No. 616,842. Patented Dec. 27, 1898.

H. E. HUNT.

AUTOMATIC REGULATOR.

(Application filed Jan. 26, 1897.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

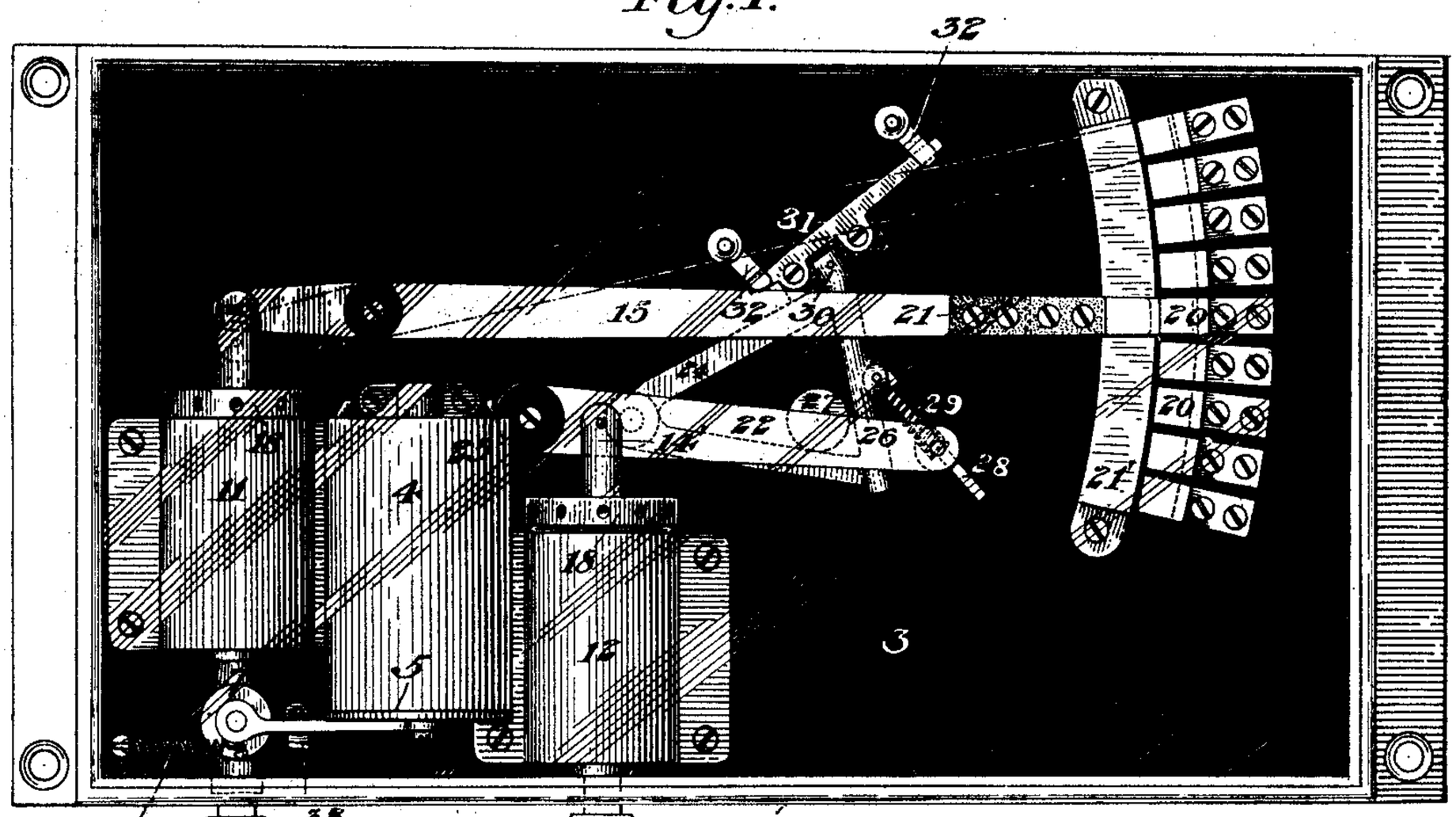
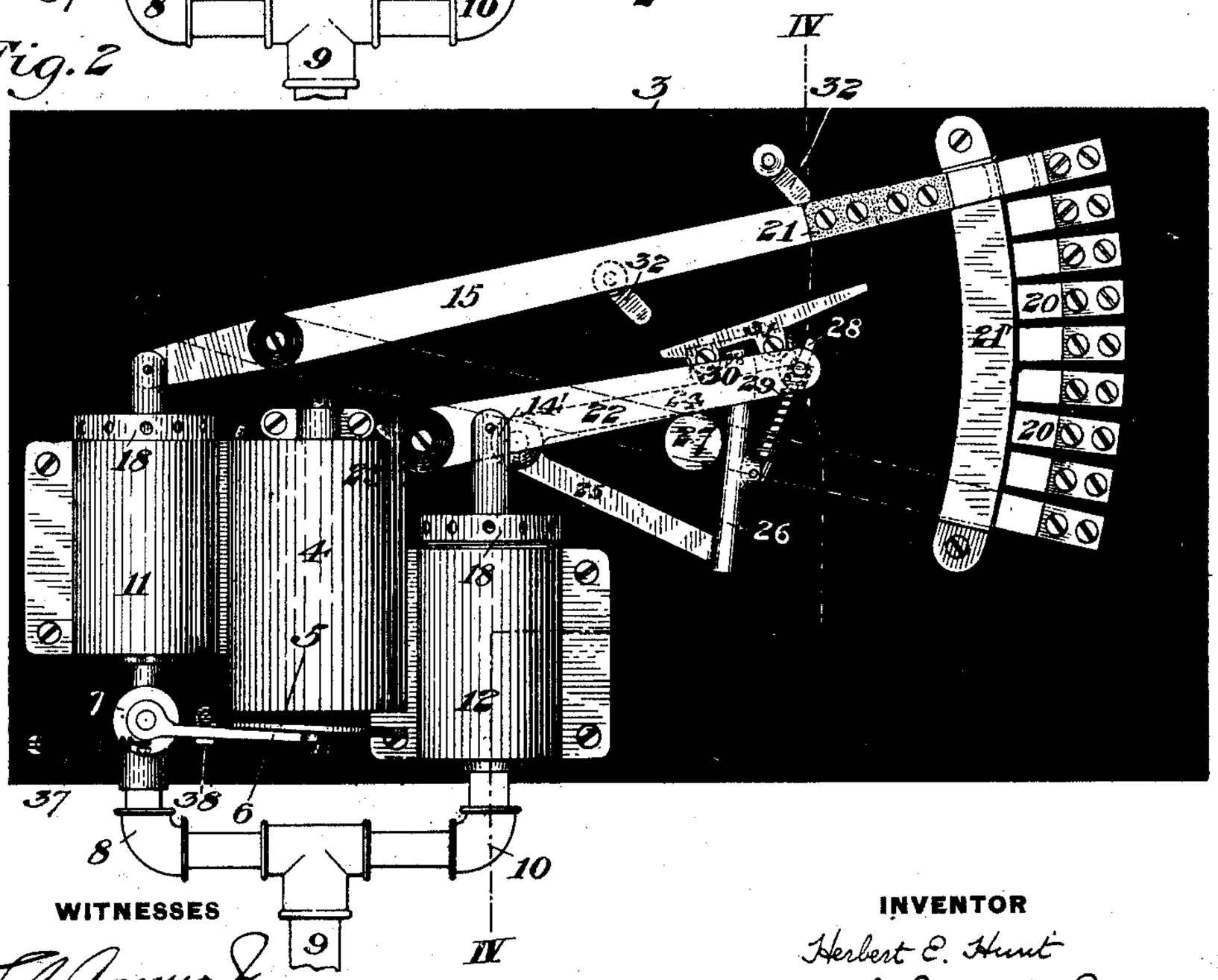


Fig. 2



WITNESSES

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(No Model.) 3 Sheets—Sheet 2.

Fig. 4.

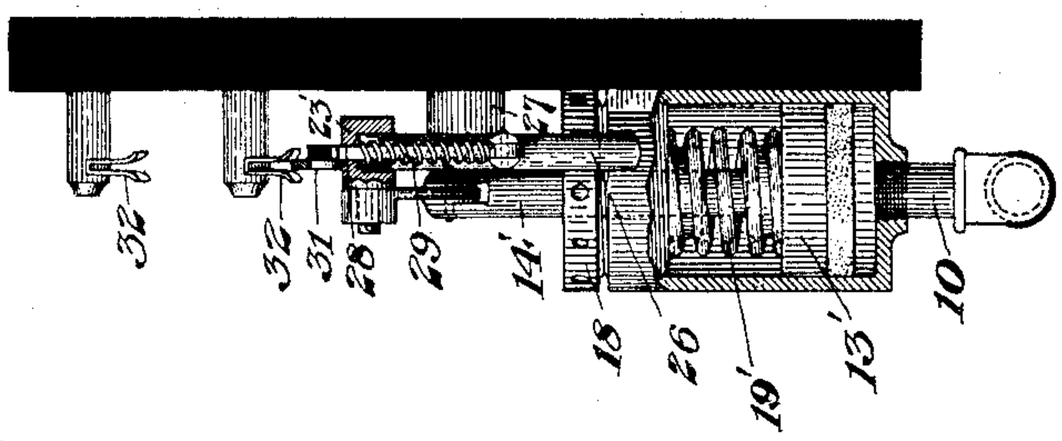


Fig. 6.

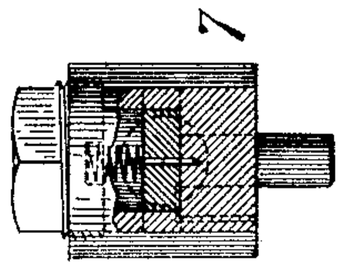


Fig. 7.

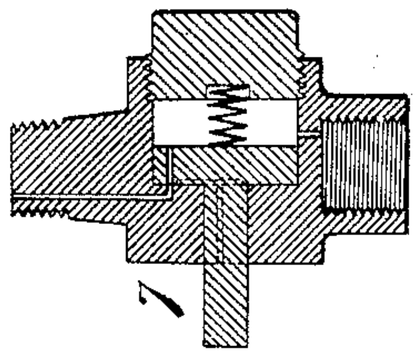


Fig. 8.

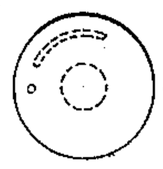


Fig. 3.

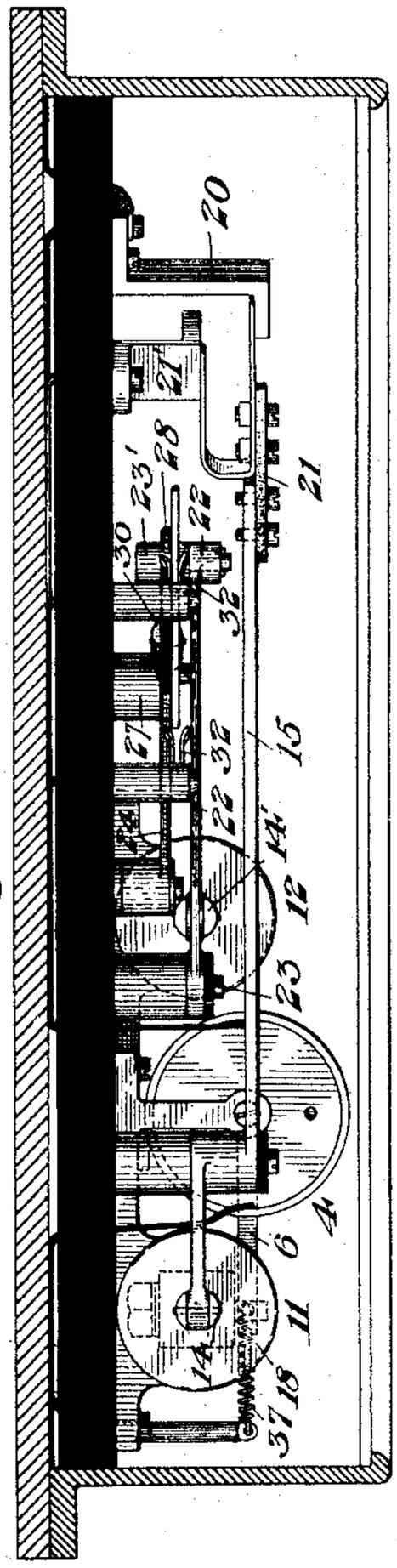
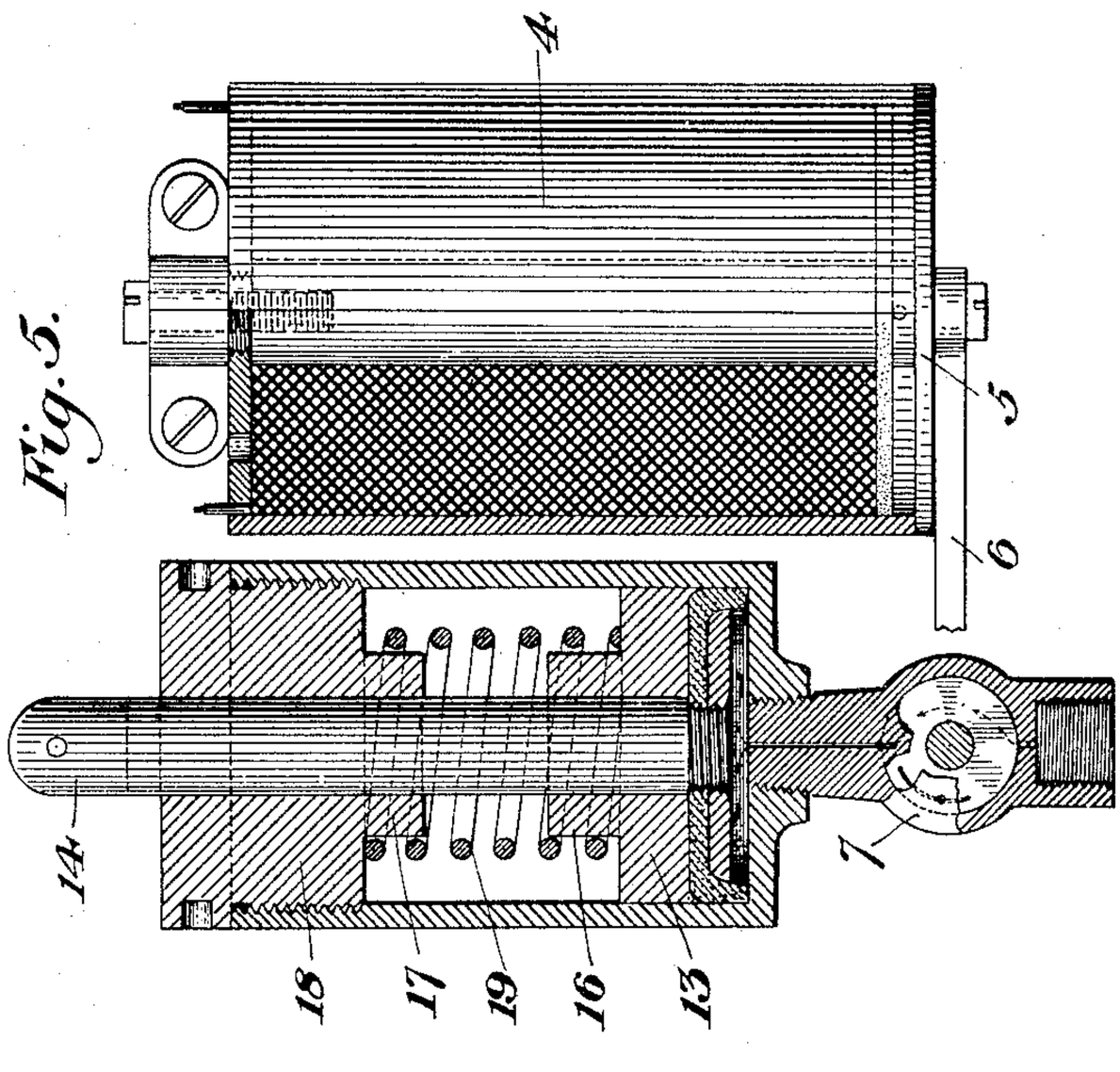


Fig. 5.



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AUTOMATIC REGULATOR.

(Application filed Jan. 26, 1897.)

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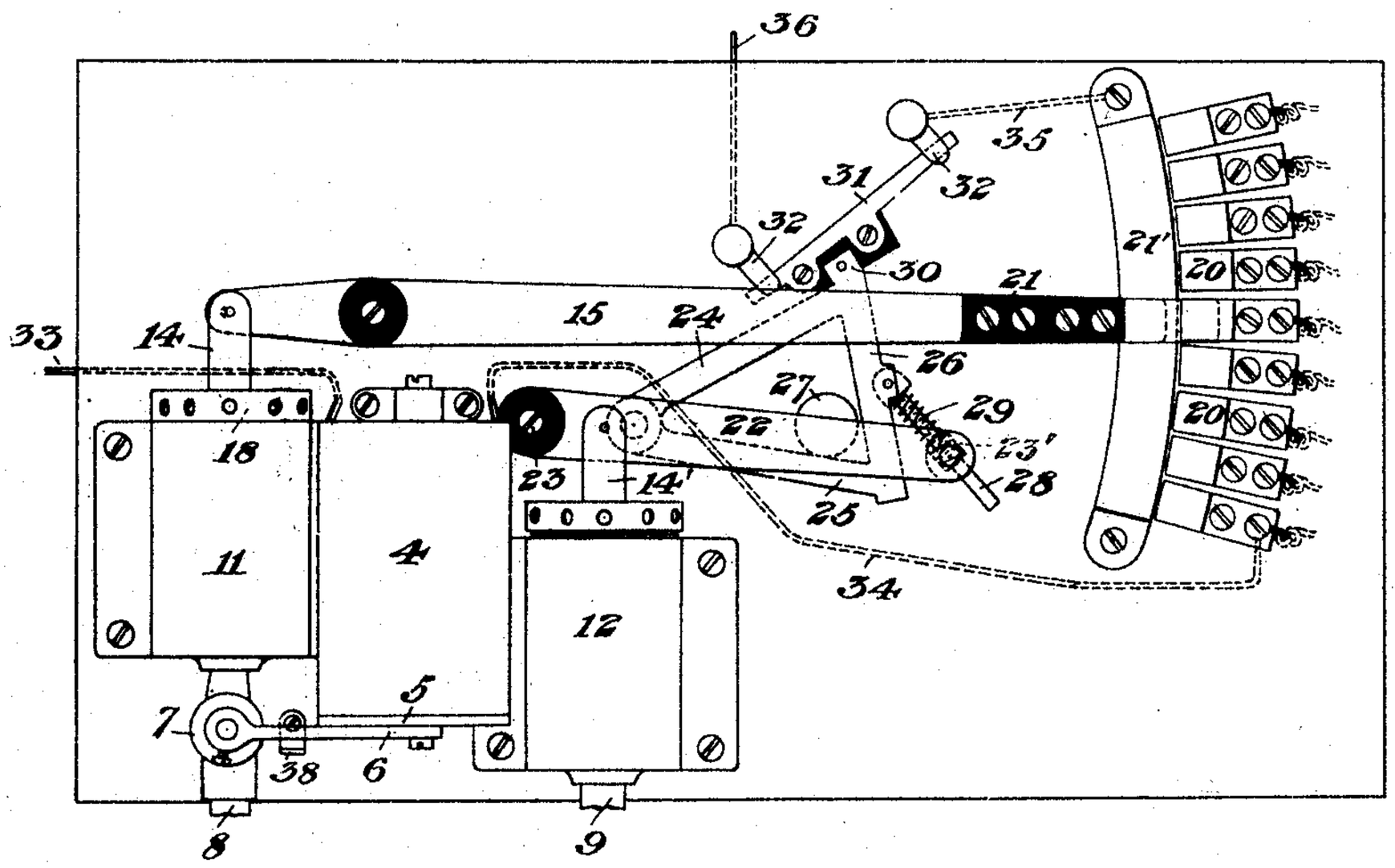
Fig. 9.



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UNITED STATES PATENT OFFICE.

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AUTOMATIC REGULATOR.

SPECIFICATION forming part of Letters Patent No. 616,842, dated December 27, 1898.

Application filed January 26, 1897. Serial No. 620,732. (No model.)

To all whom it may concern:

Be it known that I, HERBERT E. HUNT, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Automatic Regulators, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a top plan view of my improved automatic pressure-regulator, showing the parts in the position assumed while the reservoir is being charged. Fig. 2 is a similar view, the outer box being removed and the parts being shown in the position taken when the pressure has reached the predetermined limit. Fig. 3 is a top plan view of the device. Fig. 4 is a cross-section on the line IV IV of Fig. 2. Fig. 5 is a side elevation, partly broken away, of one of the pressure-cylinders and the electromagnet. Figs. 6, 7, and 8 are detail views of the three-way valve leading to the cylinder of Fig. 5; and Fig. 9 is a general diagrammatic view of the apparatus, showing the electrical connections.

My invention relates to the regulating of reservoir-pressures, being designed more particularly for use in connection with that class of street-car air-brakes wherein the air-pump is driven by a separate electric motor; and it is designed to provide an automatic regulator which will cut the current from the motor when the pressure in the reservoir rises above a certain limit and make proper connections to preserve a nearly constant predetermined pressure in the reservoir.

In the drawings, 2 represents a box having its bottom covered with a thick plate of slate or other insulating material 3, to which the parts of the apparatus are secured.

4 is an electromagnet having an armature 5 secured to the projecting lever-arm 6 of a three-way valve 7 in a branch pipe 8, leading from the pressure-pipe 9. The pipe 9 is also provided with another branch 10, these branches leading into the ends of cylinders 11 and 12, respectively. The port leading from the three-way valve 7 into the end of the cylinder 11 is of very small diameter, preferably about one sixty-fourth of an inch, for the purpose hereinafter described. Within this cylinder 11, which I shall hereinafter call the "low-pressure" cylinder, moves a piston 13, the projecting end of whose piston-rod 14 is pivotally connected to the end of a swinging lever 15. The piston 13 is provided with a projecting boss 16, in line with a boss 17, projecting from the cylinder-head 18, a spiral spring 19 surrounding these bosses and normally forcing the piston to the end of the cylinder. The pressure of this spring is regulated by the use of a screw-threaded connection between the head 18 and cylinder, as shown, rotation of the head giving a greater or less compression upon the spring. The lever 15 constitutes the contact-arm of a rheostat, whose resistance-blocks 20 are arranged in the arc of a circle, as ordinarily, the outer end of the arm, which is electrically insulated from the arm proper by interposed insulating material 21, having contact-blocks which move over the resistance-blocks 20 and over a curved contact-strip 21'. The cylinder 12 upon the other side of the electromagnet, which I shall hereinafter call the "high-pressure" cylinder, is constructed similarly to the cylinder 11, except that a very much stronger spring 19' is employed, this spring being of such strength that the piston 13' cannot move inwardly against the action of the spring until after the pressure in the pipe 9, leading from the reservoir, has moved the piston 13 to the extreme inner limit of its stroke. The piston-rod 14' is pivotally connected to a lever 22, fulcrumed at the point 23, this lever having swiveled at its outer end a projecting swinging post 23'. Below the lever 22 is pivoted a bell-crank lever, whose arms 24 and 25 are connected by a bar 26, the lever being limited in its movements by a stop 27, contacting with the two arms. To the bar 26 is pivoted a pin 28, which extends loosely through a hole in the pivoted post 23', a spiral spring 29 surrounding the pin, one end of this spring lying within a recess in the post, as shown, while the other end presses upon an enlarged portion of the pin 28, by which the pin is pivoted to the bar 26. To the projecting end 30 of the bar 26 is pivoted a contact-shoe 31, suitably insulated from the bar, as shown, and arranged to make electrical contact between two contact-springs 32.

The electrical connections are as follows: 33 is the wire leading from the trolley to the

electromagnet. 34 is a wire leading from the electromagnet to the last resistance-block of the rheostat. 35 is a wire connecting the arc-strip of the rheostat to one of the contact-springs 32. 36 is a wire leading from the other contact-spring 32 to the motor which drives the air-pump supplying air to the pressure-reservoir.

The operation is as follows: Current passing from the trolley-wire through the wire 33 to the electromagnet energizes the magnet, which, attracting its armature, moves the arm 6 and allows air to enter the cylinder 11 from the branch pipe 8. In this position of the parts the current passing through the connections above described to the motor and the motor driving the air-pumps supplies air under pressure to the reservoir, from which the air passes through the pipe 9 into the cylinders 11 and 12. As the pressure increases in the reservoir the air will pass slowly through the minute port above the three-way valve into the low-pressure cylinder and, lifting the piston therein against the action of the spring, will move the rheostat-arm slowly over its resistance-blocks, as shown in Fig. 1. As the piston moves inwardly in the low-pressure cylinder the rheostat-arm will be actuated thereby so as to cut out more and more of the resistance, thus increasing the amount of current supplied to the motor. The piston in the low-pressure cylinder is so arranged that it will reach the extreme inner limit of its movement when the rheostat-arm contacts with the last resistance-block, as shown in dotted lines in Fig. 2, and the spring in the high-pressure cylinder is of such power that it will prevent the pressure in the pipe 10 from moving its piston until the pressure has exceeded the amount necessary to drive the piston of the low-pressure cylinder the entire length of its stroke. After the pressure has increased to a certain amount necessary to move the piston of the high-pressure cylinder such piston moves upwardly to a very slight extent and through the lever 22 swings the pin 28 upon its pivot until the lever 22 is slightly beyond the dead-center of the pin-pivot, upon which the spring surrounding the pin will throw the bell-crank lever instantly into the position shown in Fig. 2, withdrawing the contact-shoe from the contact-springs 32 and breaking the electrical connections to the motor, so that the current is cut off therefrom and the air-pump ceases working. When the pressure falls below the amount necessary to move the spring of the high-pressure cylinder, this spring will force its piston downwardly and move the lever 22 in the opposite direction to that above described until the lever springs downwardly to a point beyond the dead-center of the pin, when the spring 29 will instantly throw the contact-shoe 31 back into the position shown in Fig. 1, thus giving current to the motor. When the shoe 31 is out of contact with the springs 32, the armature of the electromagnet will of course drop into the position shown in Fig. 2, this action being quickened by a spring 37, connected to the lever-arm of the three-way valve, the downward movement of this arm being limited by a stop 38. In this position of the parts the three-way valve of the low pressure is open to the atmosphere, and the pressure exhausting therethrough the spring will force the piston outwardly and swing the rheostat-arm into the normal position of Fig. 2.

The advantages of my invention will be apparent to those skilled in the art, since a simple, light, and compact apparatus is provided by which the current is automatically cut off from the motor driving the air-pump whenever the pressure in the air-reservoir exceeds a certain amount, electrical connection being again automatically made with the motor whenever the pressure drops back below this amount. The operation of the air-pump and its actuating-motor do not need the attention of the motorman and are entirely automatic in character.

Changes in the form, construction, and relative arrangement of the parts of the device will suggest themselves to the skilled mechanic without departure from my invention, since

What I claim is—

1. An automatic pressure-regulator, comprising an electromagnet, a pressure-cylinder containing a piston and connected to the pressure-reservoir, an admission-valve therefor connected to and operated by the armature of the electromagnet, a rheostat having its contact-arm connected to the piston of the cylinder, and another pressure-cylinder connected to the pressure-reservoir and arranged to break connections to the motor when the pressure exceeds a certain determined amount.

2. An automatic pressure-regulator, comprising an electromagnet, a pressure-cylinder containing a piston and connected to the pressure-reservoir, an admission-valve therefor connected to and operated by the armature of the electromagnet, a rheostat having its contact-arm connected to the piston of the cylinder, and another pressure-cylinder connected to the pressure-reservoir and having its piston connected to a lever carrying an arm provided with connections arranged to complete the circuit to the motor.

3. An automatic pressure-regulator, comprising an electromagnet, a pressure-cylinder containing a piston and connected to the pressure-reservoir, an admission-valve therefor connected to and operated by the armature of the electromagnet, a rheostat having its contact-arm connected to the piston of the cylinder, and another pressure-cylinder connected to the pressure-reservoir, and having its piston connected to a lever, a second lever carrying a contact-bar arranged to complete the circuit to the motor, and a connection between the levers arranged to throw the contact-bar out of circuit after the pressure rises above a certain limit.

4. An automatic pressure-regulator, comprising an electromagnet, a low-pressure cylinder containing a piston and connected to the pressure-reservoir, an admission-valve therefor connected to and operated by the armature of the electromagnet, a rheostat having its contact-arm connected to the piston of the cylinder, and another high-pressure cylinder connected to the pressure-reservoir and arranged to break connections to the motor when the pressure exceeds a certain determined amount.

5. An air-pressure regulator, comprising an electromagnet, a low-pressure cylinder having a piston normally pressed in one direction by a spring, said cylinder having an admission-valve therefor connected to and operated by the armature of the magnet, a rheostat having its contact-arm connected to the piston, a high-pressure cylinder having its piston normally pressed in one direction by a spring of greater strength than that of the other cylinder, said high-pressure cylinder being arranged to break connections to the motor when the pressure exceeds a certain amount and a pressure-reservoir connected to the cylinders.

6. An air-pressure regulator, comprising an electromagnet, a low-pressure cylinder having a piston normally pressed in one direction by a spring, said cylinder having an admission-valve therefor connected to and operated by the armature of the magnet, a rheostat having its contact-arm connected to the piston, a high pressure cylinder having its piston normally pressed in one direction by a spring of greater strength than that of the other cylinder, the piston of said high-pressure cylinder being connected to a lever having connections arranged to give a quick-action break to the circuit when the pressure exceeds a certain amount and a pressure-reservoir connected to the cylinders.

7. An automatic pressure-regulator comprising a pressure-cylinder connected to the pressure-reservoir and having an automatically-controlled fluid-admission valve, a rheostat having its contact-arm connected to and actuated by the cylinder, and another pressure-cylinder connected to the pressure-reservoir and arranged to break connections to the motor when the pressure exceeds a certain amount.

8. An automatic pressure-regulator, comprising a pressure-cylinder connected to the pressure-reservoir and having an automatically-controlled admission-valve, a rheostat connected to and operated by the cylinder, another pressure-cylinder having its piston pressed in one direction by a spring, said cylinder being arranged to break connection to the motor when the pressure exceeds a certain amount, and means for adjusting the spring-pressure in said cylinder.

9. An automatic pressure-regulator, comprising a pressure-cylinder connected to the pressure-reservoir and having an automatically-controlled valve, a rheostat connected to and operated by the cylinder, and another pressure-cylinder connected to a lever arranged to complete the circuit of the motor, the lever of the second cylinder being independent of the connections between the first cylinder and the rheostat in all positions of the parts.

10. An automatic pressure-regulator, comprising an electromagnet, a pressure-cylinder connected to the pressure-reservoir, said cylinder having an admission and release valve connected to and operated by the electromagnet, a rheostat connected to and operated by the cylinder, and another pressure-cylinder connected to the pressure-reservoir and arranged to break connections to the motor when the pressure exceeds a certain amount.

In testimony whereof I have hereunto set my hand.

HERBERT E. HUNT.

Witnesses:
G. I. HOLDSHIP,
H. M. CORWIN.