No. 754,689. PATENTED MAR. 15, 1904.

F. D. PEARNE & C. L. KRUM.

ELECTRICAL SELECTIVE APPARATUS.

APPLICATION FILED FEB. 3, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.

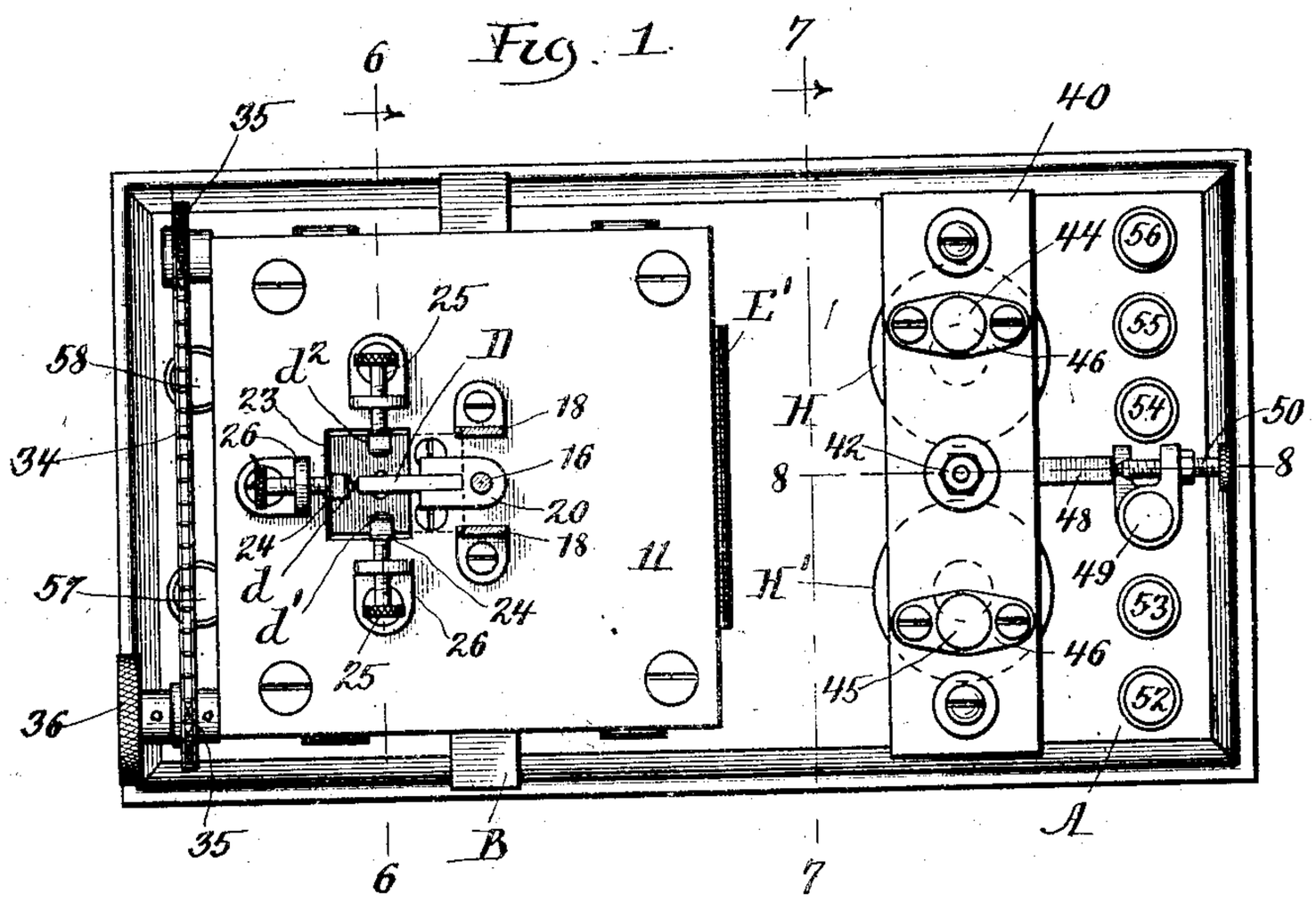
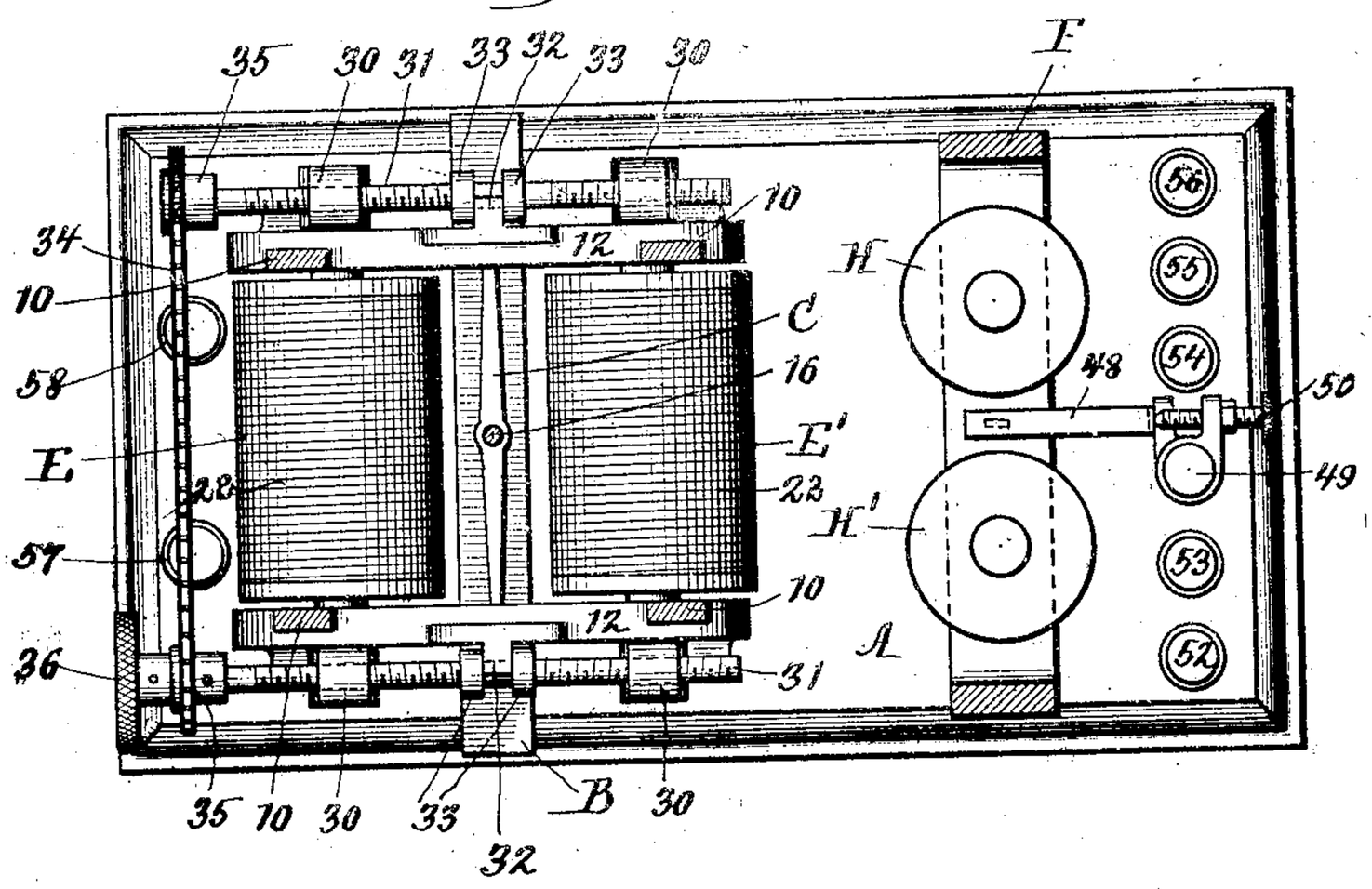


Fig. 2.



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NO MODEL. 3 SHEETS—SHEET 2.

Fig. 3

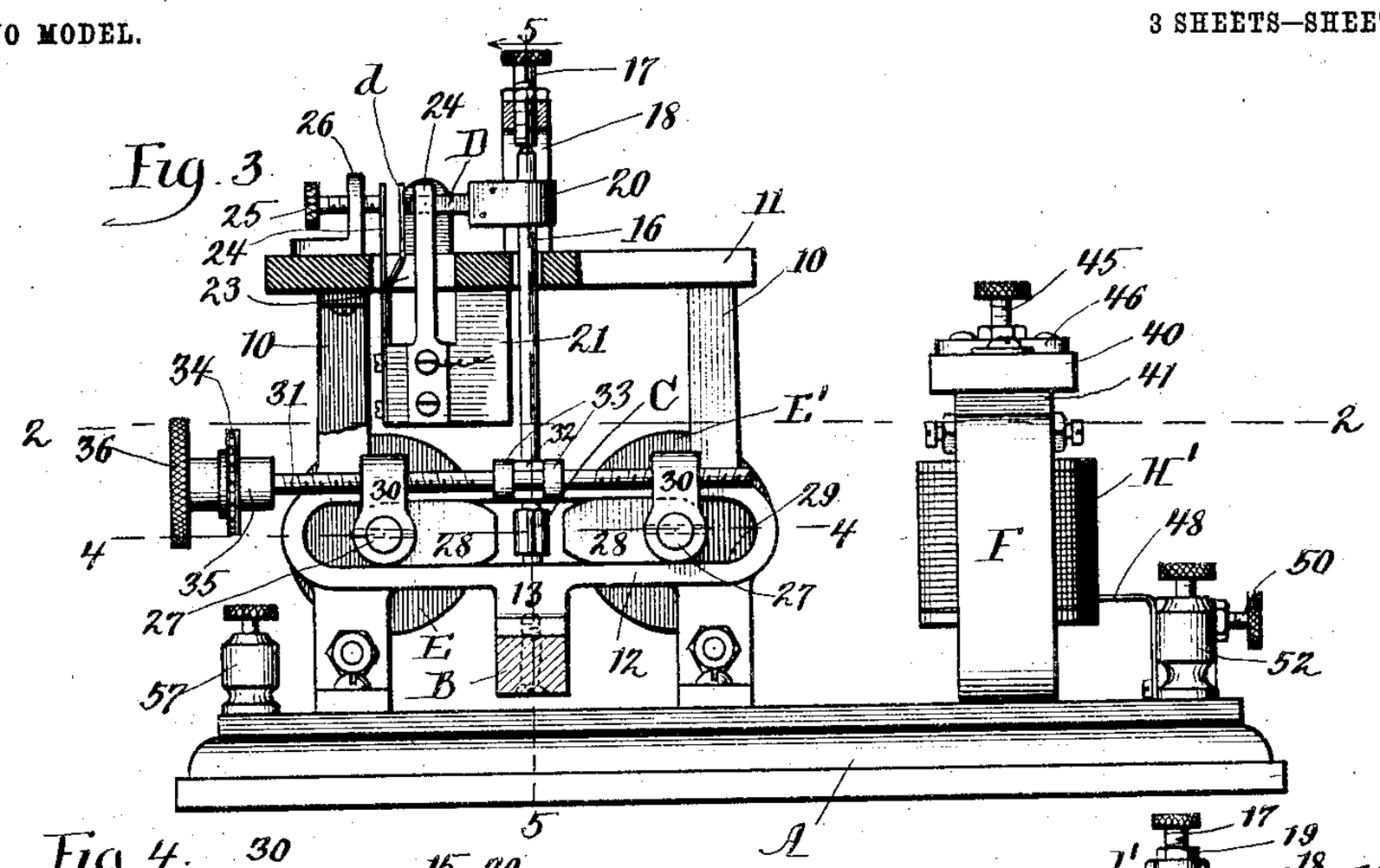


Fig. 4.

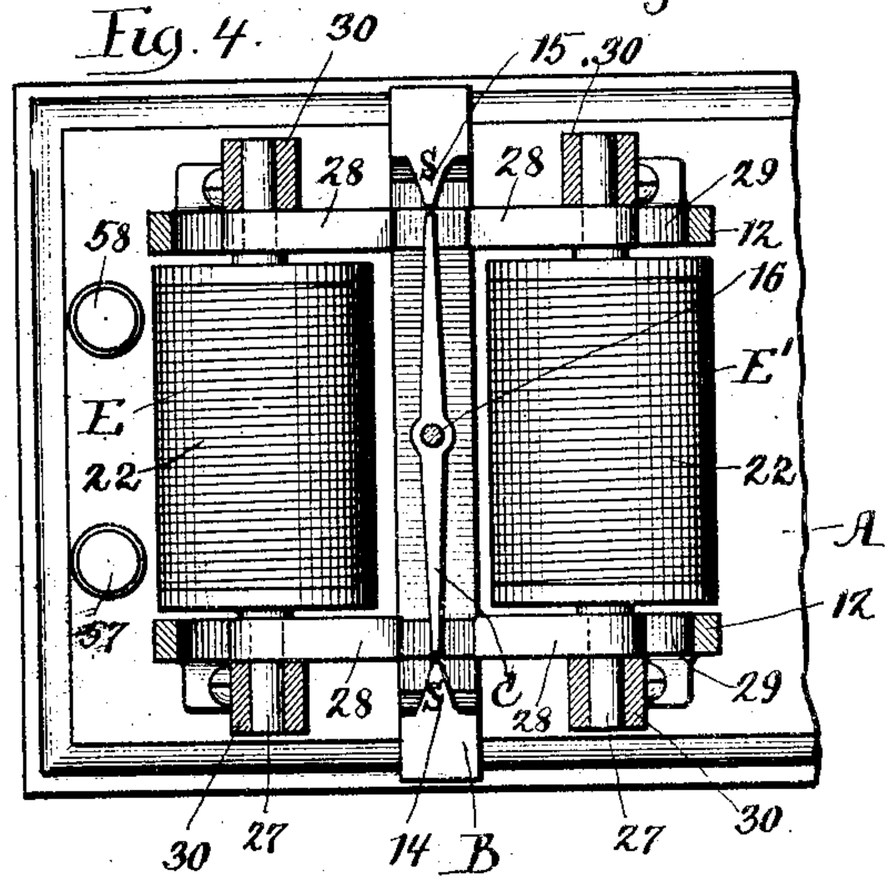


Fig. 5.

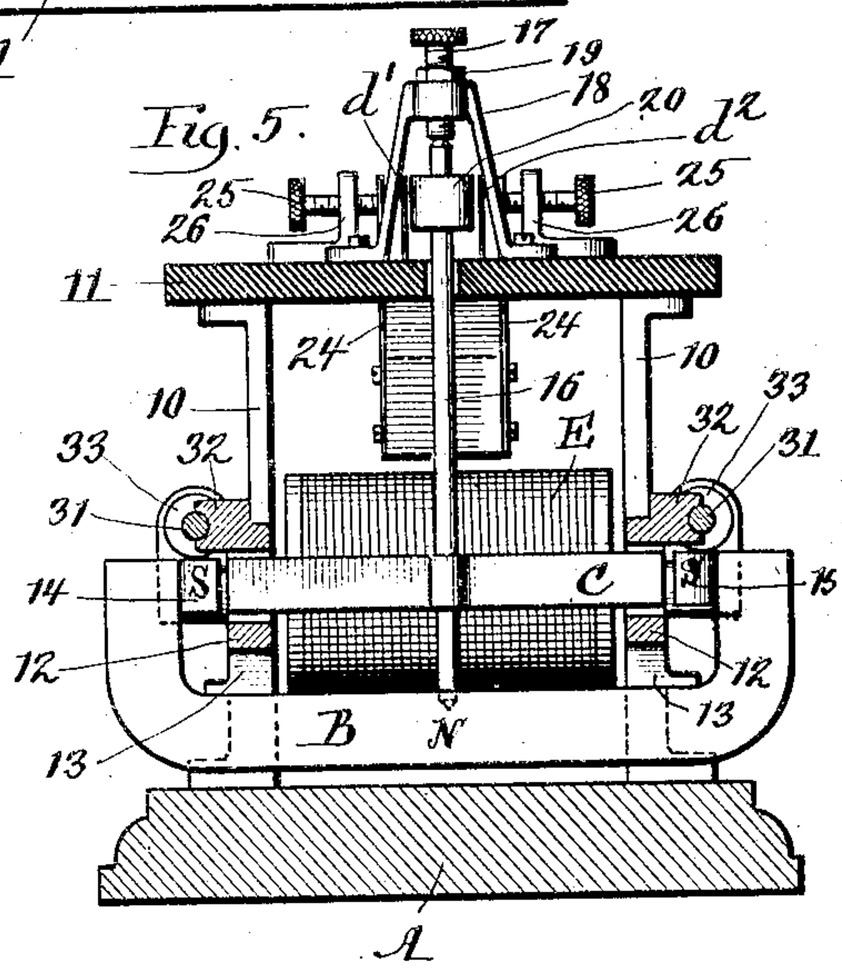
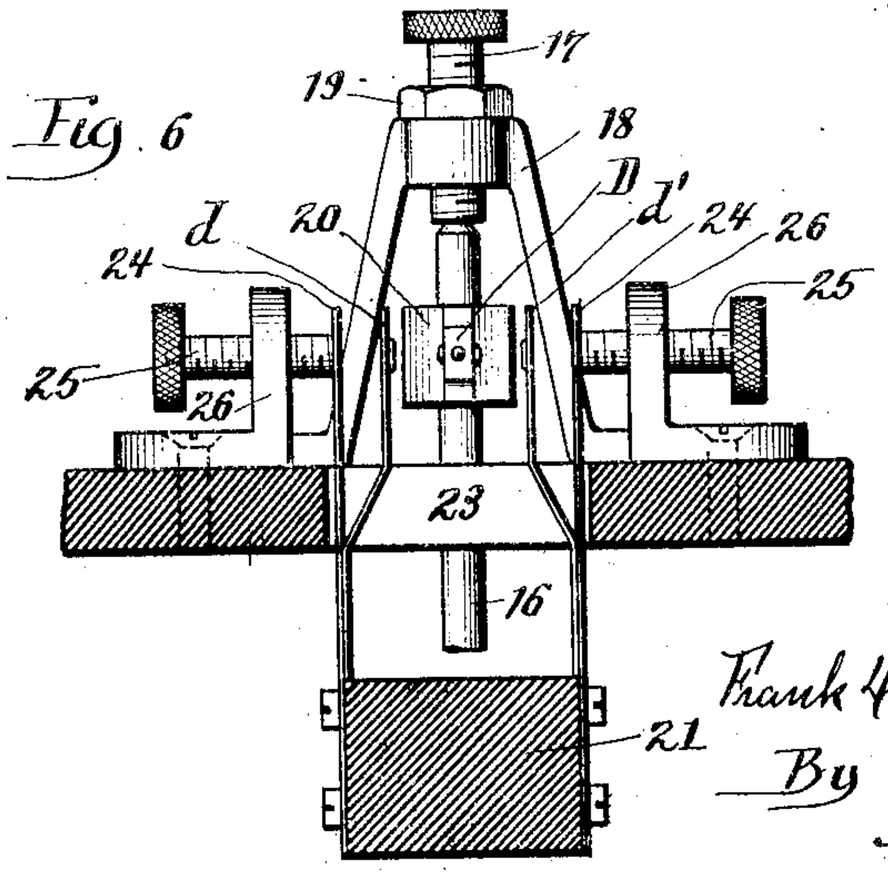


Fig. 6



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NO MODEL. 3 SHEETS—SHEET 3.

Fig 7 &

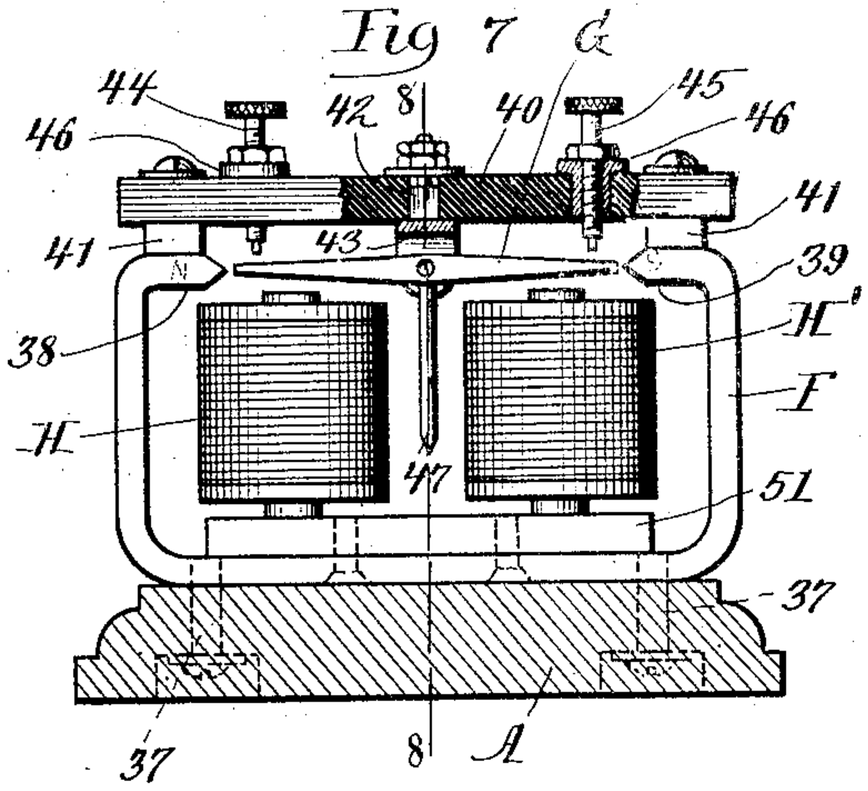

Fig. 8.

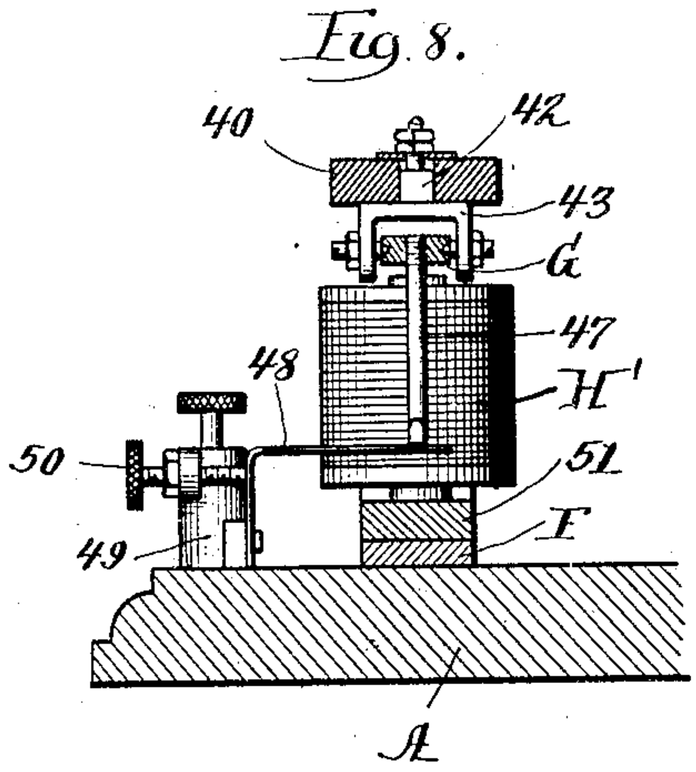

Fig. 9.

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No. 754,689. Patented March 15, 1904.

UNITED STATES PATENT OFFICE.

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ELECTRICAL SELECTIVE APPARATUS.

SPECIFICATION forming part of Letters Patent No. 754,689, dated March 15, 1904.

Application filed February 3, 1902. Serial No. 92,264. (No model.)

To all whom it may concern:

Be it known that we, FRANK D. PEARNE and CHARLES L. KRUM, citizens of the United States, and residents of Chicago, in the county of Cook and State of Illinois, have jointly invented certain new and useful Improvements in Electrical Selective Apparatus, of which the following is a full, clear, and exact description.

The invention relates to the electrical selective apparatus, and seeks to provide a selective relay which will be extremely sensitive, positive and rapid in operation, and by which one of two or three branch circuits may be selected or closed, and to provide in conjunction therewith a magnetic lock arranged to hold the selected branch circuit in a closed condition.

The improved apparatus is particularly designed to be one of several similar devices located in a line-circuit and used to control a series of local branch circuits operating a set of signals, the separate parts of a printing-telegraph or electrical type-writer, or other similar receiving devices.

The invention consists in the features set forth in the following description, illustrated in the accompanying drawings, and more particularly pointed out in the appended claims.

In the drawings, Figure 1 is a plan view of the improved apparatus. Fig. 2 is a horizontal section on line 2 2 of Fig. 3. Fig. 3 is a side elevation, parts being broken away and parts shown in section. Fig. 4 is a partial horizontal section on line 4 4 of Fig. 3. Fig. 5 is a vertical section on line 5 5 of Fig. 3. Fig. 6 is an enlarged detail section on line 6 6 of Fig. 1. Fig. 7 is a vertical section on line 7 7 of Fig. 1. Fig. 8 is a partial vertical section on line 8 8 of Figs. 1 and 7. Fig. 9 is a diagrammatic view of the circuits.

Near one end of a base-board A are firmly secured the uprights or corner-supports 10, upon which is fixed a top plate 11, of insulating material. The corner-supports 10 are preferably of brass, and each side pair is connected intermediate the ends of the supports by a side frame-bar 12, which is also of brass and preferably cast or formed in one piece with the connected corner-supports. A field-magnet B is secured in transverse position to a pair of central downwardly-projecting lugs 13 upon side bars 12. This field-magnet is formed of magnet-steel and its ends bent upwardly and then inwardly to form the pole-pieces 14 and 15, located in the same horizontal plane. The bar B is permanently magnetized, with the poles 14 and 15 of like polarity and with a central unlike pole—that is, if the central part of the bar (marked N) is the north pole the oppositely-facing ends (marked S) are south poles. An armature C, of soft iron, extends between and in line with the oppositely-disposed like poles 14 and 15 and is fixed to a vertically-disposed center pivot or spindle 16, the lower cone-shaped end of which is stepped or journaled within an opening formed in central position upon the top face of the field-magnet B and at its unlike pole. The spindle 16 extends upwardly through an opening in the top plate 11, and its upper cone-shaped end is journaled within the end of a screw 17, which is adjustably threaded through a piece 18, of inverted-U shape, fixed to the upper face of plate 11 and held thereby some distance above the top plate. A lock-nut 19 serves to hold the bearing-screw 17 in its proper adjusted position.

A head or block 20, of insulating material, is fixed to the upper end of spindle 16 intermediate the plate 11 and screw-bearing 17 and serves as a support for a metal contact or switch arm D. Upon a block 21, of insulating material, fixed to the under side of top plate 11, are mounted three spring strips or contacts d, d', and d^2, which project upwardly through an opening 23 in top plate 11 and surround the end of the contact-arm D. Each of these spring-strips is preferably brazed to or fixed in any suitable manner at its lower end to a spring-strip 24, which also projects upwardly through the opening 23 in the top plate. The upper ends of the spring-contacts d, d', and d^2 are bent inwardly, as shown, and spaced apart from the upper ends of the spring-strips 24, while a thumb-screw 25, adjustably threaded through a lug 26, is arranged to engage the upper end of each of the spring-strips 24. The contacts d, d', and d^2 are thus

yieldingly and adjustably held in position, and the adjusting thumb-screws are situated at the upper portion of the apparatus, and thus are easily accessible.

With the arrangement of field-magnet and armature above described the lines of force will pass from the north pole of the magnet through the lower portion of the spindle 16, in direct contact therewith, and then divide and pass in opposite directions through the armature C to the south poles 14 and 15. Armature C is thus polarized by the magnetic action of the field-magnet B and held in normal central position in line with the like poles 14 and 15. So, also, the contact-arm D is normally held in central position in engagement with the contact-spring *d* and out of engagement with the contact-springs *d'* and *d²*. By rocking the armature in one or the other direction contact with spring *d* will be broken and contact made with either spring *d'* or spring *d²*.

For rocking armature C a pair of electromagnets E E' are mounted upon either side of the armature C and with their opposite pole-pieces respectively adjacent the opposite ends of the armature. Each of these actuating-magnets is preferably formed of a single spool 22, transversely arranged between the side frame-pieces 12, and to the soft-iron cores 27 of which are swaged or otherwise firmly fixed in place the pole-pieces 28, which project inwardly toward the armature C.

In order to adjust the sensitiveness of the relay, the magnets E E' are movably supported between the side bars 12, the pole-pieces 28 being mounted to slide in slots or guideways 29, formed in the side bars 12. To the ends of each of the cores 27 of the spools 22 are pinned or otherwise rigidly fixed in position the upwardly-extending lug-pieces 30, through each adjacent side pair of which are threaded the opposite ends of a right and left handed screw 31. Each of the screws 31 is held against longitudinal movement by a center lug 32 upon the adjacent cross-bar 12, which extends between and engages a pair of collars 33 upon screw 31. Right and left hand screws 31 are of similar size and pitch and connected by a gear-chain 34, passing over a pair of sprockets 35, fixed to the outer ends of the screws, and one of the screws is provided, as shown, with an adjusting thumb-nut 36. By this means both ends or poles of both of the actuating-magnets E E' may be adjusted simultaneously and equably to and from the armature C and the sensitiveness of the relay thus quickly and accurately adjusted.

Upon the opposite end of the base-board A is secured by screws 37 an upright U-shaped permanent field-magnet F, having inwardly-turned unlike pole-pieces 38 and 39. A cross-strip 40, of insulating material, extends between and is secured to the pole-pieces 38 and 39, but is spaced somewhat above the pole-pieces by the interposed blocks 41. A binding-post 42 is secured in central position in the cross-strip 40, and to its lower end is fixed a yoke 43, in which is centrally pivoted an armature G, extending between the pole-pieces 38 and 39 of the field-magnet F, so as to be held in normal central position by the attraction of the magnet.

Metallic contact-pins 44 and 45 are adjustably threaded through metallic sleeves 46, fixed in the opposite ends of the insulating-strip 40, the lower ends of the pins forming contact-points in position to be engaged, respectively, by the opposite ends of armature G when the latter is rocked in one or the other direction. A contact-pin 47, fixed centrally to the armature G and extending downwardly therefrom, normally engages a bent spring-contact 48, which is fixed to a lug on a binding-post 49, mounted upon the base-board A. An adjusting-screw 50 for spring-contact 48 is threaded through a second lug on the binding-post 49 and engages the spring-contact, as shown.

Upon a brass piece 51, secured to the horizontal portion of magnet F, are fixed two separate electromagnets H H', arranged adjacent the opposite ends of armature G, so that by energizing one or the other of said magnets the armature may be rocked into engagement either with contact 44 or with contact 45, while the contact between pin 47 and spring 48 is broken.

At one end of base-board A in line with binding-post 49 are mounted the binding-posts 52, 53, 54, 55, and 56, and at the opposite end of the base-board adjacent the relay are fixed the binding-posts 57 and 58.

In Fig. 9 the line-circuit may be traced by wire 59 to binding-post 57, by wire 60 to relay-magnet E, thence through the coil of this magnet and by wire 61 to the relay-magnet E', and through its coil and by wire 62 to binding-post 58, and from thence back by wire 63 over the line or to the next succeeding relay, if more than one are employed. Line impulses of the proper strength and of opposite polarity will serve to move armature C in one or the other direction. When the current passes in one direction, one end of polarized armature C will, for example, be attracted toward the adjacent pole of magnet E and repelled by the adjacent pole of magnet E', while its opposite end is repelled by the adjacent pole of magnet E and attracted by adjacent pole of magnet E' and the armature rocked to bring contact-arm D against contact-spring *d'*.

When the line impulse passes in the reverse direction, the effect of the relay-magnets E and E' upon armature C will be the reverse of that above stated, and the armature will be rocked to bring contact-arm D into engagement with contact-spring *d²*. It is thus obvious that the effects of electromagnets E and E' and of the

permanent polarizing field-magnet B are combined whenever the relay is traversed by a line impulse, so that the operation of the relay is extremely positive and sensitive. As soon as the line impulse ceases the armature C is at once returned to normal central position by the permanent field-magnet B, and the contact-arm D is returned to normal engagement with contact-spring *d*.

I, I′, and I² in Fig. 9 represent separate electrical devices or magnets of the receiving apparatus, which may of course be grouped at a single station or located at a separate station and used for a variety of purposes. Each of these devices is included in a separate branch circuit, in this instance separate branch circuits of a battery K. In the normal position of armature C of the relay the circuit from battery K is traced by wire 64 to binding-post 55, by wire 65 to contact-arm D, thence by contact-spring *d* and wire 66 to binding-post 56 and by wire 67 to the next succeeding relay.

50 represents the return-wire to the battery. In the normal position of armature G a branch of battery K in this instance is closed through the member I² of the receiving apparatus, as follows: By wire 64 and branch wire 68 to a spring-held make-and-break switch L, normally engaging a contact 69, from thence by wire 70 to binding-post 54, by wire 71 to binding-post 42, thence by armature G and contact-pin 47 to contact-spring 48, thence by binding-post 49 and wires 72, 73, and 50 through the receiving device I² back to battery K.

When the armature C is rocked by a line impulse as described—for example, against the contact *d*′—the circuit from battery K is traced by wire 64 to binding-post 55, by wire 65 to contact-arm D, by contact *d*′ and wires 74 and 75 through the coil of magnet H′ to binding-post 52, thence by wires 76, 77, and 50 through receiving device I back to battery K. Magnet H′ is thus energized, and the amature G, which responds to the slightest impulse passing through the branch circuit, is rocked into engagement with contact 44 and the contact between pin 47 and spring 48 is broken. The branch circuit through the receiving member I is then closed through a shunt around the contact-arm D as follows: from battery K by wires 64 and 68 to make-and-break switch L, by contact 69, wire 70 to binding-post 54, by wire 71 and binding-post 42 to armature G, by contact 44 and wires 78 and 74 through the coil of magnet H′, thence by wires 75 to binding-post 52 and by wires 76, 77, and 50 through the receiving device I back to battery K.

When the line impulses of opposite polarity rock armature C to bring contact-arm D into engagement with the spring-contact *d*², the branch circuit through receiving device I′ and locking-magnet H is closed in a similar manner. The line impulses of opposite polarity thus operate through the medium of the sensitive relay to select one of two branch circuits, and the slightest impulse through the selected branch serves, through the medium of the locking-magnet H H′, to hold said branch circuit in a closed condition through the selected receiving device until broken at the make-and-break switch L. The latter may be actuated automatically from the separate receiving devices I and I⁴ or otherwise, as desired.

When the line impulses cease, armature C is at once returned to normal by field-magnet B and contact-arm D brought into engagement with spring *d*. The circuit from battery K is then closed at this point and through wires 66 and 67 to the next succeeding relay. When the circuit through either of the controlled branch circuits is broken by the make-and-break device L, the armature G is returned to normal by field-magnet F. The apparatus is then in condition to be actuated by the next succeeding line impulse.

It will be understood that various changes may be made in the arrangement and construction of the various features without departure from the essentials of the invention.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. The combination with a line-circuit and with two independent, separate branch circuits, of a relay in said line-circuit, means controlled by said relay for closing either of said branch circuits, a pair of locking-magnets, one controlled by each of said branch circuits and a shunt around said circuit-controlling means arranged to be closed by the operation of said locking-magnets through the selected branch circuit.

2. The combination with a line-circuit and with two independent, separate branch circuits, of a polarized relay in said line-circuit comprising a pivoted armature having means for controlling said branch circuits, means for holding said armature in central position with both of said branch circuits open, means for rocking said armature in one or the other direction to close either of said branch circuits, a locking-magnet in each of said branch circuits, means controlled by said locking-magnets and a shunt around said circuit-controlling means arranged to be closed through the selected branch circuit by said means.

3. The combination with a line-circuit and with two independent, separate branch circuits, of a relay in said line-circuit comprising a permanent field-magnet, a pivoted armature held in normal central position thereby and means for rocking said armature in one or the other direction, a contact-arm controlled by said armature and normally held thereby out of engagement with the terminals of said separate branch circuits but arranged to close either of the latter as said armature is rocked in one

or the other direction, a locking-magnet in each of said branch circuits, a common pivoted armature for said locking-magnets, arranged to be rocked in one or the other direction thereby and a shunt around said contact-arm arranged to be closed through the selected branch circuit by the movement of said locking-armature.

4. The combination with a line-circuit and with two separate independent branch circuits, of a relay comprising a permanent field-magnet having two like poles and one unlike pole, an armature extending in line with and normally held in central position between said like poles and an electromagnet for rocking said armature in one or the other direction, a contact-arm controlled by said relay-armature and normally held out of contact with the terminals of said branch circuits but arranged to close one or the other of the latter as said armature is moved, a locking-magnet in each of said branch circuits, a common centrally-pivoted armature for said locking-magnets, and a shunt around said contact-arm arranged to be closed through the selected branch circuit by the movement of said locking-armature.

5. The combination with a line-circuit and with two normally open branch circuits controlling receiving devices, of means controlled by said line-circuit for closing either of said branch circuits, a locking-magnet in each of said branch circuits and a shunt arranged to be closed by said locking-magnets through the selected branch circuit.

6. The combination with a line-circuit and with two independent, normally open branch circuits controlling separate receiving devices, of a relay controlled by said line-circuit for closing either of said branch circuits, a pair of locking-magnets arranged side by side one in either of said branch circuits, a common centrally-pivoted armature arranged to be moved in one or the other direction by said locking-magnets and a shunt arranged to be closed by the movement of said armature through the selected branch circuit.

7. The combination with a line-circuit and with two normally open branch circuits controlling separate receiving devices, of a relay in said line-circuit arranged to close either of said branch circuits, a pair of locking-magnets arranged side by side, one in either of said branch circuits, a common centrally-pivoted armature, a permanent field-magnet arranged to hold said armature in normal central position and a shunt arranged to be closed by said armature through the selected branch circuit when said armature is rocked in one or the other direction by the operation of said locking-magnets.

8. The combination with a line-circuit and with two independent, normally open branch circuits controlling separate receiving devices, of means controlled by said line-circuit for closing either of said branch circuits, a pair of locking-magnets, one arranged in either of said branch circuits, a common pivoted armature normally held in central position, a third branch circuit controlling a third receiving device and a shunt controlled by said pivoted armature and normally closed thereby through said third branch circuit but arranged to be broken through said third branch and closed through either of the normally open branches when said armature is rocked in one or the other direction by the operation of said locking-magnets.

9. The combination with a line-circuit and with two separate branch circuits, of means operated by said line-circuit for controlling said separate branch circuits, a locking-magnet in each of said branch circuits and a shunt-circuit around said circuit-controlling means arranged to be actuated by each of said locking-magnets.

10. The combination with a line-circuit and with two independent, separate branch circuits, of a relay in said line-circuit, switch-contacts in said branch circuits controlled by said relay, a pair of locking-magnets, one controlled by each of said branch circuits and shunt-circuits around said switch-contacts controlled respectively by said locking-magnets.

11. The combination with a line-circuit and with two independent, separate branch circuits, of a relay in said line-circuit, means operated by said relay for controlling said branch circuits, a pair of locking-magnets controlled respectively by said separate branch circuits, a shunt around said circuit-controlling means having switch-contacts controlled by said locking-magnets and an unlocking-switch in said shunt.

12. The combination with a line-circuit and with two independent, separate branch circuits, of a relay in said line-circuit, means controlled by said relay for closing either of said branch circuits, a pair of locking-magnets controlled respectively by said separate branch circuits, a shunt around said circuit-controlling means arranged to be closed by the operation of said locking-magnets through the selected branch circuit and an unlocking-switch in said shunt.

13. The combination with a line-circuit and with two independent, separate branch circuits, of a polarized relay in said line-circuit comprising switch-contacts for respectively controlling said separate branch circuits, a locking-magnet in each of said branch circuits, a shunt-circuit around the switch-contacts of said relay, switch-contacts in said shunt-circuit controlled by said locking-magnets and an unlocking-switch in said shunt-circuit.

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