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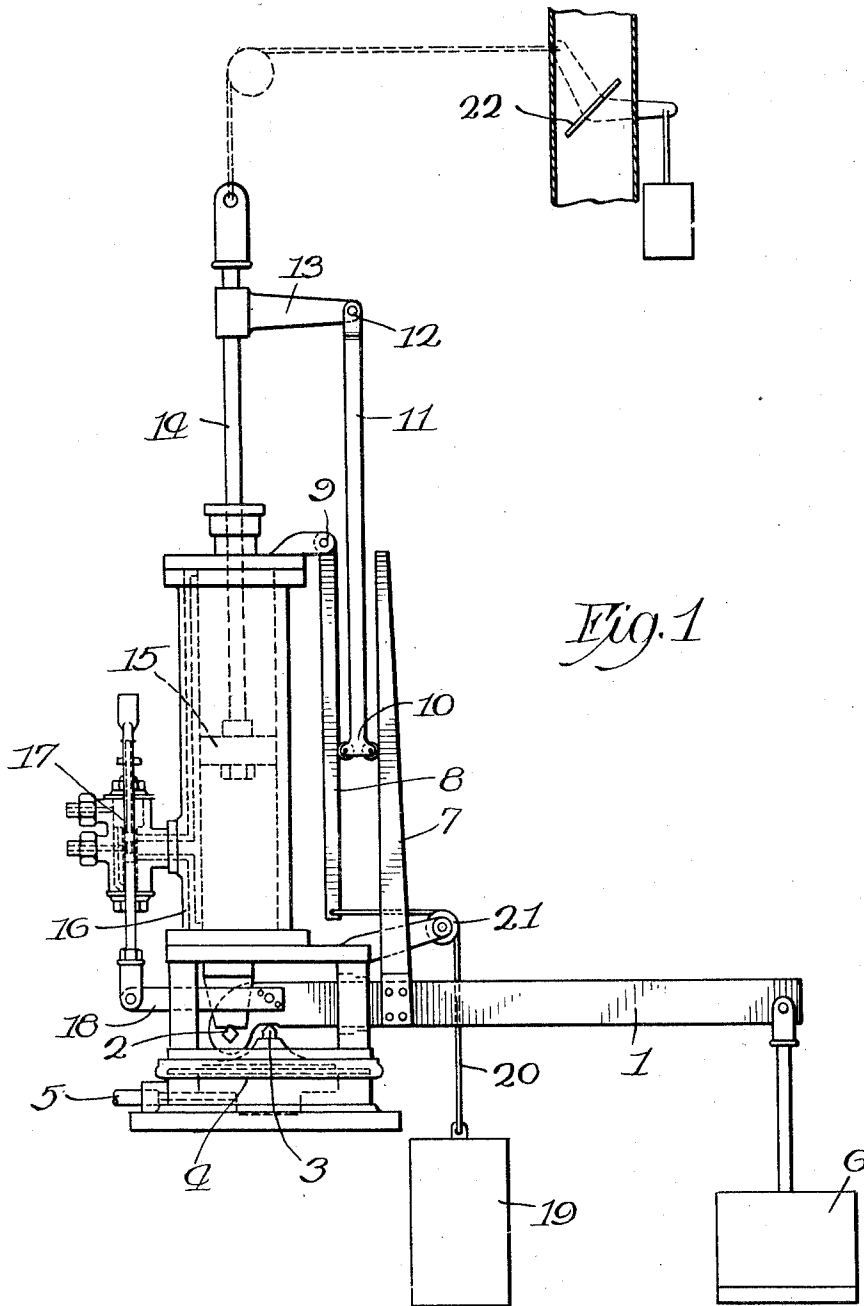
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AUTOMATIC REGULATOR

Filed Jan. 12, 1928

2 Sheets-Sheet 1



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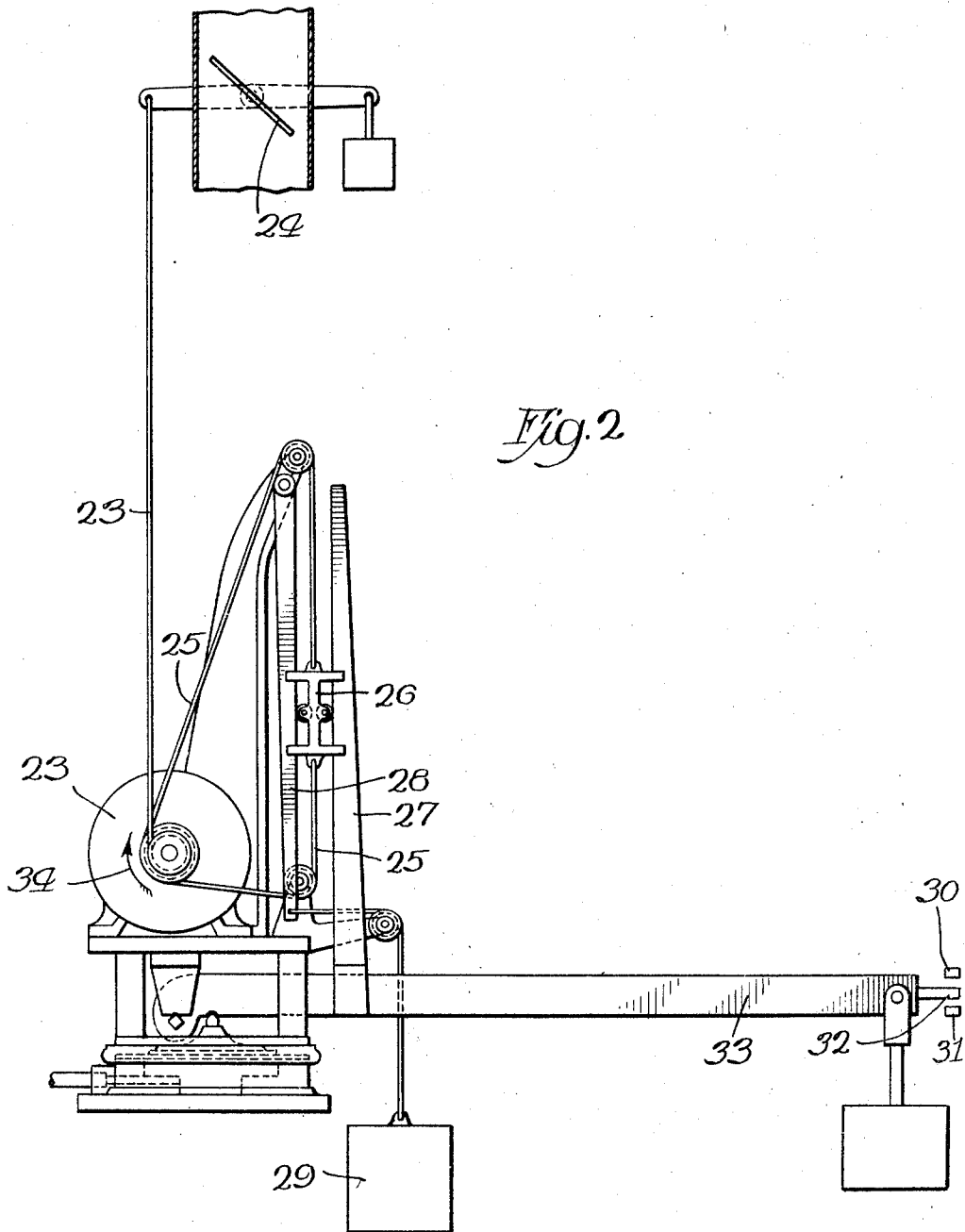
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UNITED STATES PATENT OFFICE

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AUTOMATIC REGULATOR.

Application filed January 12, 1928. Serial No. 246,144.

This invention relates to automatic controlling apparatus in general, but more particularly to apparatus of this kind for automatically controlling a boiler furnace damper, thereby to automatically maintain, as nearly as possible, a uniform and predetermined steam pressure.

Generally stated, the object of the invention is to provide a novel and improved automatic controlling apparatus having a horizontally disposed counterbalance arm and having a vertically movable compensating device for modifying the action of said counterbalance arm.

It is also an object to provide certain details and features of construction and combinations tending to increase the general efficiency and the desirability of an automatic controlling apparatus of this particular character.

To the foregoing and other useful ends, the invention consists in the matters hereinafter set forth and claimed, and shown in the accompanying drawings, in which,—

Fig. 1 is a side elevation, more or less diagrammatic in character, showing an automatic controlling apparatus embodying the principles of the invention.

Fig. 2 is a similar view, showing a different form of the invention.

As thus illustrated, and referring to Fig. 1, the invention comprises a horizontally disposed counterbalance arm 1 fulcrumed at 2 on a stationary portion of the apparatus, and supported on a knife edge 3 carried by the diaphragm of the pressure responsive device 4, which latter is connected by a pipe 5 with the steam or other fluid pressure, whereby any variation of the pressure will cause the arm 1 to move up and down, this arm preferably having a counterbalance weight 6 hung thereon. A compensating device, for modifying the action of said arm, is provided, comprising a vertically disposed arm 7 rigid with the arm 1, a vertically disposed rod or bar 8 pivoted at 9, at its upper end, on a stationary portion of the apparatus, together with a traveler 10 having wheels for engaging the opposing edges of said arms 7 and 8, which traveler is suspended on a rod 11 that is

pivoted at 12, at its upper end, on an arm 13 carried by the piston rod 14 of the vertically movable piston head 15 in the cylinder 16, which latter is practically supported in vertically disposed position directly above the said pressure responsive device. The valve mechanism 17 controls the supply of steam or other pressure to the cylinder, to operate the said piston therein, and this valve mechanism is controlled by an arm 18 which is rigid with the arm 1 and suitably connected to said mechanism. A compensating counterbalance weight 19 is connected by a cable 20 with the lower end of the previously mentioned arm 8, this cable being supported on a sheave 21 suitably mounted on some stationary portion of the apparatus. The upper end of the rod 14 is suitably connected with the damper 22 of the boiler furnace smoke flue.

With this construction and arrangement, the arm 1 moves downward, of course, when the pressure falls in the device 4, and this operates the valve mechanism 17 to cause the pressure in the cylinder 16 to move the piston 15 downward, thus causing the opening movement of the damper 22 in the smoke flue. Also, this causes a downward movement of the traveler 10 between the arms 7 and 8, whereby the effective pull of the weight 19, through the bars 7 and 8 and the traveler 10, upon the arm 1 is reduced, as the leverage is reduced, of course, as the traveler 10 moves downward and shortens the distance between its point of engagement with the arm 7 and the arm 1 below. When the pressure in the device 4 rises above the desired point, the arm 1 is moved upward, and the reverse action takes place, the traveler 10 moving upward to increase the effective pull of the weight 19 on the arm 1, in a manner that will be readily understood. In this way, the compensating device modifies the action of the arm 1, in a manner calculated to maintain the steam pressure more nearly at a uniform pressure.

In Fig. 2 the construction is substantially the same as that previously described, but in this case a rotary motor 23 is employed in place of the reciprocating motor shown in Fig. 1 of the drawings. This rotary motor

is preferably an electric motor of the well known kind, that is, self-braking, so to speak, having a positive start and stop, and the motor is also of the kind that is reversible. Said motor is connected by a cable 23 with a damper 24 in the smoke flue of the boiler furnace, and the motor is also connected by a cable 25 with the traveler 26 that travels up and down between the bars 27 and 28, which bars are like the bars or arms 7 and 8 previously mentioned. The rotary motor 23, therefore, operates to pull the traveler 26 downward, when the pressure falls and the damper 24 is to be opened, and serves to pull the traveler 26 upward when the pressure rises to a certain point and when the damper is to be closed, so that the effectiveness of the weight 29, which is connected and arranged exactly the same as the weight 19 previously mentioned, is automatically varied, as previously explained. The motor has a controller in the form of a switch, comprising the stationary contacts 30 and 31 and the movable contact 32 between them, the contact 32 being normally in the position shown. The contacts 30 and 31 are included, it will be understood, in circuits including the motor 23 and a source of electric current. The contact 32 is rigid with the counterbalance arm 33, and when the latter moves downward, the contact 32 engages the contact 31 and causes the motor to rotate in the direction indicated by the arrow 34, thereby to cause an opening movement of the damper. On the other hand, when the arm 33 moves upward, the motor rotates in the opposite direction, thus causing the closing movement of the damper.

In either form of the invention, therefore, the compensating device is provided, in combination with a horizontally disposed counterbalance arm, but the compensating device is movable up and down or vertically, thereby to in effect increase or decrease the effective downward pull of the weight 19 or the weight 29, on the counterbalance arm, in the manner explained, and in this way the steam or other pressure is maintained more nearly uniform.

Thus a variable leverage pressure is exerted through the traveler (10 or 26) and there is a double action leverage as the leverage of both arms (7 and 8 or 27 and 28) is changed by the up and down movement of the traveler. It is through this double acting variable leverage that the weight (19 or 29) exerts a pull on the counterbalance arm (1 or 33) of the apparatus.

Without disclaiming anything, and without prejudice to any novelty disclosed, what I claim as my invention is:

1. Automatic controlling apparatus, comprising a motor for operating the means to be controlled, a horizontally disposed counterbalance arm, pressure responsive means for causing said arm to move up and down, a counterbalance weight supported for up and

down movement only, and mechanical compensating means having an element thereof movable up and down by said motor and comprising lever means engaging said element and providing a variable leverage pressure transmitted horizontally through said up and down movable element, said compensating means being connected to said arm and operative thereby in effect to vary the effective pull of said weight transmitted through said element on said counterbalance arm.

2. A structure as specified in claim 1, said compensating means comprising a vertically disposed arm rigid with said counterbalance arm, a pivoted arm disposed substantially parallel with said vertically disposed arm, said counterbalance weight being connected to the free end of said pivoted arm, together with a traveler forming said element and engaging the opposing edges of said vertically disposed arms and movable up and down therebetween by said motor.

3. A structure as specified in claim 1, said compensating means comprising a vertically disposed arm rigid with said counterbalance arm, a pivoted arm disposed substantially parallel with said vertically disposed arm, said counterbalance weight being connected to the free end of said pivoted arm, together with a traveler forming said element and engaging the opposing edges of said vertically disposed arms and movable up and down therebetween by said motor, said vertically disposed arm having its lower end rigid with said counterbalance arm, and said pivoted arm being pivoted at its upper end, and the weight being connected to the lower end of this pivoted arm.

4. A structure as specified in claim 1, said compensating means comprising substantially parallel arms and a traveler forming said element and engaging the opposing edges of said arms and movable back and forth therebetween by said motor.

5. In automatic controlling apparatus, a compensating device comprising substantially parallel arms, one arm being pivoted at one end thereof, the other arm being rigid at the other end with a movable element of the controlling apparatus, means tending constantly to move the free end of the pivoted arm toward the other arm, a traveler engaging the opposing edges of said arms, and means for operating said traveler back and forth between the arms, thereby in effect to change the leverage communicated through said compensating device to said movable element.

6. A structure as specified in claim 5, said movable element being a variable pressure operated counterbalance arm.

7. A structure as specified in claim 5, said arms being vertically disposed, and said traveler being movable up and down between said arms.

8. A structure as specified in claim 5, said means for operating the traveler comprising suspension means to reciprocate said traveler between said arms.

on said counterbalance arm, said compensating means comprising substantially parallel arms and a traveler engaging the opposing edges of said arms and movable back and forth therebetween by said motor.

Specification signed this 7th day of January, 1928.

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9. A structure as specified in claim 5, said means for operating said traveler comprising a depending swinging support to operate the traveler up and down between said arms.

10. Automatic controlling apparatus, comprising a motor for operating the means to be controlled, a horizontally disposed counterbalance arm, pressure responsive means for causing said arm to move up and down, a counterbalance weight, and compensating means having an element thereof movable up and down by said motor, to provide a variable leverage and operative to thereby in effect vary the effective pull of said weight on said counterbalancing arm, said compensating means comprising a vertically disposed arm rigid with said counterbalance arm, a pivoted arm disposed substantially parallel with said vertically disposed arm, said counterbalance weight being connected to the free end of said pivoted arm, together with a traveler forming said element and engaging the opposing edges of said vertically disposed arms and movable up and down therebetween by said motor.

11. Automatic controlling apparatus, comprising a motor for operating the means to be controlled, a horizontally disposed counterbalance arm, pressure responsive means for causing said arm to move up and down, a counterbalance weight, and compensating means having an element thereof movable up and down by said motor, to provide a variable leverage, and operative to thereby in effect vary the effective pull of said weight on said counterbalance arm, said compensating means comprising a vertically disposed arm rigid with said counterbalance arm, a pivoted arm disposed substantially parallel with said vertically disposed arm, said counterbalance weight being connected to the free end of said pivoted arm, together with a traveler forming said element and engaging the opposing edges of said vertically disposed arms and movable up and down therebetween by said motor, said vertically disposed arm having its lower end rigid with said counterbalance arm, and said pivoted arm being pivoted at its upper end, and the weight being connected to the lower end of this pivoted arm.

12. Automatic controlling apparatus comprising a motor for operating the means to be controlled, a horizontally disposed counterbalance arm, pressure responsive means for causing said arm to move up and down, a counterbalance weight, and compensating means having an element thereof movable up and down by said motor, to provide a variable leverage and operative to thereby in effect vary the effective pull of said weight

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