No. 733,565. PATENTED JULY 14, 1903.

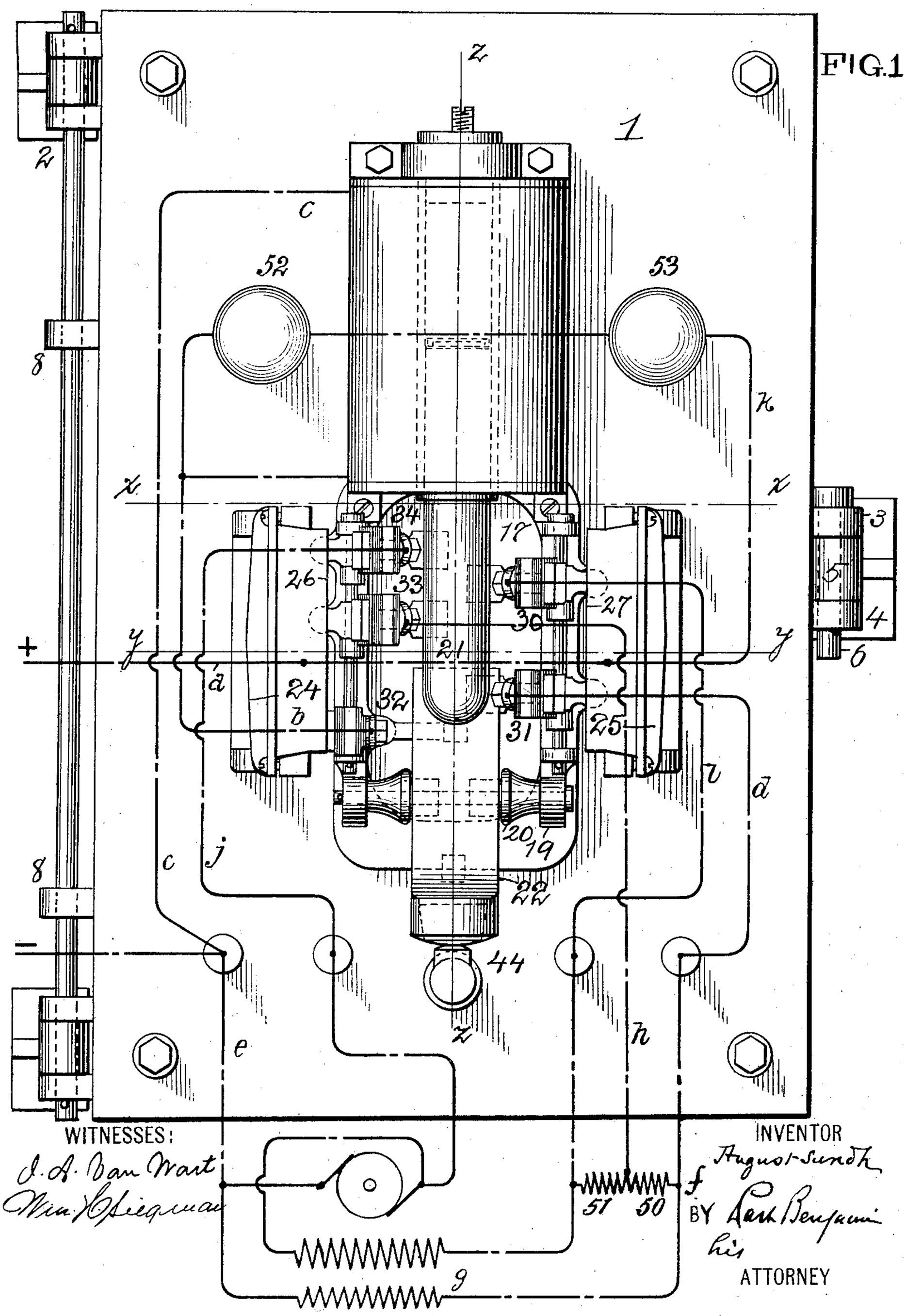
A. SUNDH.

ELECTRIC CONTROLLER.

APPLICATION FILED MAR. 16, 1903.

NO MODEL. 3 SHEETS—SHEET 1.

FIG. 1



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NO MODEL. 3 SHEETS—SHEET 2.

FIG. 2.

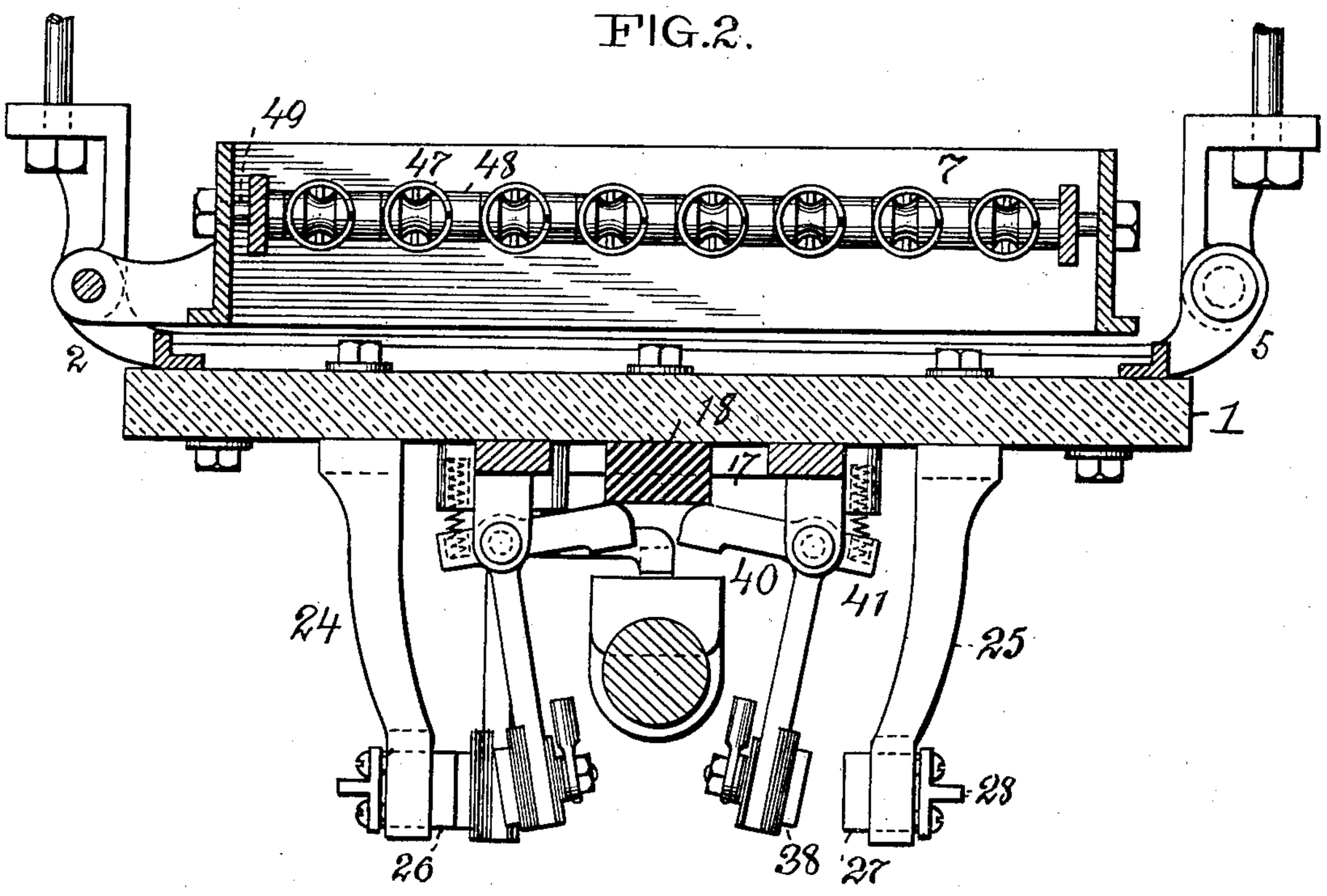
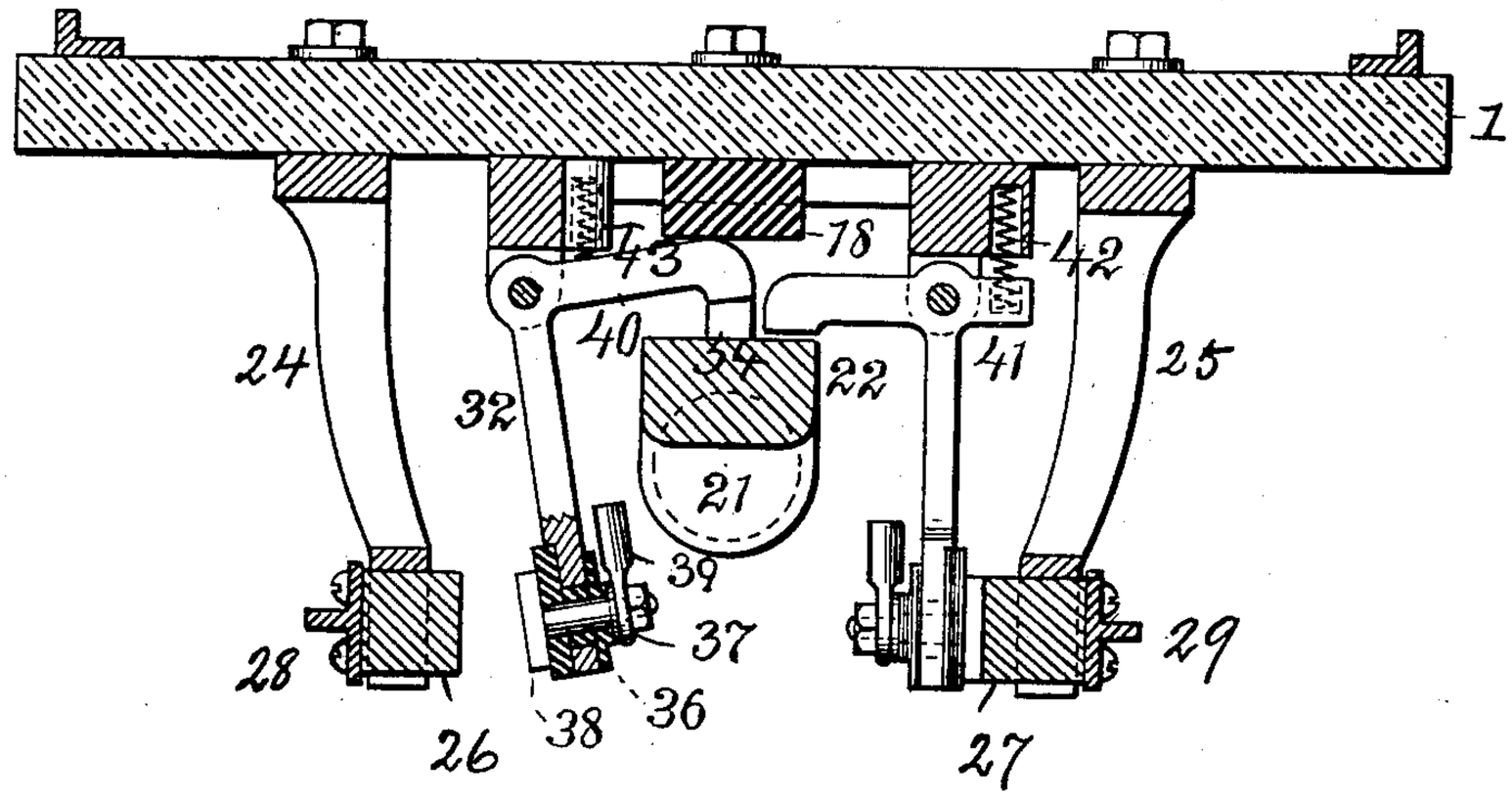


FIG. 3.



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NO MODEL. 3 SHEETS—SHEET 3.

FIG. 4.

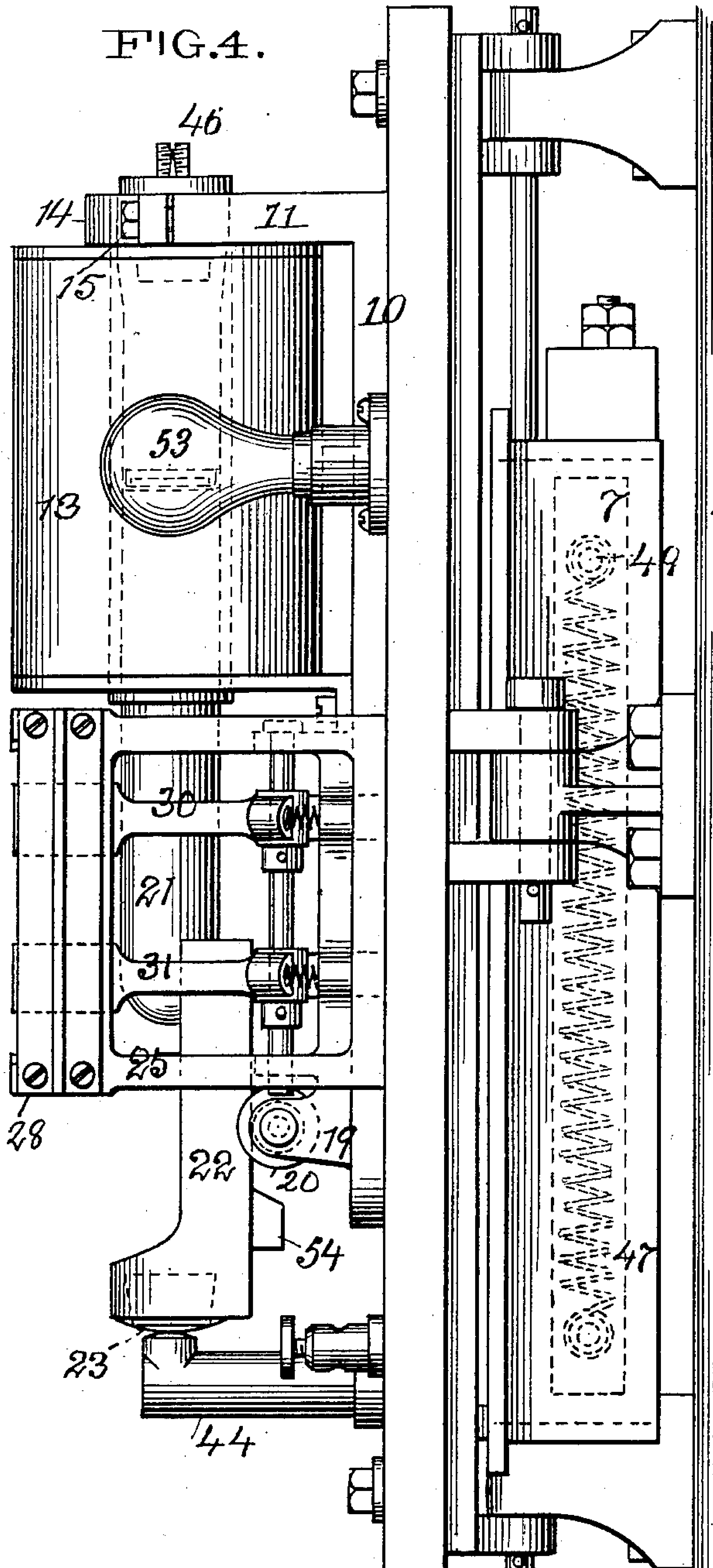
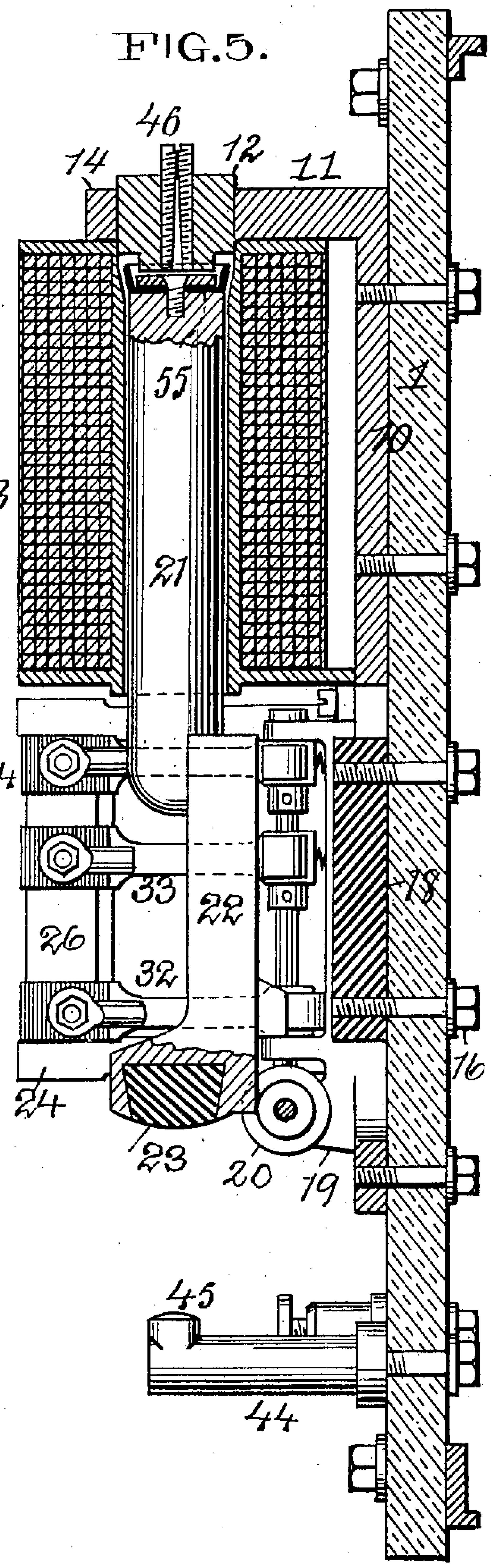


FIG. 5.



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No. 733,565. Patented July 14, 1903.

UNITED STATES PATENT OFFICE.

AUGUST SUNDH, OF YONKERS, NEW YORK.

ELECTRIC CONTROLLER.

SPECIFICATION forming part of Letters Patent No. 733,565, dated July 14, 1903.

Application filed March 16, 1903. Serial No. 148,053. (No model.)

To all whom it may concern:

Be it known that I, AUGUST SUNDH, of Yonkers, Westchester county, New York, have invented a new and useful Improvement in Electric Controllers, of which the following is a specification.

The invention relates to an electric controller for translating devices.

The invention consists in the means for magnetically moving the circuit-closing levers so as gradually to augment current in the translating device and in the various combinations set forth in the claims.

In the accompanying drawings, Figure 1 is a front elevation of my apparatus, showing the circuits in electrical diagram. Fig. 2 is a transverse section on the line *x x* of Fig. 1. Fig. 3 is a section on the line *y y* of Fig. 1. Fig. 4 is a side elevation. Fig. 5 is a vertical section on the line *z z* of Fig. 1.

Similar numbers and letters of reference indicate like parts.

1 is a plate, preferably of slate or other insulating material, upon which the apparatus is mounted and carried by the hinges 2. On the opposite side of the plate are two projecting lugs 3 4, which receive between them a sleeve 5, fast on the wall or other support. A pin 6 passes through the lugs 3 4 and sleeve 5, and so holds the plate in position against the wall. On the rear side of the plate 1 is a resistance-box 7, which is provided with lugs 8, through which passes the rod of hinge 2. By reason of this construction when the pin 6 is taken out the plate may be swung on its hinge away from the wall, and then the resistance-box 7 may be swung on its lugs away from the rear of the plate 1, so as conveniently to give access to its interior.

10 is a bracket-frame, of magnetic material, which has a protruding arm 11, which receives a plug 12, also of magnetic material, which plug is secured firmly in the end of solenoid 13. The plug is retained in the arm 11 by means of the semicircular clamping-piece 14, which is set up by bolts 15 in the usual way. The magnetic frame-plate 10 extends down behind the solenoid, as best shown in Fig. 5, and to a considerable distance below the same and there has an opening 17, in which opening is placed a block of magnetic material 18, which is secured to the back plate 1 by screw-bolts 16, as shown. Near the bottom of said plate are projecting lugs 19, in which are journaled two shouldered rollers 20. These rollers and also the pin on which they turn are made of brass. The solenoid-core 21 is provided at its end with an offset prolongation 22, the flat rear face of which rests upon the shouldered rollers 20. The bottom of the prolongation 22 is provided with a dovetail recess to receive a block of elastic material 23.

Secured on the back plate 1 and on each side of the plate 10 are standard-frames 24 25. Mounted in suitable openings in the outer ends of these frames are bars, preferably of carbon, 26 27, which are secured to said frames by means of the T-shaped brass bars 28 29. The standards are of conducting material. Pivoted between lugs formed on the plate 10 are five bell-crank levers 30 31 32 33 34, as shown best in Fig. 3. At the end of the outwardly-projecting arm of each of said levers there is an opening to receive an insulating-sleeve 36, through which sleeve passes a brass shank 37, which at one end carries a contact-plate 38, and the other end has secured to it any suitable coupling 39 for the attachment of a circuit-wire. The inner arm 40 of each bell-crank lever extends over the block 18 of insulating material and has its end turned upward to face the flat inner side of the offset prolongation 22 of the core 21. All of the levers excepting the lever 32 have an extension of arm 40, as shown at 41. This extension in every case has connected to it a helical spring 42, which enters a recess in the plate 10 and is secured therein. The normal effect of these helical springs is to push outwardly, thus throwing the several levers into the position in which they are shown in Fig. 2. The lever 32, on the other hand, has no projection 41, but has a helical spring 43 secured directly to its arm 40, and this spring, as before, enters a recess in the plate 10 and is secured therein. This spring acts to push outwardly the arm 40 of lever 32. When the levers 30 to 34 are thrown in the direction of standards 24 25, then the contact-plates 38 on said levers respectively make contact with the fixed contact-plates 26 27. It will be seen that the effect of the springs 42 acting on all the levers excepting lever 32 is to force the

contact-plates 38 on said levers away from the fixed contact-plates 26 27, whereas the effect of the spring 43 on the lever 32 is normally to move the contact-plate on that lever into contact with the contact-plate 26. The ends of the arms 40 of all of the levers 30 to 34 are in inductive proximity to the inner face of the prolongation 22 of the core 21, so that face as said core is drawn up by its solenoid comes in front of each lever-arm 40 in turn and so attracts each arm successively until all are attracted. In this way the levers are swung to establish circuit with the contact-terminals 26 27 by the movement of the core, and hence of the prolongation 22. I provide a fixed stop 44, having a rounded face 45, which the elastic block 23 strikes against when the core is at its lowest position.

For the purpose of rendering suitably slow the movement of the core 21 I insert in the block 12 in upper plate 11 a screw 46, having an angular air-opening in its side. By turning this screw in or out the effective area of the air-passage may be increased or diminished, so that air may be more or less imprisoned within the solenoid above the core, and thus offer different degrees of resistance to the movement of said core.

Within the swinging box 7 I provide any suitable number of resistance-coils 47, which, as indicated in Fig. 2, are connected at their ends to insulating-rings 48, strung upon a transverse rod 49. These resistance-coils may be grouped in any suitable way. For present purposes I shall assume that they are mounted in two groups. (Indicated diagrammatically in Fig. 1 at 50 and 51.) 52 and 53 are two incandescent lamps, the purpose of which will be explained hereinafter.

The operation of the instrument and the circuits are as follows, the parts being disposed as in Fig. 4—that is, with the prolongation 22 in contact with the stop 44: Beginning at the plus terminal circuit proceeds by wire *a* to the two standards 24 25. From standard 24 it passes directly to the contact on lever 32, (see Fig. 2,) which lever, it will be remembered, is normally held closed, then from the lever 32 by wire *b*, Fig. 1, to the solenoid, then from the solenoid by wire *c* to the negative terminal. The solenoid is now energized and proceeds to draw upward its core 21. As soon as the upper end of the prolongation 22 comes in front of the arm 40 of the lever 31 it attracts that arm 40 and swings the lever 31 outward, so as to establish contact between that lever and the contact-plate 27 on the standard 25. Current will then pass from standard 25 to the contact-plate 38 on lever 31, to the stem of that plate, and so to the wire *d* and through the resistances 50 51 to the series coil of the motor, through the armature of the motor, and so by wire *e* to the main negative terminal. The current also branches at *f* to pass through the shunt-coil *g* of the motor and so to the negative terminal. The core continues its upward movement, bringing the prolongation 22 now over the arm 40 of the next lever in succession, which is the lever 33. The arm 40 of that lever is then attracted, causing said lever to make contact with the contact-plate 26 on standard 24, so that current will then pass from standard 24 to the plate 38 on lever 33 and so by wire *h* to a point midway between the two resistances 50 and 51, whereby the resistance 50 becomes cut out of the motor series circuit, and as a necessary consequence the motor speeds up. The core still moving upward now acts upon the lever 30 in the same way to close contact, when the current passes by the wire *i* directly to the series coil of the motor, thus cutting out the resistances 51 50. The core still moving upward attracts the lever 34 and establishes contact in the same manner already described, when the current passes by the wire *j* directly to the motor-armature, so cutting out the series coil. The core has not yet completed its inward movement, but it has reached a position (see Fig. 4) when a cam projection 54 on the inner side of the prolongation 22 strikes the arm 40 of the lever 32, as shown in Fig. 3, and mechanically forces that arm rearward, and so breaks contact at that lever. The circuit first described as in the branch from standard 24 to the lever 32 by way of wire *b* to the solenoid is now broken, but continues in the branch from standard 25 by wire *k*, to and through the incandescent lamps 53 52, and so to the wire *b* to the solenoid and out by wire *c* to the negative terminal.

It will be seen from the foregoing that as soon as the core reaches the end of its upward movement the whole current goes through the motor, which then speeds up to its full extent. The incandescent lamps, which are switched in in series with the solenoid, reduce the current in the solenoid-coil, and hence prevent overheating of the latter, while leaving current of sufficient strength to retain the core in its final position.

Referring now to Fig. 5, on the upper end of the core 21 is clamped a cup-shaped flexible packing 55, which normally fits closely within the internal cylinder of the solenoid. When, however, the resistances in the lamps are switched into the circuit of the solenoid, the attractive power of the solenoid is reduced. It is then desirable to do away both with the friction of the packing and also the compression of the air above the core, so as to permit the core at the extreme end of its stroke to be freely moved by the comparatively small magnetic effect left in the solenoid; this also in order to effect a rapid break of circuit at lever 32. Therefore I flare the upper end of the solenoid-cylinder, as shown in Fig. 5, so as to allow the free edges of the packing freely to enter therein and also to permit the air to escape around the packing.

The arms of the levers 30, 31, 33, and 34 are made of magnetic material. The arms of lever 32 are made of non-magnetic mate-

rial. The reason for this will be obvious, since the four levers mentioned are all to be attracted by the core and so moved, while lever 32 is operated mechanically by the cam projection 54.

I claim—

1. An electromagnet, a movable armature and a circuit-closing device controlled by the magnetic field of said armature when said armature is moved by said electromagnet into and out of attractive proximity to said circuit-closing device.

2. A magnet, a circuit-closing device controlled by the field of said magnet, means for moving said magnet into attractive proximity to said circuit-closing device and thereby causing said device to close circuit, and means for retaining said magnet in said position.

3. An electromagnet, a movable armature, a circuit-closing device controlled by the magnetic field of said armature and caused to close circuit when said armature is moved into attractive proximity thereto, and means for reducing the current strength in said electromagnet after said circuit has been closed.

4. A magnet, a plurality of circuit-closing levers of magnetic material, a contact-terminal in the path of each lever, and means for moving said magnet into attractive proximity to each of said levers successively until all of said levers have been attracted by said magnet and moved into contact with their associated terminals.

5. An electromagnet, an armature, a plurality of circuit-closing levers of magnetic material, a contact-terminal in the path of each lever; the said armature being constructed and arranged when said magnet is energized to move into attractive proximity with each of said levers successively until all of said levers have been attracted by said armature and moved into contact with their associated terminals.

6. An electromagnet, an armature, a plurality of circuit-closing levers of magnetic material, a contact-terminal in the path of each lever, the said armature being constructed and arranged when said magnet is energized to move into attractive proximity with each of said levers successively, until all of said levers have been attracted by said armature and moved into contact with their associated terminals, and means controlled by said armature for then cutting resistances into the electromagnet-circuit.

7. A solenoid, a core having an offset prolongation, a series of pivoted bell-crank circuit-closing levers of magnetic material each having an arm in inductive proximity to a longitudinal face of said prolongation and contact-terminals in the paths of the other arms of said levers; the aforesaid parts being constructed and arranged so that when said core is moved by its solenoid the face of said prolongation is caused to travel over said proximate lever-arms successively until all of said arms have been attracted thereby and circuit closed with said contact-terminals through the other arms of said levers.

8. A solenoid, a core having an offset prolongation, a series of pivoted bell-crank circuit-closing levers of magnetic material, each having an arm in inductive proximity to a longitudinal face of said prolongation and contact-terminals in the paths of the other arms of said levers; the aforesaid parts being constructed and arranged so that when said core is moved by its solenoid the face of said prolongation is caused to travel over said proximate lever-arms successively until all of said arms have been attracted thereby and circuit closed with said contact-terminals through the other arms of said levers, and mechanism controlled by said core for then cutting resistances into the solenoid-circuit.

9. A solenoid, a core, branch conductors in circuit with said solenoid, a circuit-breaker in one branch, a resistance in the other branch, a plurality of pivoted circuit-closing levers of magnetic material, and contact-terminals in the paths of said levers; the aforesaid parts being constructed and arranged so that when said core is moved by its solenoid into attractive proximtiy to each of said levers all of said levers become successively attracted to said core and thereby moved to close circuit with their associate terminals, and thereafter said circuit-breaker is actuated by said core to break circuit through the branch conductor including it.

10. An electromagnet, an armature, a circuit-closing lever of magnetic material in inductive proximity to said armature, a contact-terminal in the path of said lever, and means controlled by said armature for reducing the current strength in the circuit of said electromagnet; the aforesaid parts being constructed and arranged so that when said armature is moved by said electromagnet into attractive proximity to said lever said lever is attracted to said armature to close circuit at said contact-terminal, and thereafter the current strength in said electromagnet is reduced by said means controlled by said armature to an amount sufficient to retain said armature in its final position.

11. The combination of the solenoid 13, having an internal cylindrical chamber flaring at its upper end, core 21 and flexible cup-packing 55 secured to the upper extremity of said core and constructed to enter said flared portion of said chamber.

12. The combination of the solenoid 13 having an internal chamber, core 21 in said chamber and the screw 46 having a V-shaped slot longitudinally disposed in its shank and adjustable to regulate escape of air from said chamber.

13. The combination of the solenoid 13, core 21 thereof having offset prolongation 22, pivoted bell-crank levers 31, 30 of magnetic material having arms 40 and contact-termi-

nal 26 in the path of said levers; whereby when said core 21 is moved toward its solenoid said lever-arms 40 will be successively attracted by said core and retained in said attracted position thus closing circuit with said contact-terminal 26.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

AUGUST SUNDH.

Witnesses:
I. A. VAN WART,
WM. H. SIEGMAN.