No. 822,323.

PATENTED JUNE 5, 1906.

E. THOMSON.

THERMOSTATIC CONTROL.

APPLICATION FILED OCT. 1, 1904.

Fig. 1.

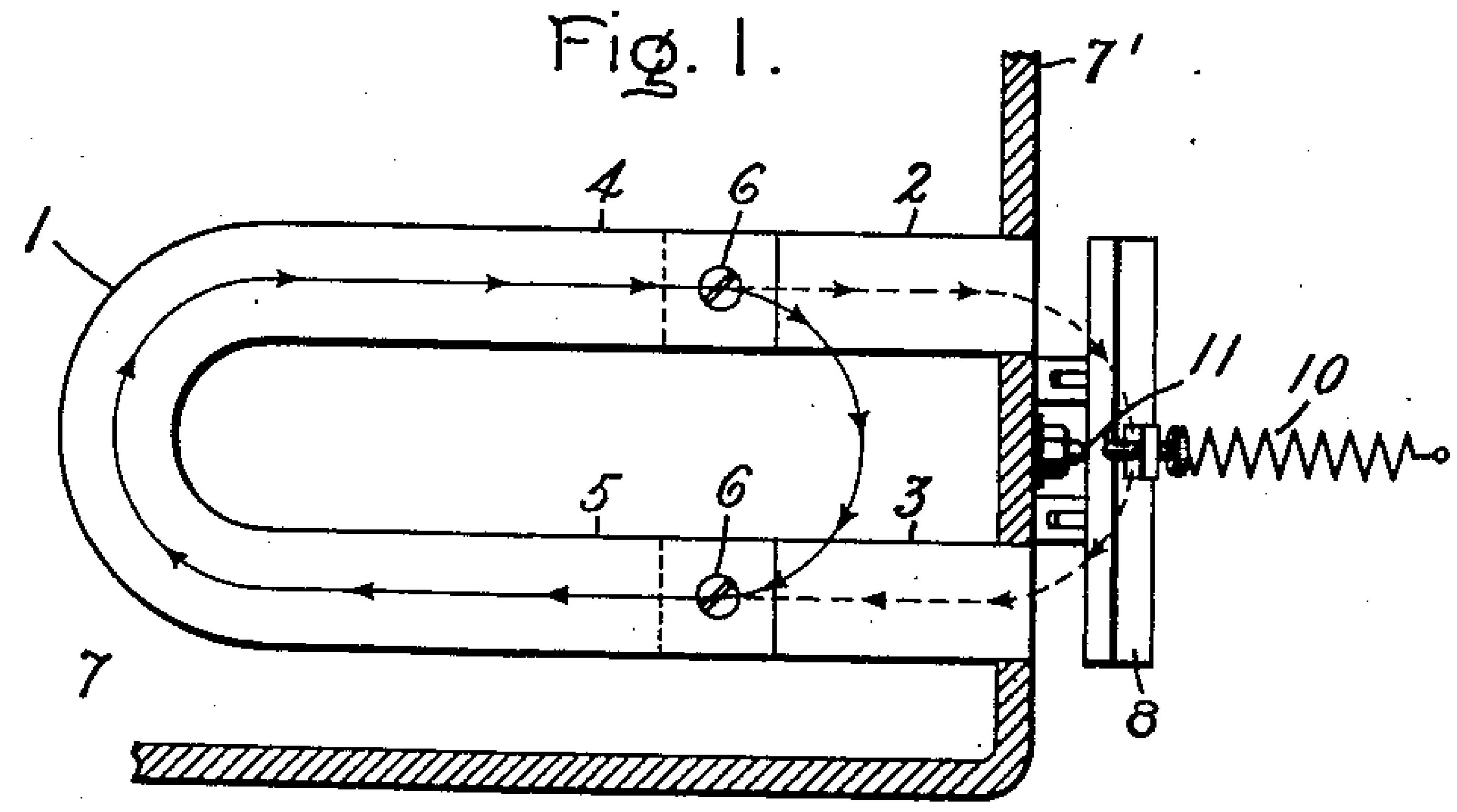


Fig. 2.

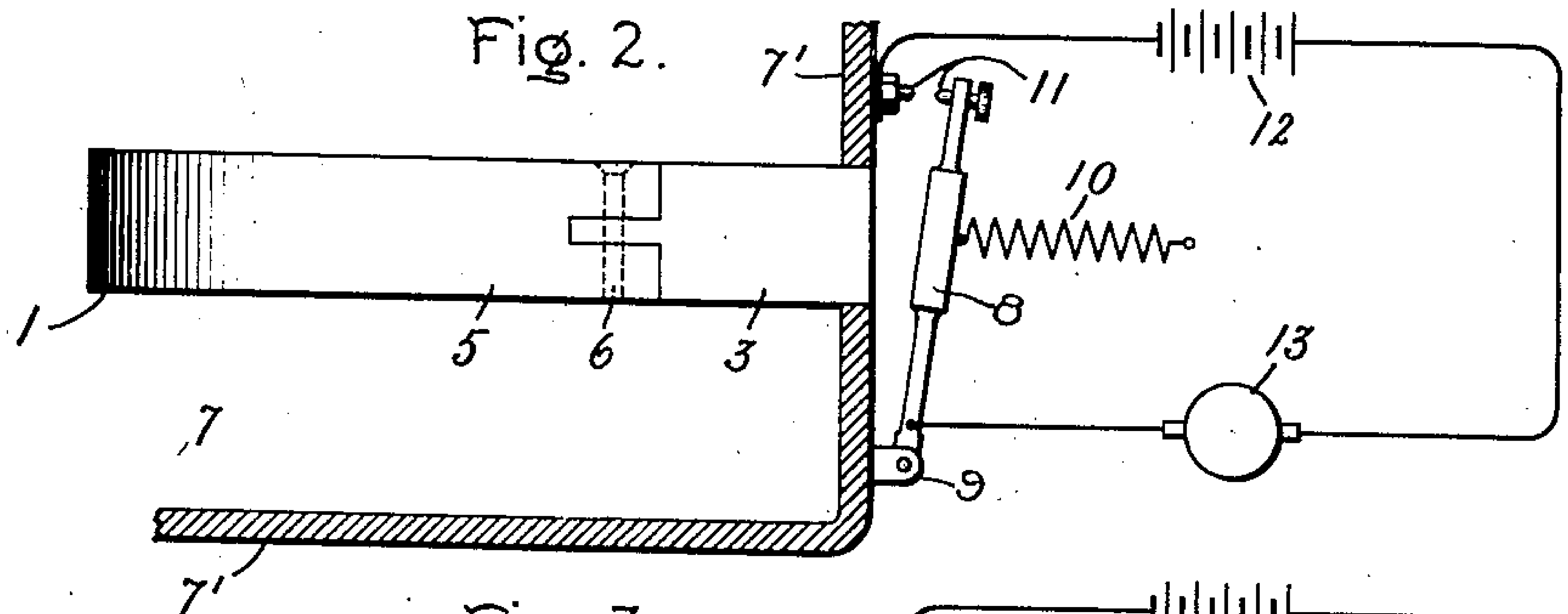


Fig. 3.

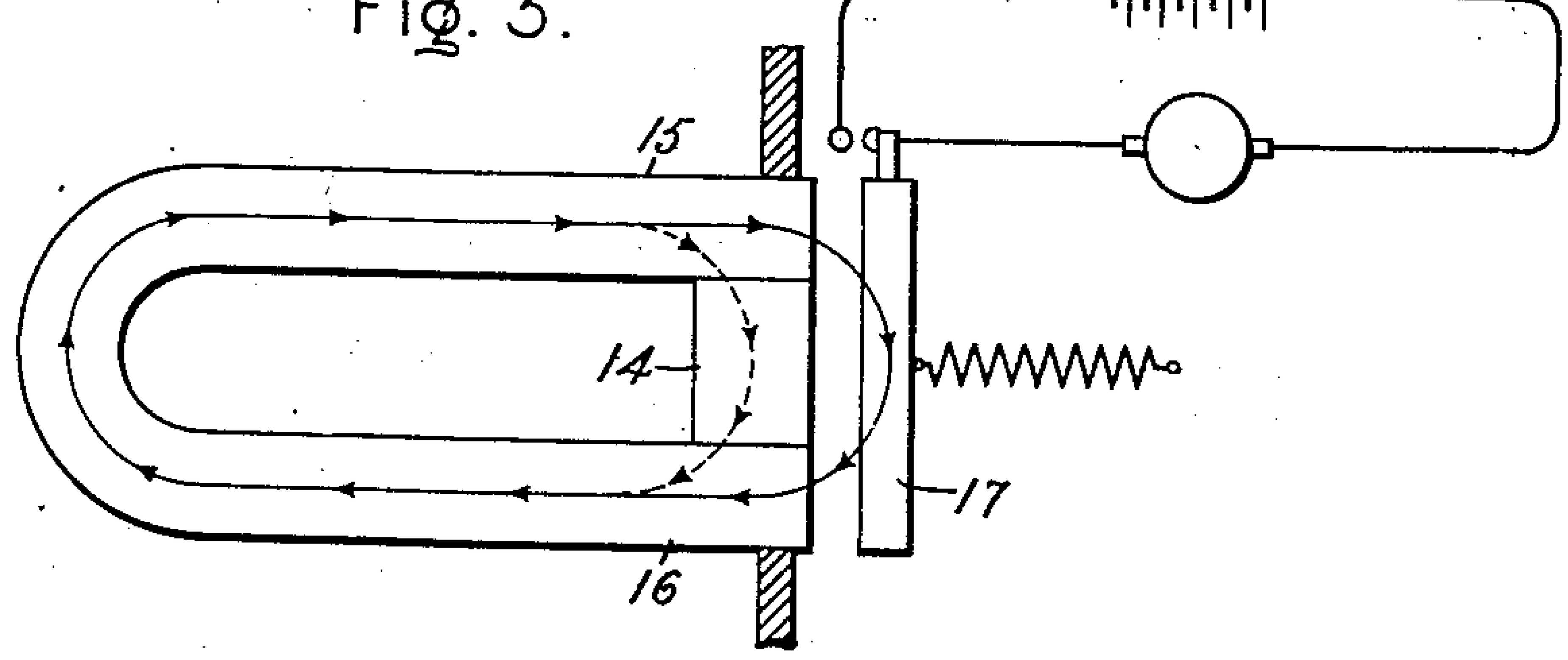
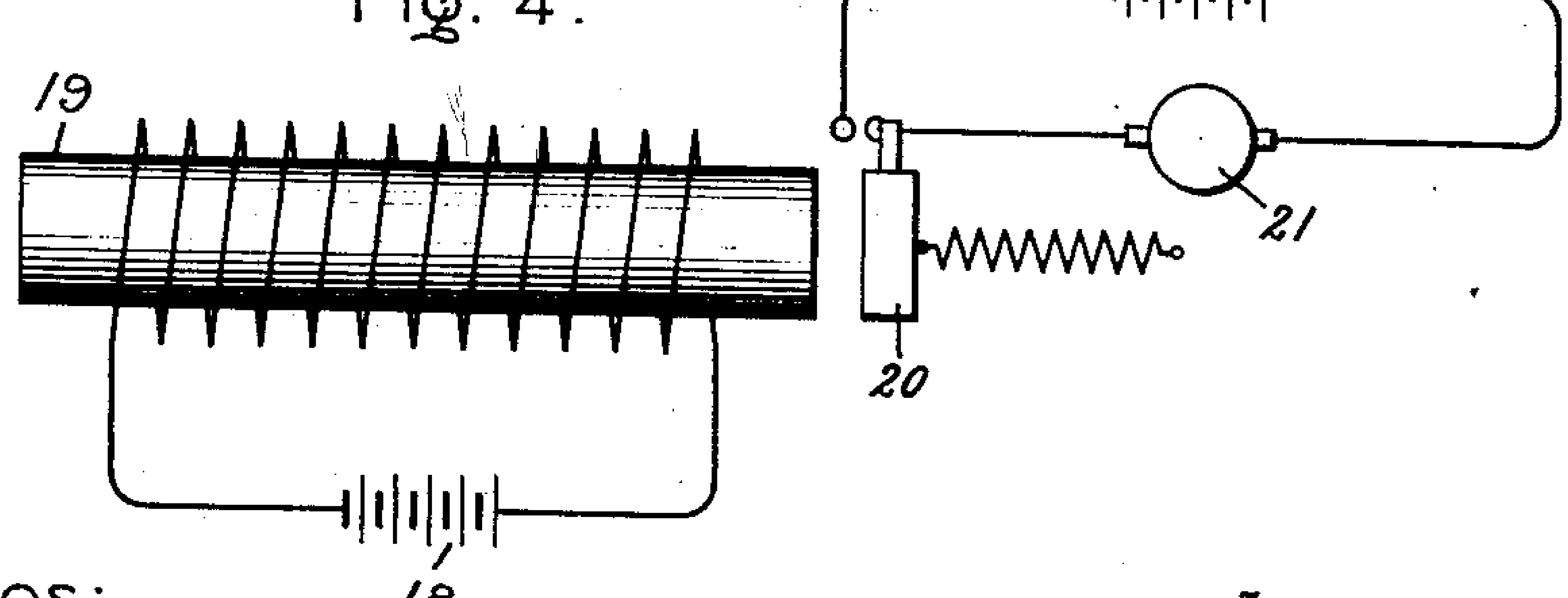


Fig. 4.



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UNITED STATES PATENT OFFICE.

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THERMOSTATIC CONTROL.

No. 822,323. **Specification of Letters Patent.** **Patented June 5, 1906.**

Application filed October 1, 1904. Serial No. 226,746.

To all whom it may concern:

Be it known that I, Elihu Thomson, a citizen of the United States, residing at Swampscott, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Thermostatic Control, of which the following is a specification.

It has been discovered that certain metallic alloys which are ordinarily magnetic become substantially non-magnetic when heated to a sufficiently high temperature. In other words, the permeability of the alloy is to a certain extent dependent on the temperature. The critical temperature at which the alloy becomes non-magnetic varies with alloys of different composition; but with an alloy of the proportions hereinafter enumerated the critical temperature is approximately 60° centigrade.

It is the object of this invention to make use of this change in the magnetic properties of such alloys for the purpose of temperature indication and regulation by subjecting the sensitive alloy to the heat of a gas, liquid, or solid, the temperature of which is to be regulated and utilizing the sudden change of permeability of the alloy to operate a suitable armature or similar actuating device. The movement of this armature serves to set in motion a motor or other power mechanism which in turn performs such operative acts as are necessary to secure the desired temperature regulation.

While my invention is not limited in its application to any specific form of apparatus, I will mention, as an illustration of the manner in which it may be applied, that it may be used for controlling the temperature of a gasolene-engine cylinder by regulating the amount of cooling-water supplied thereto. It may also be used for automatically regulating the temperature of electric heaters and for many other purposes which will readily suggest themselves.

I have shown in the drawings forming a part of this specification three operative forms of regulators embodying my invention; but it is to be understood that these are merely illustrative and that my invention is not limited to the structural details shown therein.

In the drawings, Figure 1 is a plan view of a horseshoe-magnet having polar extensions of a sensitive alloy. Fig. 2 is an elevation of the same. Fig. 3 is a modification in which the sensitive alloy is placed between the two pole-tips of the horseshoe-magnet, and Fig. 4 shows a solenoid the core of which consists of a sensitive alloy.

In Fig. 1 the horseshoe-magnet 1 has pole-tips 2 and 3 of the sensitive alloy secured, respectively, to the pole-tips 4 and 5 in any suitable manner, as by a dovetail joint and the screws 6. The horseshoe-magnet and the sensitive alloy are located within the chamber 7, the temperature of which is to be regulated, and may project through the wall 7′ of this chamber, as shown in the drawings, or may be entirely within the chamber, if desired. An armature 8, of magnetic material, is pivotally supported to the wall 7′ at 9 and is held normally retracted from the sensitive pole-tips by the spiral spring 10. Contact-points at 11 serve to close a local circuit through battery 12 and a translating device (shown diagrammatically at 13) when the armature 8 is drawn toward the pole-tips. This translating device may be a motor, a relay, or any other operative means for controlling the water-valves, fuel-supply valves, or other devices, and thus producing the desired temperature regulation within the chamber 7. While I have shown the armature 8 as located on the outside of the chamber inclosed by the wall 7′, and therefore unexposed to the heating medium within the chamber 7, it is obvious that it might be located within the chamber if such an arrangement appeared desirable.

While I may use sensitive alloys of various compositions, I preferably employ one containing substantially seventy-five per cent. copper, twenty-four per cent. of an alloy of manganese and aluminium combined in their atomic proportions, and one per cent. of lead, as this gives an alloy the permeability of which changes at approximately 60° centigrade. At temperatures below this critical value the lines of force which radiate from the poles of magnet 1 pass through the sensitive alloy tips 2 and 3 and through the armature 8, thus attracting the armature and closing the contact 11. If, however, the temperature within the chamber 7 becomes higher than the critical temperature, the alloy tips 2 and 3 become non-magnetic, and the magnetic flux passes directly between the pole-tips 4 and 5, as shown by the heavy arrows in Fig. 1, and armature 8 is retracted by the spring 10 and opens the local circuit at the contact 11.

Fig. 3 shows a modification in which the sensitive alloy 14 is located directly between the pole-tips 15 and 16 of the permanent magnet, and so acts to shunt the magnetic flux from the armature 17. In this modification the action is in a sense the reverse of that previously described, for in this case a decrease in temperature allows the armature to be drawn away from the horseshoe-magnet, whereas in the other case a decrease in temperature caused an attraction of the armature. While I have shown the sensitive alloy 14 as occupying only a small part of the space between the two legs of the magnet, it is obvious that it might occupy the entire space between the two legs or that the magnet might be entirely incased in the sensitive alloy, if such an arrangement appeared desirable.

While I have shown the horseshoe-magnets as permanent magnets, it is obvious that the regulation might be effected equally well by the substitution of electromagnets.

In the modification shown in Fig. 4 a solenoid energized by current from a suitable source, such as the battery 18, serves to set up a magnetic flux through the core 19. This core is made wholly or in part of the sensitive alloy, so that with constant excitation of the winding the magnetic flux through the core will undergo a substantial change when the temperature of the core reaches the critical temperature of the alloy. These changes in magnetic flux may be used to change the position of the armature 20, thus opening or closing the local circuit through the translating device 21 and effecting the regulation desired.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a thermostatic device, a movable armature of magnetic material, a permanent magnet for energizing said armature, and a magnetizable alloy lying in the magnetic field of said magnet and subject to variations in permeability by the action of a heating fluid.

2. In a thermostatic device, means for producing a magnetic field, means for utilizing the heat of the fluid to change the strength of said field, and means for utilizing said change of field strength to produce mechanical movement.

3. In a thermostatic device, a magnetic copper alloy sensitive to changes in temperature below that of boiling water, and an armature in inductive relation to said magnetic alloy and movable relatively thereto.

4. In a thermostatic device, an alloy, the magnetic permeability of which is subject to a violent change at a temperature below that of boiling water, and means for utilizing said changes of permeability to produce mechanical movement.

5. In a thermostatic device, an alloy, the magnetic permeability of which is subject to change upon a change of temperature, means for producing a magnetic field the strength of which changes when the permeability of said alloy changes, an armature located in said magnetic field and means for subjecting said alloy to the action of a heating fluid to produce said change in permeability.

6. In a thermostatic device, a copper alloy, the magnetic permeability of which is subject to change upon a change of temperature, a permanent magnet for producing a magnetic flux in said alloy, and an armature movable relatively to said alloy and traversed by said magnetic flux.

7. The combination of a permanent magnet having a plurality of adjacently-disposed poles for establishing a magnetic field, a sensitive alloy lying in said field, and an armature operable by the energy of said field and set in motion by changes in the permeability of said alloy.

8. In a thermostatic device, an alloy of copper, manganese, aluminum and lead combined in such proportions that the alloy is magnetic at low temperatures but loses its magnetism when heated to a temperature less than that of boiling water, means for producing a magnetic flux in said alloy the strength of which changes when the permeability of said alloy changes, and an armature for utilizing said change of permeability to produce mechanical movement.

9. The combination of a chamber containing a heating medium, an alloy within said chamber exposed to the action of said heating medium and subject to change in permeability with change in temperature, means for establishing a magnetic flux through said alloy and an armature movable relatively to said alloy and set in motion by said change in permeability.

10. The combination of a chamber containing a heating medium, a permanent magnet within said chamber exposed to the action of said heating medium, an alloy in contact with one end of said magnet and receiving a magnetic flux therefrom, said alloy having a permeability subject to change upon a change in temperature, and power-operating means set in motion by said change in permeability of said alloy.

In witness whereof I have hereunto set my hand this 29th day of September, 1904.

ELIHU THOMSON.

Witnesses:

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