(No Model.) 3 Sheets—Sheet 1.

# J. P. B. FISKE.

## RHEOSTAT.

No. 518,236. Patented Apr. 17, 1894.

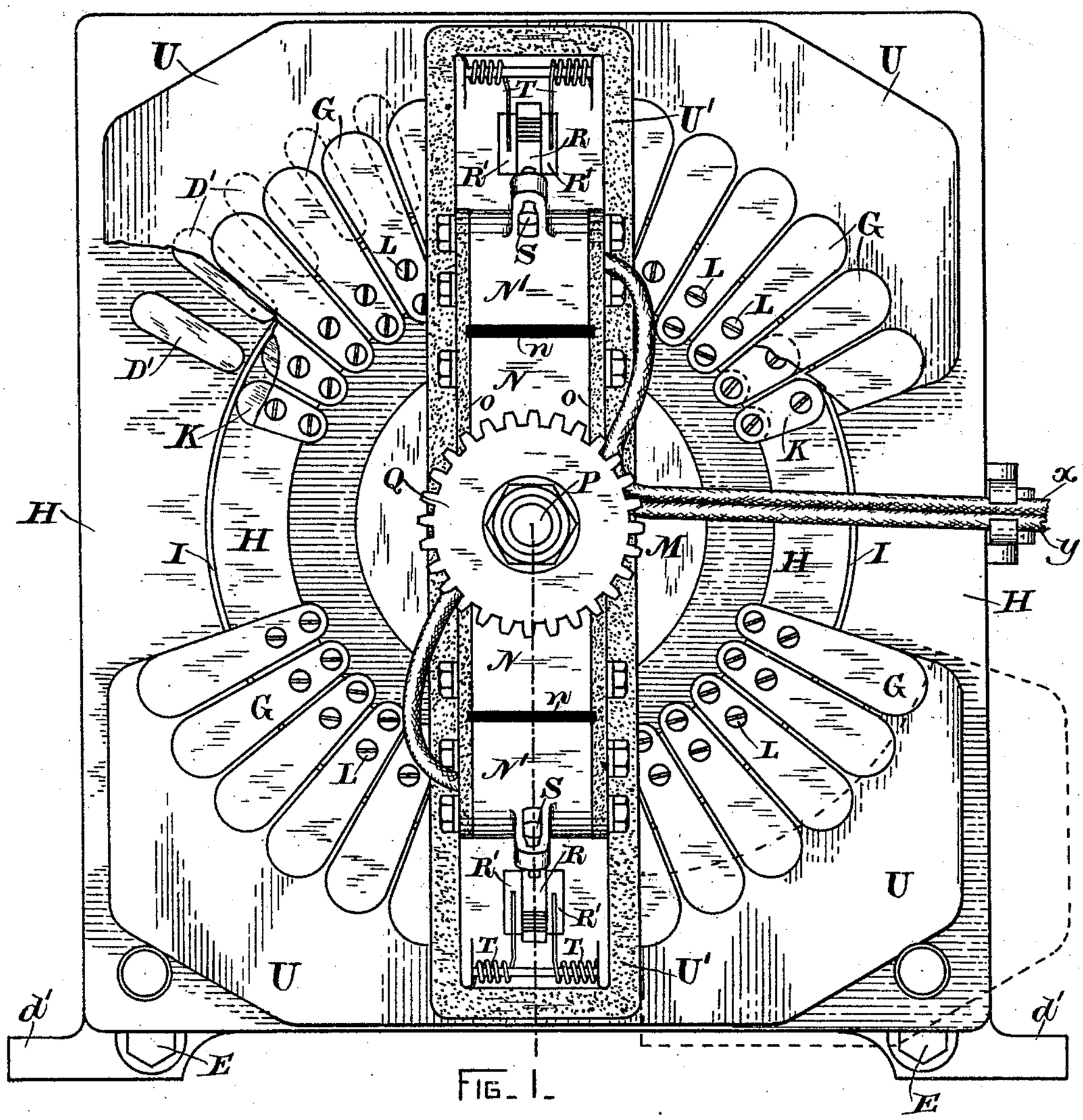


FIG. 1.

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## RHEOSTAT.

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FIG. 2.

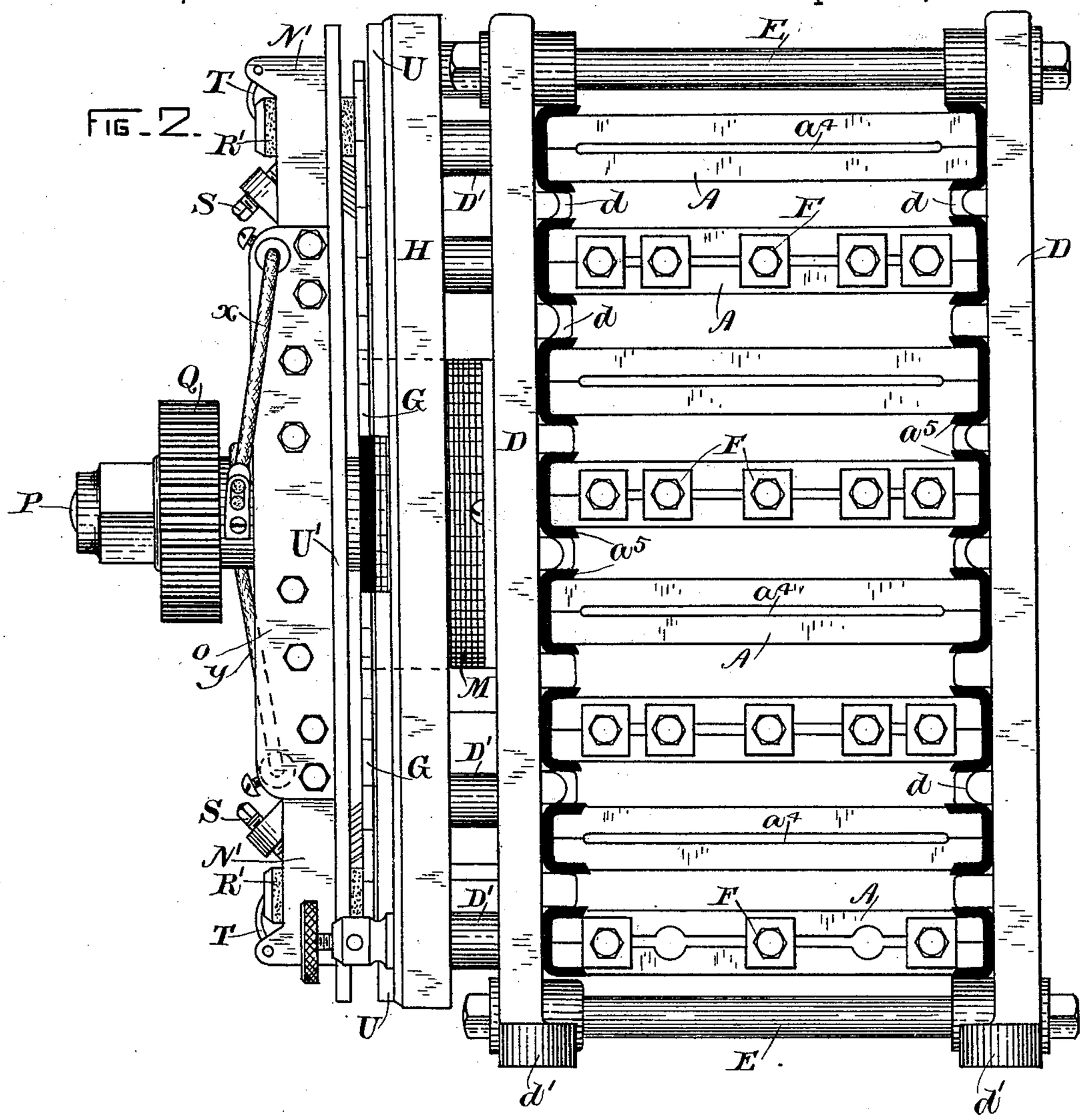
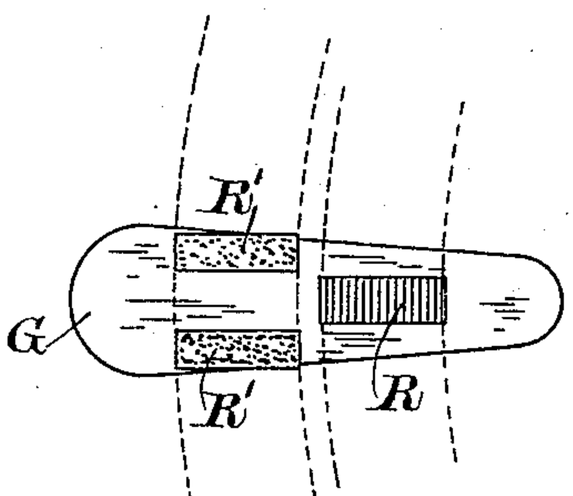



FIG. 7.

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(No Model.) 3 Sheets—Sheet 3.

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## RHEOSTAT.

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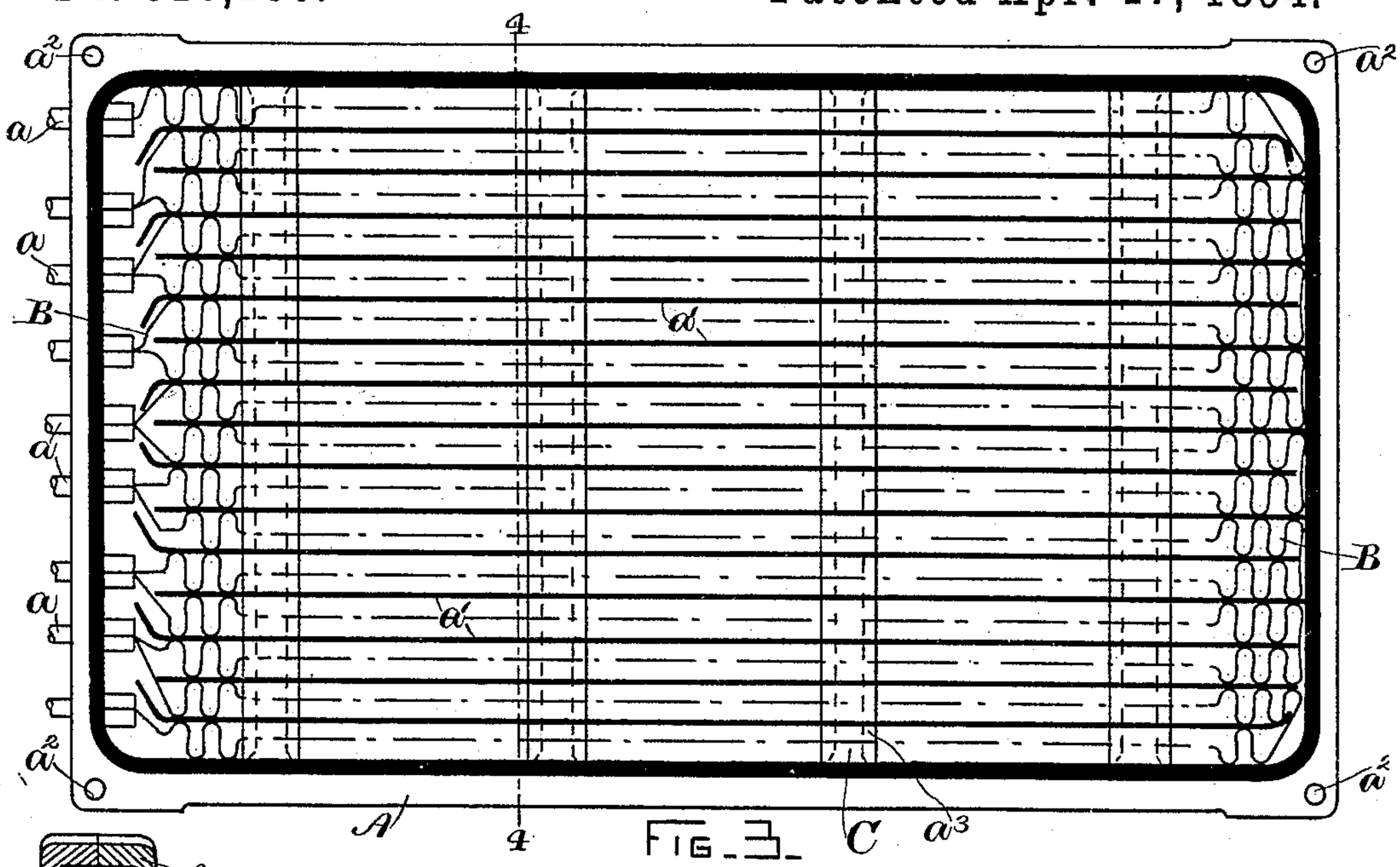



FIG. 3.

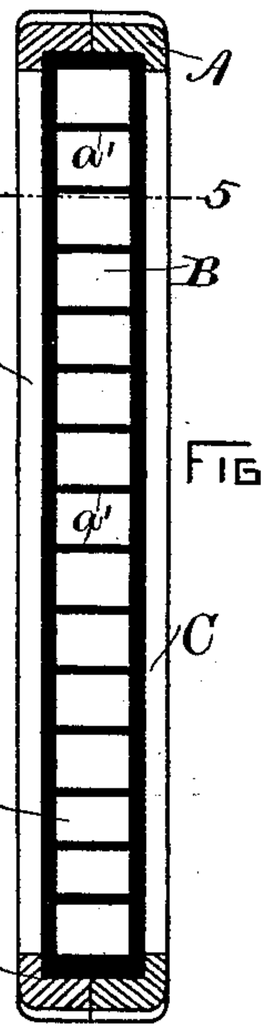



FIG. 4.

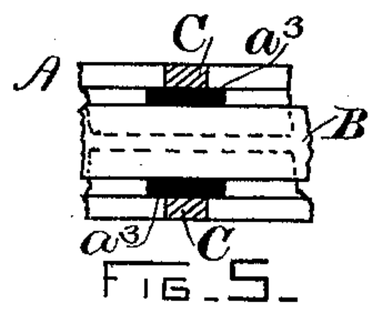
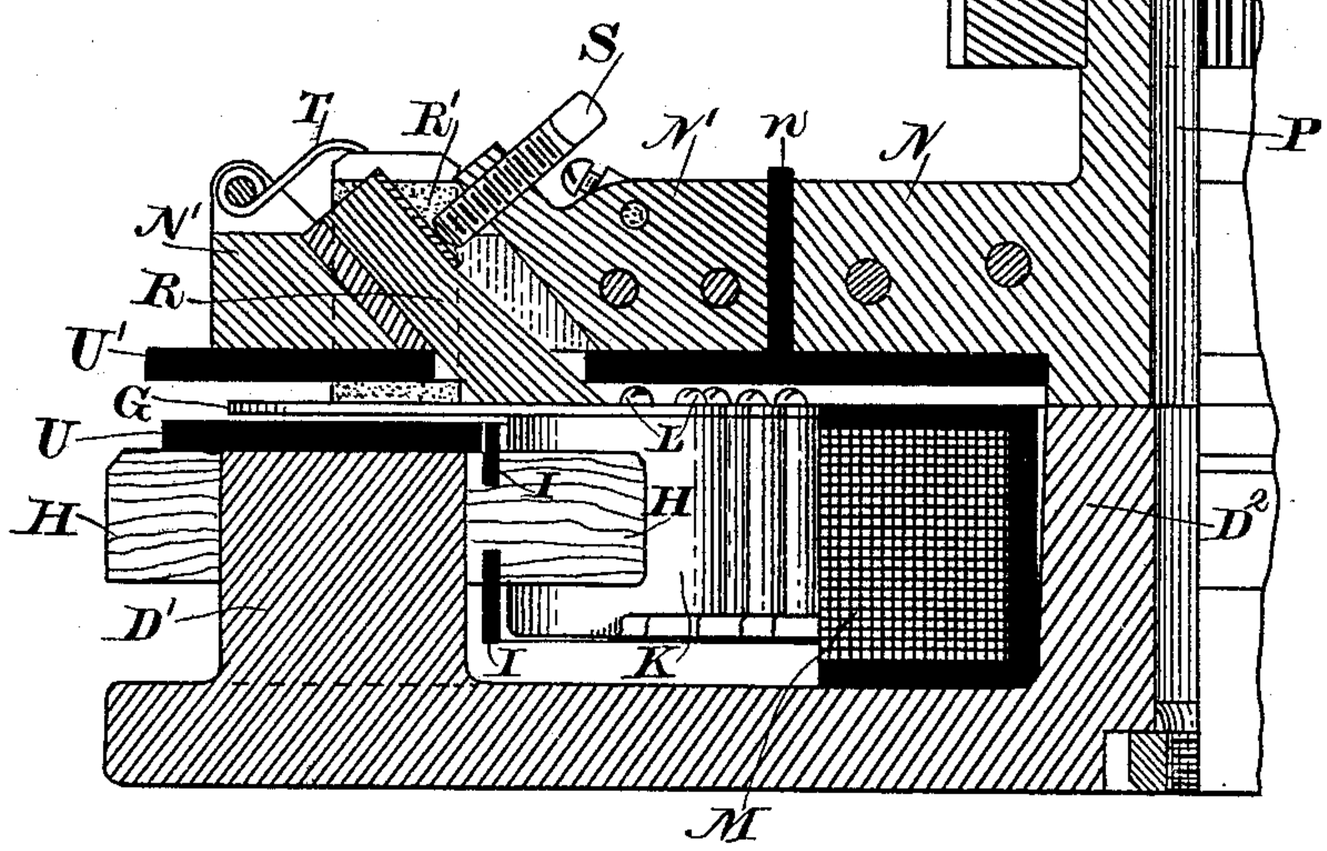



FIG. 5.

FIG. 6.

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# UNITED STATES PATENT OFFICE.

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## RHEOSTAT.

SPECIFICATION forming part of Letters Patent No. 518,236, dated April 17, 1894.

Application filed February 25, 1893. Serial No. 463,755. (No model.)

*To all whom it may concern:*

Be it known that I, JONATHAN P. B. FISKE, a citizen of the United States, residing at Lynn, county of Essex, and State of Massachusetts, have invented certain new and useful Improvements in Rheostats, of which the following is a specification.

My invention relates to rheostats and it consists of certain improvements in the several parts thereof, comprising, first, a novel construction of trays for supporting the resistance ribbon, and a tray holding frame so arranged that it is nearly impossible for short circuits to occur between the sections of the ribbon itself, or between the ribbon and its supporting tray or the tray supporting frame.

The invention also comprises improvements in current shifting devices which permit currents of large volume to be varied, without troublesome sparking between the contact plates and moving brushes.

The invention likewise comprises certain improvements in the contact brushes, possessing great advantages over those which have hitherto been employed in the art.

The invention consists also in certain improvements whereby the capacity of the rheostat may be increased or diminished in definite units very easily, and it relates, further, to specific details of construction, as referred to hereinafter.

In the drawings, Figure 1 is a face view of a rheostat embodying my invention, showing the contact plates, the contact arm, the circuit connections, and other details. Fig. 2 is a side elevation, showing a number of trays in their supporting frame, and also the contact device, or switch. Fig. 3 is a plan view of one of the improved resistance carrying trays. Fig. 4 is a section through the same, on line 4—4 Fig. 3. Fig. 5 is a section on line 5—5, Fig. 4. Fig. 6 is a side sectional view showing the improved contact and arc preventing devices. Fig. 7 is a detail illustrating the operation of one of the contact devices.

The rheostat proper consists of a tier of shallow, metal trays A which support the resistance ribbon B, wound back and forth in a zigzag manner, and then laid from end to end of the tray alternately, connections being taken out at one end of the tray, at $a$, as many as may be desired. The parallel sections of the resistance ribbon are insulated from each other by asbestus, or other heat resisting insulating strips $a'$, insulation being also placed between the sections of the resistance ribbon and the bottom and sides of the supporting tray. The resistance ribbon may be made of any suitable metal, though conductors possessing the properties of the alloy known as German silver are preferred. The resistance so disposed is held firmly in position by clamping it between a half portion of the tray A mentioned, and another corresponding half portion, as shown in Fig. 4, the two halves meeting on a median plane and being bolted together by bolts passing through the holes $a^2$, as many as may be required to give stiffness, according to the size of the tray. The terminals $a$ lead to the contact plates to be described hereinafter. The opposite sides of the tray are united by ribs C which support the resistance ribbon and prevent its sagging when heated but leaves large open spaces through which air can freely circulate to carry off the heat when current is flowing. Insulation $a^3$ is placed between the ribs and the ribbon. The two half portions of the tray when united also leave an open space between them at the end, as shown at $a^4$, Fig. 2. These trays are carried by an outer metal frame D, as shown in Fig. 2, composed of plates D D united by bolts E E, and clamping the trays between them, the trays being supported at some distance from each other by lugs $d$, projecting from the frames D and leaving considerable space between the trays to assist convection of the heated air. The frame has feet $d'$ which may rest on the floor or be secured to a suitable support. In addition to the insulation between the resistance ribbon and the trays, already mentioned, other insulating strips or pieces $a^5$ isolate the trays from the frame. With this construction should an accidental contact exist between the resistance ribbon and one of the trays a complete short-circuit by way of the frame is prevented, and possible injury is confined to the particular tray in which the contact occurs. The trays

are so placed in the supporting frame that the terminals *a* of the adjacent trays lead out at opposite ends to terminal contact bolts F, Fig. 2, and from these connection is made from as many trays as desired through suitable conductors to the contact plates G, Fig. 1, such connections, however, not being shown in this figure.

The contact mechanism is supported on a face plate or contact carrying plate H, Fig. 2. This plate may be made of hard wood, such as maple, and is supported on projections D′ Figs. 1 and 2, cast integral with the frame D and projecting through said plate H. The plate has a deep circular groove in one or both faces, in which is placed a piece of non-inflammable insulation, I, such as leatheroid. The projections D′ are on one side of and concentric with this insulating strip I, being preferably on the outside, while on the other side are a number of plates K, only a portion of which can be seen through the cut-away parts at the upper left-hand side of Fig. 1. The number of these plates K corresponds with the number of contact plates G, which are secured to the plates K by screws L, as shown, so as to be individually removable. The supporting projections or studs D′ extending from the frame D constitute magnetic poles which are energized by a coil M, shown in section in Fig. 6, which coil may be included in any electric circuit as, for instance, in series with the circuit *x y*, the magnetic circuit being completed through the frame D, central pillar $D^2$ and the iron arms N′ N′ of the switch. The studs D′ are situated directly back of the gap or space between the adjacent contact plates G, and are intended to blow out any arc that may follow the traverse of the contact brush over the plates, in accordance with well known principles.

The brush carrying arm is composed of a middle portion N, and two end portions N′, all of iron and insulated from each other by suitable insulation *n*. They are clamped in alignment between side pieces *o*, of insulation, such as leatheroid or vulcabeston, by bolts, as shown, and the brushes at either end of the arm are connected by cables, *x y*, to the external circuit in which flows the current which is to be regulated. The middle portion N is pivoted upon a pin P fixed in the frame D, and carries a pinion Q, or other means for rotating it on said pin to change the position of the brushes, the contact plates G being traversed by brushes carried at either end of the rotatable arm. These brushes are really twin brushes possessing different characteristics. One is composed of copper and is indicated at R, Fig. 6. It consists of a number of superposed copper laminæ clamped in an inclined position, as shown, by a set screw S, in such manner that the end of each laminæ rests upon the contact plate. This affords great current carrying capacity. Adjacent to the brush R is another brush R′, of carbon, of much less current carrying capacity than the brush R and in fact having a considerably higher resistance. The purpose of having two brushes is to prevent arcing, the carbon brush being so supported, with relation to the copper brush, that it is last to leave a segment G when the contact arm moves in either direction. The carbon brush may be wider than the copper brush to secure this result. If of the same width it may be placed at a narrower portion of the contact segments, or two carbon brushes may be placed, one on either side of the copper brush, as shown in Fig. 7, to give the same result. The particular improvement, however, upon which stress is laid in the present invention consists in causing the brushes R and R′ to traverse separate portions of the contact plates G. This is important because there is always some slight sparking when a copper brush leaves a contact segment which gives a slight roughness to the surface. If the carbon brush were to traverse this roughened surface, but slight contact would be made. This would cause increased sparking at the copper brush on account of the carbon brush failing to make good enough contact to suppress the arc and the trouble would soon so exaggerate itself that the contact plates would be ruined. All this is obviated by arranging the brushes to ride on separate portions of the contact plate surfaces, as indicated in Figs. 6 and 7. The carbon brush is retained in a suitable receptacle at the end of the arm N′ and is pressed into contact with the plate G by the spring T. Between the multiple magnetic poles D′ and the contact plates G are interposed plates of insulation U, Figs. 1 and 6, which may be leatheroid or other non-combustible substance. Insulation U′ is also placed on the under side of the arm. The insulation U prevents short circuits between the plates G and the poles D′, and the insulation U′ prevents short circuits from the contact plates G to the arm. Arcs formed between the contact plates G are quickly disrupted by the magnetic field between the poles D′ and the arm, forming a part of the magnetic circuit. Such arcs destroy the insulation in time, and it is therefore preferred to make such insulation in the form of removable insulating shields which can be slipped between the contact plates and the pole pieces. The dotted lines in the lower right-hand part of Fig. 1 indicate how these pieces may be removed and inserted.

What I claim as new, and desire to secure by Letters Patent, is—

1. A rheostat comprising a frame and a tier of removable trays supported therein, each tray containing a resistance coil, substantially as described.

2. A rheostat comprising a frame, a tier of removable trays supported therein, a resistance coil in each tray, and a series of contact

plates connected with said coils, substantially as set forth.

3. A rheostat comprising a frame, a tier of removable trays supported therein, and insulation between each tray and the frame, substantially as described.

4. A rheostat comprising a frame, and a tier of trays supported therein, each tray having open sides to permit free circulation of air, substantially as set forth.

5. A rheostat comprising a frame, a tier of trays supported therein, a resistance coil in each tray, and insulation between said coil and the tray, substantially as described.

6. A tray for a rheostat having open sides with ribs extending across them, substantially as set forth.

7. A tray for a rheostat composed of two portions meeting on a median plane, substantially as described.

8. A tray for a rheostat composed of two similar portions meeting on a median plane, each portion having an open side with ribs extending across it, substantially as set forth.

9. A resistance coil for a rheostat, comprising a removable conductor inclosed in a flat tray, such conductor being bent back and forth in the same plane and having insulating strips inserted between adjacent lengths thereof, substantially as set forth.

10. The combination with the plates D having the lugs *d*, of removable trays A supported on said lugs, and resistance coils in said trays, substantially as described.

11. In a rheostat, the plate D having a plurality of studs D′, and a central pillar $D^2$, a switch arm pivoted on said pillar and adapted to swing over said studs, and means for magnetizing said parts, substantially as described.

12. In a rheostat, the plate D having a plurality of studs D′, and a central pillar $D^2$, a helix surrounding said pillar, and a switch arm pivoted on said pillar, substantially as set forth.

13. In a rheostat the plate D having a plurality of studs D′, an insulating face plate supported by said studs, and a series of contact plates carried by said insulating face plate, substantially as described.

14. In a rheostat, the plate D having a plurality of studs D′, an insulating face plate supported by said studs, a series of contact plates carried by said insulating face plate and projecting over said studs, and a sheet of insulation between the studs and the contact plates, substantially as set forth.

15. In a rheostat, the combination with magnetic spark rupturing poles and superposed contact plates, of a removable sheet of insulation interposed between said poles and contact plates, substantially as described.

16. In a rheostat, a switch arm provided with brushes of different resistance moving in concentric arcs of different radii, substantially as described.

17. In a rheostat, the combination with a series of contact plates, of a switch arm carrying two brushes of different resistance, and arranged to traverse different portions of the contact plates, substantially as set forth.

18. In a rheostat, the combination with a series of contact plates, of a switch arm carrying brushes of different resistance, and so arranged that in both directions of its motion the brush of higher resistance is the last to leave the contact plates, substantially as described.

In testimony whereof I have hereunto set my hand this 23d day of February, 1893.

JONATHAN P. B. FISKE.

Witnesses:
JOHN W. GIBBONEY,
BENJAMIN B. HULL.