2 Sheets—Sheet 1.

R. A. HAYES.

ELECTRO-MAGNETIC BOILER FEED-REGULATOR.

No. 189,098. Patented April 3, 1877.

Fig. 1.

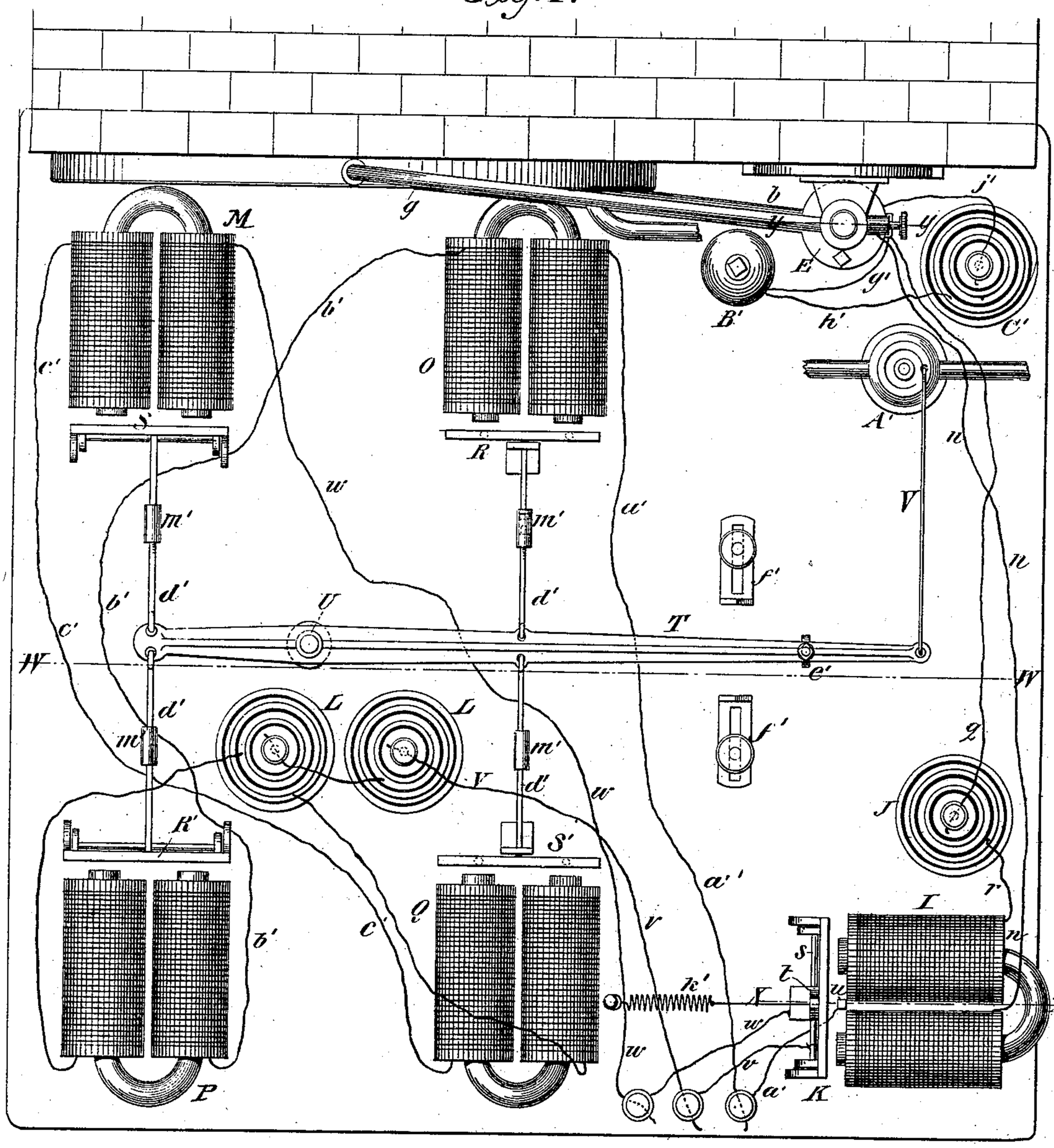

Fig. 2.

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2 Sheets—Sheet 2.

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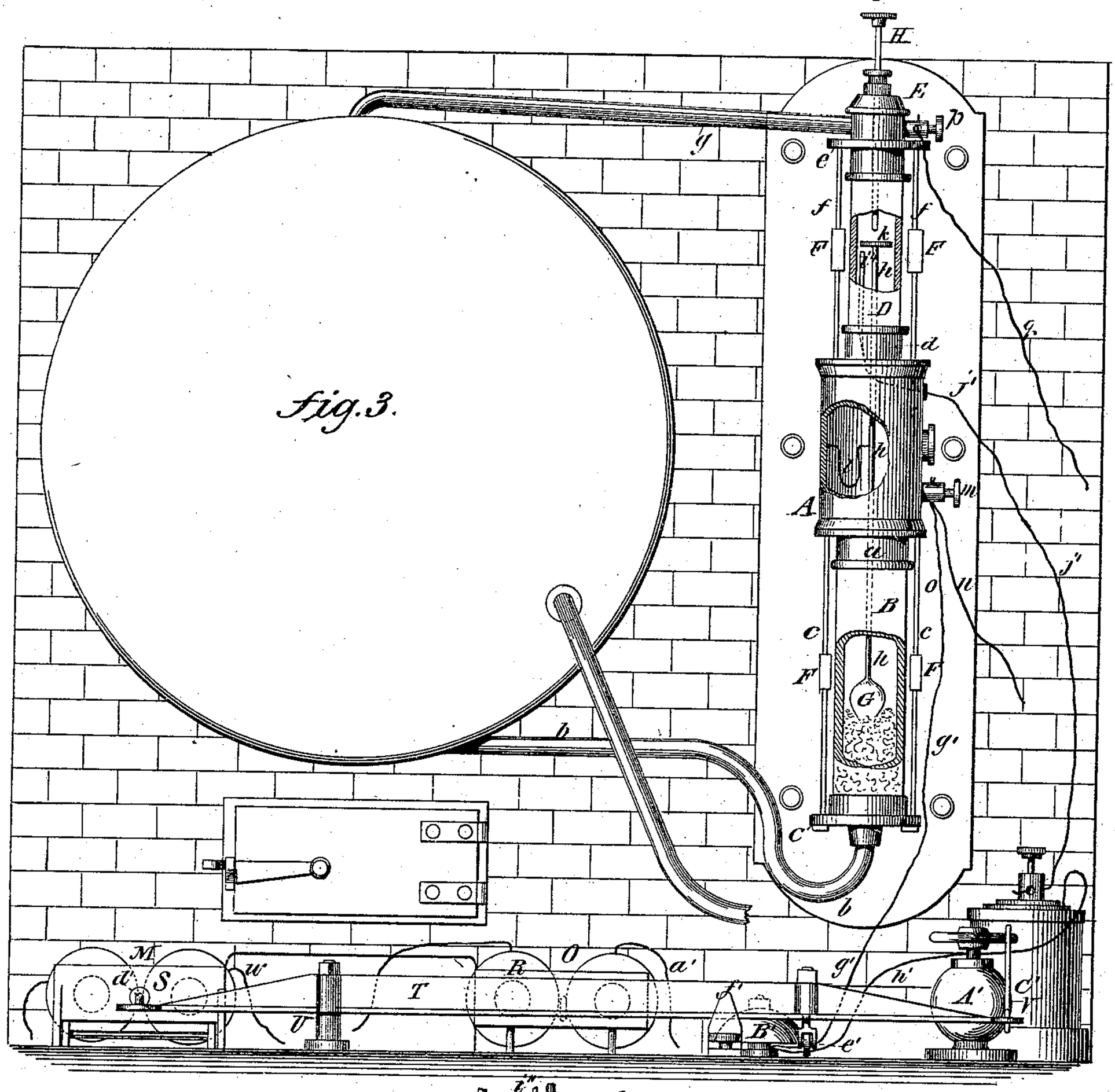

Fig. 3.

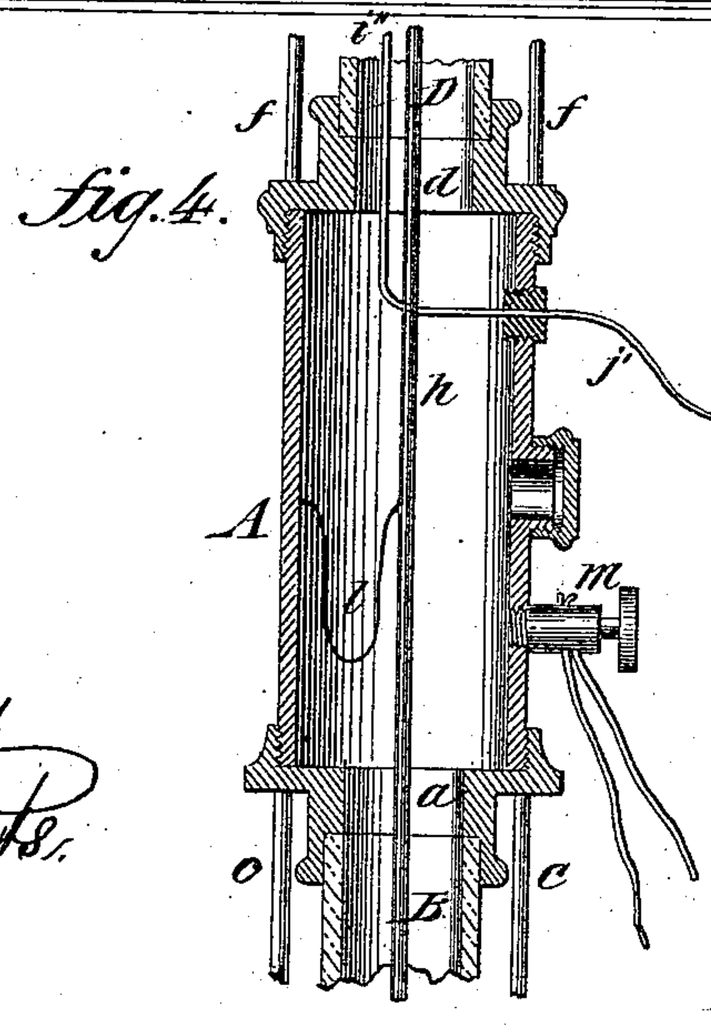

Fig. 4.

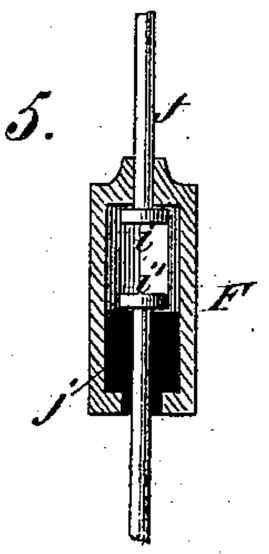

Fig. 5.

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UNITED STATES PATENT OFFICE.

RICHARD A. HAYES, OF ELGIN, ILLINOIS.

IMPROVEMENT IN ELECTRO-MAGNETIC BOILER-FEED REGULATORS.

Specification forming part of Letters Patent No. **189,098**, dated April 3, 1877; application filed January 22, 1877.

To all whom it may concern:

Be it known that I, RICHARD A. HAYES, of Elgin, in the county of Kane and State of Illinois, have invented a new and Improved Electro-Magnetic Boiler-Feed Regulator, of which the following is a specification:

Figure 1 is a plan. Fig. 2 is a detail sectional view of one of the magnets and armatures, taken on line *x x*, Fig. 1. Fig. 3 is a front elevation on line *w w*, Fig. 1. Fig. 4 is a detail view in section on line *y y* in Fig. 1. Fig. 5 is a detail view of one of the insulators.

Similar letters of reference indicate corresponding parts.

My invention relates to apparatus for regulating the supply of water fed to a boiler; and it consists of a lever connected with a steam-supply valve of a boiler-feed pump, or with a valve in the water-supply pipe, and with the armature of two series of electro-magnets, the said magnets being connected with a relay, which directs the current through either series as may be required.

The invention also consists in the details of construction and arrangement which will be hereinafter more fully described, and then pointed out in the claims.

Referring to the drawing, A is a hollow metallic cylinder, having at its lower end a socket, *a*, for receiving the upper end of a glass cylinder, B, which is smaller in diameter than the metallic cylinder.

C is a metallic head, which is recessed to receive the lower end of the glass cylinder B, and is provided with a central opening for receiving the pipe *b* that connects it with the lower portion of the boiler. This head is of sufficient size to receive the bolts *c*, which pass through it, and into the lower end of the cylinder A, and bind it and the glass cylinder to the said cylinder A.

D is a glass cylinder that is smaller than the cylinder B. Its lower end is placed in a socket, *d*, on the upper head of the cylinder A.

E is a metallic cap fitted to the upper end of the glass tube D, and provided with a flange, *e*, for receiving the bolts *f*, which pass into the upper head of the cylinder A. The bolts *c* and *f'* are divided, and provided with insulators F, as shown in the enlarged sectional view, Fig. 5.

The separated ends of the bolts are provided with heads *i i'* that are placed in the insulator-case. The head *i* rests upon an insulating substance, *j*, supported by the bottom of the case, which surrounds the bolt, and prevents it from touching the case, and the head *i'* rests against the upper head of the insulator-case.

By means of the insulator F, and the glass cylinders B and D, the metallic cylinder A is perfectly insulated.

The cap E is connected with the upper part of the boiler by the pipe *g*, and as there is an open passage from the said cap to the lower head C, the pressure in the metallic and glass cylinders is the same as that of the boiler to which the apparatus is attached, and the water stands at the same level in the boiler, and in the said cylinders.

G is a float, made of metal, or other suitable material, that is placed in the cylinder B, and is provided with a spindle, *h*, a part of which, between the float G and the wire *l*, is made of insulating material. This spindle extends upward through the cylinder A into the glass cylinder D, and has upon its upper end a metallic head or guide, *k*, that fits the cylinder loosely, and holds the spindle centrally in the cylinder D.

The upper surface of the guide *k* may be made conical, so that it will not retain dirt or sediment.

A fine wire or chain, *l*, connects the cylinder A and the spindle *h*, and a binding-screw, *m* is attached to the cylinder A, for receiving the electrical conducting-wires *n o*.

H is an adjustable rod that slides through a stuffing-box in the top of the cap E, and *p* is a binding-screw that receives the wire *q*.

I is a relay-magnet connected with the battery J by the wire *r*, and with the binding-screw of the metallic cylinder A by the wire *n*.

The battery J is connected with the cap E by the wire *q*.

The armature K of the relay-magnet I swings on a pivot, *s*, between the posts *t u*, and is connected by a wire, *v*, with one of the poles of the battery L. The post *t* is con-

nected by the wire *w* with the magnet M, and the post *u* is connected by the wire *a'* with the magnet O.

The terminal wire of the magnet O is connected by a wire, *b'*, with the magnet P, whose terminal wire is connected with the battery L.

The terminal wire of the magnet M is connected by the wire *c'* with the magnet Q, whose terminal wire is connected with the battery L.

It will be seen that the magnets O P and the magnets M Q are arranged diagonally opposite.

R R' are, respectively, the armatures of the magnets O P, and S S' are the armatures of the magnets M Q.

T is a lever fulcrumed at U, and connected by rods *d'* with the armatures of the magnets M O P Q.

The rods *d'* of the magnets M P are oppositely connected to the end of the short arm of the lever T, and the rods *d'* of the magnets O Q are connected to the long arm of the lever at a distance from the fulcrum equal to the length of the short arm.

The end of the long arm of the lever T is connected by a rod, V, with a balanced throttle-valve, A', which is placed in the steam-supply pipe of a steam-pump, or in the feed-pipe that leads from the pump to the boiler.

The long arm of the lever T is supported by a caster, *e'*, and its motion is limited by the stops *f' f'*, which are slotted, and provided with screws for holding them in any desired position.

B' is a bell-magnet of any ordinary construction, which is connected, by a wire, *g'*, with the binding-screw *m* of the metallic cylinder A, and also with the battery C' by the wire *h'*, the battery being connected with a point, *i''*, by an insulating-wire, *j'*.

The operation is as follows:

When water is at the required level in the boiler, the float G supports the spindle *h*, so that the guide *k* touches the rod H, completing the electrical circuit of the battery J, exciting the relay-magnet I, so that its armature K is drawn toward it and into contact with the post *u*.

By this means a circuit is established through the magnets O P, and the long arm of the lever T is drawn toward the valve A', which is thereby nearly closed, and remains so as long as the current is unchanged and the steam-pump is only normally active. When the water drops in the boiler the float G also falls, and the current through the wires *l n q* is broken, and the spring *k'* draws the armature K from the port *u* and against the port *t*, thus breaking the battery-connection with the magnets O P and establishing a current through the magnets M Q. This draws the long arm of the lever T from the valve A', opening the valve and admitting steam to the feed-pump, which works with increased rapidity until the required water-level is attained, when the guide *k* touches the rod H, completing the circuit through the wires *l r n q*, and the magnets O P, being again excited, move the lever T toward the valve A', closing it and diminishing the action of the pump, or stopping it altogether.

Should the water drop below the prescribed level, the guide *k* strikes the wire *i''* and establishes a current through the bell-magnet B', which continues to sound the alarm as long as a low state of water exists, or until the electrical current is broken by the rising of the float.

This device for giving an alarm may be constructed and used independently, if desired.

The rods *d'*, that connect the armatures with the lever T, are provided with turn-buckles *m'*, for adjusting the relative position of the armatures.

The armatures R R' of the diagonally-opposite magnets are arranged so that as one of them approaches the face of its magnet it brings the other armature within the influence of its magnet.

The turn-buckles *m'* are so constructed that they permit a continued motion in the lever T after one of the armatures strikes its magnet, in order to allow the diagonally-opposite magnet to draw its armature to its seat. This is effected by threading one end of the turn-buckle and allowing the head of the rod *d'* to rest in the other end.

The armatures S S' are arranged in the same manner.

I do not limit my improvements to the exact form herein described, as it may, in practice, be found that a single magnet connected with the lever T, and an opposing spring or weight may serve to move the valve A', and wires may also be arranged so that the current will be established through the water when it rises so as to touch the said wires, when the float may be dispensed with.

The advantages claimed for the invention are, that it controls the action of the pump, so that a constant water-level is maintained in the boiler, and in case of a derangement of the float or its connections the magnets that open the steam-pump throttle-valve are made to operate by the circuit established by releasing of the relay-armature.

If all the valve-operating magnets should become inoperative and the water continues to go down, an alarm is given by the bell-magnet, when the guide *k* strikes the wire *i''*, which continues to sound until the proper water-level is attained, or until the electrical current is broken by the rising of the float.

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

1. A float that varies in height with the level of the water in the boiler, a relay, and a series of oppositely-arranged magnets, constructed and arranged to open or close the throttle or governor valve of a steam-boiler feed-pump, or the water-supply valve, as the

electrical current is established or broken by the rise or fall of the said float, substantially as herein shown and described.

2. The float-chamber consisting of a central metallic section, A, the glass cylinders B D, cap E, head C, and bolts *c f*, substantially as herein shown and described.

3. The float C, having the spindle *h* and guide *k*, the float-chamber, having an insulated central metallic section, A, the metallic cap E, adjustable rod H, and the electrical conducting-wires *l n q*, in combination, substantially as herein shown and described.

4. The relay I and battery J, in combination with the float and float-chamber, made as described, and the conducting-wires *n q*, substantially as herein set forth.

5. The relay I, the oppositely-arranged magnets M Q and O P and their conducting-wires, the lever T, connecting-rod V, and throttle-valve A, combined and arranged substantially as herein shown and described.

6. The bell-magnet B′ and battery C′, in combination with the float G, point *i″*, insulated wire *j′*, conducting-wires *l o*, and the float-chamber, consisting of the parts A B C D E, in combination, substantially as herein shown and described.

7. The insulators F, consisting of a metallic casing and an insulating substance, *j*, in combination with the bolts *c f*, substantially as shown and described.

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Witnesses:
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GEO. M. HOPKINS.