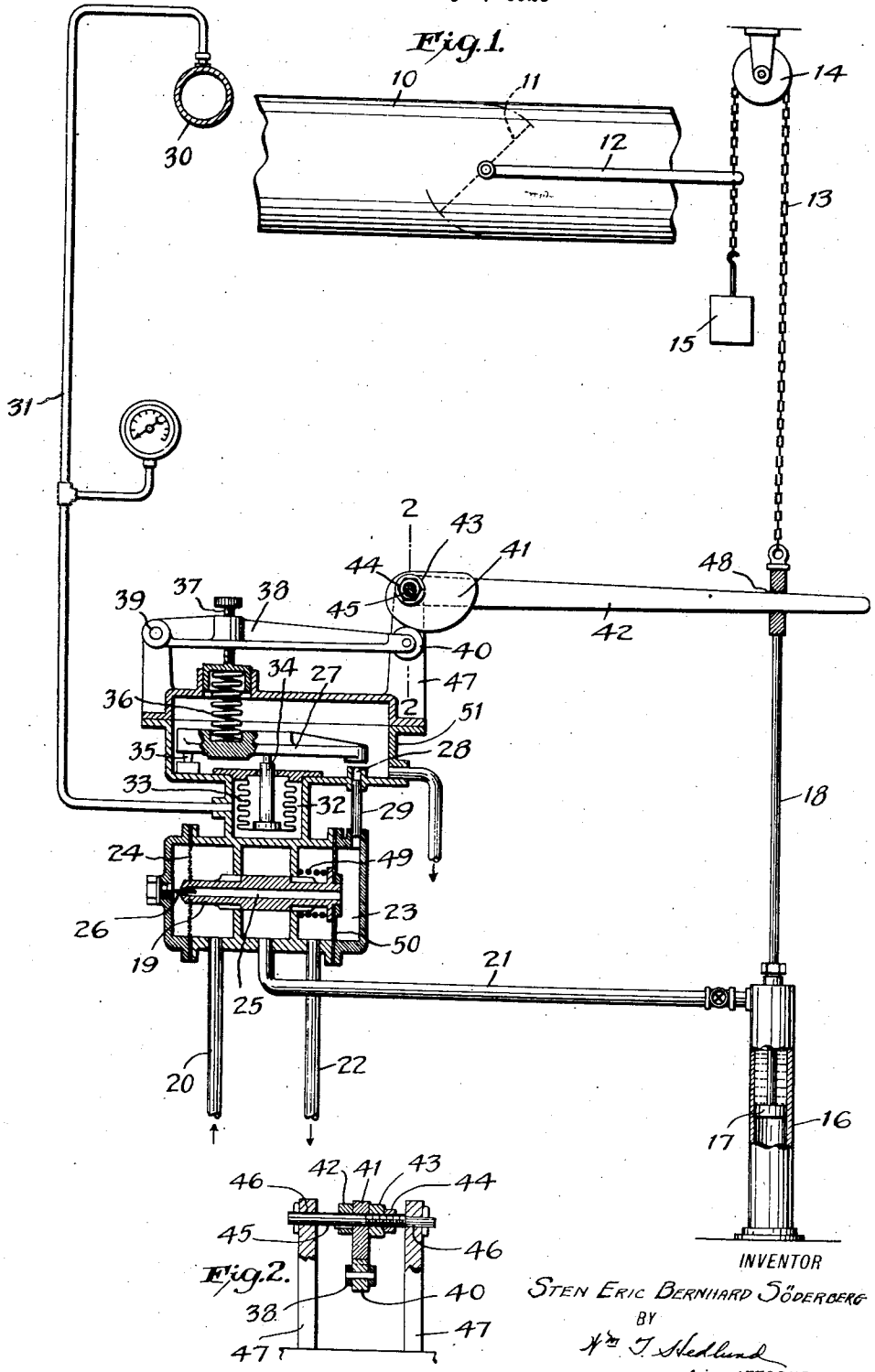


Fig. 2.

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UNITED STATES PATENT OFFICE.

STEN ERIC BERNHARD SÖDERBERG, OF NEW YORK, N. Y., ASSIGNOR TO ARCA REGULATORS, INC., OF NEW YORK, N. Y., A CORPORATION OF VIRGINIA.

COMPENSATION FOR REGULATION.

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My invention relates to regulators and more specifically to regulators of the indirect type wherein fluid under pressure is used as a force transmitting agency.

The purpose of my invention is to provide a novel means of compensation for a regulator whereby return motion is effected quicker than if the effect of regulation is transmitted through the primary agency of regulation for checking of the regulator action and hunting is prevented.

Further purposes of my invention and the nature thereof will be apparent from the following description of one embodiment thereof shown in the accompanying drawing, in which

Figure 1 shows the general layout of the embodiment selected to illustrate my invention and Figure 2 is a cross-sectional view taken on line 2—2, Figure 1.

Reference character 10 designates an air duct supplying air to the combustion chamber of a boiler, in which duct is arranged a main regulating member in the form of a damper 11, rotated by means of lever 12 and controlling flow through the duct. Lever 12, at the end remote from the damper, is connected to a flexible member in the form of a chain 13 which passes over pulley 14 and carries a counterweight opposing the pressure of liquid in servo-motor cylinder 16, acting on piston 17 to which is attached piston rod 18 which is attached to chain 13.

Pressure of liquid in cylinder 16 is controlled by pilot valve 19 which operates to effect communication either between a supply conduit 20 and conduit 21 connected to cylinder 16 or between conduit 20 and waste conduit 22. Movement of pilot valve 19 is effected by changes of liquid pressure in chamber 23, acting on diaphragm 50 and opposed to spring 49. Liquid is supplied to chamber 23 from supply conduit 20 through filter 24 and through longitudinal passageway 25 extending throughout the length of the pilot valve 19. Pin 26 serves to maintain the entrance end of the longitudinal passageway which is restricted, clean at all times. Changes of pressure in chamber 23 are effected by movement of baffling member 27, in the form of a lever, and situated in relay housing 51, towards or away from nozzle opening 28 in conduit 29 which communicates with chamber 23.

Changes in steam pressure occurring in conduit 30 are transmitted through tubing 31 to bellows chamber 32 which is formed between the regulator casing and a flexible bellows 33. Within the bellows and serving to transmit motion from the bellows to lever 27 is a pin 34. Lever 27 is pivoted on two point bearings 35 placed at equal distances to each side of the center line of the lever. The spring 36 acts upon lever 27 in opposition to the steam pressure in chamber 32. Spring 36 is adjustable by means of a screw threaded member 37 which passes through a lever 38 secured to the regulator casing at one end by swinging connection 39. The opposite end of lever 38 carries a roller 40 which is adapted to roll upon the surface of cam 41. Cam 41 is secured to a lever 42 by means of an adjustable nut 43 and a lock nut 44. Lever 42 is securely fastened to shaft 45 mounted in bearings 46 on stationary supports 47. Cam 41 fits loosely upon shaft 45 so that it may be adjusted with respect to lever 42 by loosening nuts 43 and 44, rotating the cam to desired position and then setting up again on the nuts. The opposite end of lever 42 is secured in any desired manner to a movable part of the servo-motor, as for example, by being placed in a slot 48 formed in an extension of piston rod 18.

The operation of the regulator is as follows:

Suppose the pressure in conduit 30 increases. A corresponding increase of pressure then takes place in chamber 32, causing an upward movement of the bottom of bellows 33 which causes upward movement of pin 34 and increases the distance between the movable end of lever 27 and the nozzle opening 28, whereby pressure in conduit 29 and in chamber 23 is decreased. The force of spring 49 then overcomes the pressure exerted on diaphragm 50 and pilot valve 19 is moved to the right as shown in the drawing, whereby communication is effected between conduit 20 and 21, so that pressure liquid can pass into the servo-motor cylinder 16 and move piston 17 downwardly, whereby the free end of lever 12 is moved upwardly and damper 11 is closed somewhat. Downward motion of piston rod 18 in this operation causes a downward movement of the free end of lever 42 whereby cam 41 rotates

and this moves roller 40 in such a manner that the free end of lever 38 is moved downwardly, whereby motion is transmitted through spring 36 to lever 27, moving the lever or baffling member nearer to the nozzle discharge opening 28, whereby the pressure is increased in chamber 23, thus offsetting the previous decrease of pressure in chamber 23 and returning the pilot valve in direction toward its position before the supposed increase in pressure in conduit 30 took place, thereby causing a return to normal conditions quicker than if supply of air through duct 10 should have to effect the steam pressure.

By means of the adjustability of cam 41 any desired rate of return motion or any desired characteristic of regulation may be obtained. The effect may also obviously be altered by changing the contour of cam 41.

If the steam pressure in conduit 30 should decrease, the operation is the reverse, lever 27 is moved closer to nozzle opening 28 whereby pressure in chamber 23 is increased and communication is effected between conduit 21 and waste conduit 22, so that pressure of liquid is relieved in cylinder 16 and damper 11 is opened more or less. This operation causes movement of cam 41 in such direction that the free end of lever 38 moves upwardly and lever 27 is brought back to normal position.

By means of the regulator thus described great precision is obtained and hunting is effectively prevented.

Liquid entering into relay housing 51 may pass out through conduit 52.

While I have described one embodiment of my invention, it is to be understood that my invention is not limited to the form described, but that many changes may be made within the spirit and scope of the invention.

The duct 10 may obviously be a waste gas flue leading from a boiler, in which case the operation will be the same as above outlined.

What I claim is:

1. In a liquid pressure operated regulator, in combination, a relay housing, means to discharge a stream of liquid into said housing, a baffling member to control said stream of liquid, means to move said baffling member, a main regulating member affected by changes of pressure in said stream of liquid and return motion mechanism including a cam movable in response to movement of the regulating member, and means operated by said cam acting on said baffling member.

2. In a liquid pressure operated regulator, in combination, a relay housing, means to discharge a stream of liquid into said housing, a baffling member to control said stream of liquid, means to move said baffling member, a main regulating member affected by changes of pressure in said stream of liquid and return motion mechanism including a cam movable in response to movement of the regulating member, means operated by said cam acting on said baffling member and means to adjust the position of the cam with respect to the said members.

3. In a liquid pressure operated regulator, in combination, a relay housing, means to discharge a stream of liquid into said housing, a baffling member to control said stream of liquid, means to move said baffling member, a main regulating member affected by changes of pressure in said stream of liquid and return motion mechanism including a cam movable in response to movement of the regulating member, and a roller bearing on said cam and operating to transfer rotation of said cam to movement of said baffling member.

4. In a liquid pressure operated regulator, in combination, a relay housing, a nozzle discharging a stream of liquid into said housing, a lever acting as a baffling member to control discharge through said nozzle, a main regulating member movable upon changes in pressure in said stream of liquid, a second lever, a resilient connection between said levers, a roller on said second lever, a cam contacting said roller and means to move said cam upon movement of said main regulating member.

5. A regulator comprising a first lever, means to rock said lever in response to changes in a condition, a main regulating member, a servo-motor operated by movement of said first lever and serving to move said main regulating member, a second lever adapted to be rocked by said servo-motor, a cam rotated by rocking of said second lever, a member moved by rotation of said cam, and a resilient connection between the last-mentioned member and the first lever.

6. A regulator comprising a first lever operated in response to changes in a condition, a main regulating member controlled by said lever, a shaft, a second lever mounted on said shaft and rocked upon movement of said main regulating member, a cam mounted on said shaft, means to secure said cam in different positions on said shaft, a third lever rotated by said cam and a yieldable motion transmitting member between the first and third levers.

7. A regulator comprising a first lever operated in response to changes in a condition, a main regulating member, liquid-pressure operated means to control said main regulating member, means whereby said lever controls said liquid-pressure operated means, a shaft, a second lever mounted on said shaft and rocked upon movement of said liquid-pressure operated means, a cam mounted on said shaft, means to secure said cam in various positions on said shaft, a third lever ro-

tated by said cam and a yieldable motion transmitting member between the first and third levers.

8. A regulator comprising a relay housing, an element in said housing movable in response to changes in a condition, a main regulating member, means whereby said element operates said main regulating member, bearing mechanism fixed to said housing, a shaft mounted in said bearing mechanism, a lever mounted on said shaft, a cam mounted on said shaft, a member bearing against the cam surface of said cam and yieldably connected to said element and means whereby movement of said main regulating member causes movement of said lever.

9. A regulator comprising an element operated in response to changes in a condition and having a relatively short range of travel, a main regulating member, a part connected to said main regulating member having a relatively great range of travel, means whereby said element moves said part, a lever having its free end co-operating with said part and moved thereby, a cam mounted co-axially with said lever, a member moved by contact with the cam surface of the cam, the cam surface being such that a relatively great movement of the free end of the lever gives a relatively small movement of the last-mentioned member, and means to transmit movement from the last-mentioned member to said element.

10. A regulator comprising an element operated in response to changes in a condition, and having a relatively short range of travel, a main regulating member, a part connected to said main regulating member having a relatively great range of travel, means whereby said element moves said part, a lever having its free end co-operating with said part and moved thereby, a cam mounted co-axially with said lever, a member moved by contact with the cam surface of the cam, the cam surface being such that a relatively great movement of the free end of the lever gives a relatively small movement of the last-mentioned member, means to transmit movement from the last mentioned member to said element and means to adjust the cam with respect to the lever.

In testimony whereof I affix my signature.

STEN ERIC BERNHARD SÖDERBERG.