No. 721,410. PATENTED FEB. 24, 1903.

J. J. WOOD.

SWITCH FOR ELECTRIC CIRCUITS.

APPLICATION FILED JUNE 28, 1901.

NO MODEL. 2 SHEETS—SHEET 1.

FIG. 1.

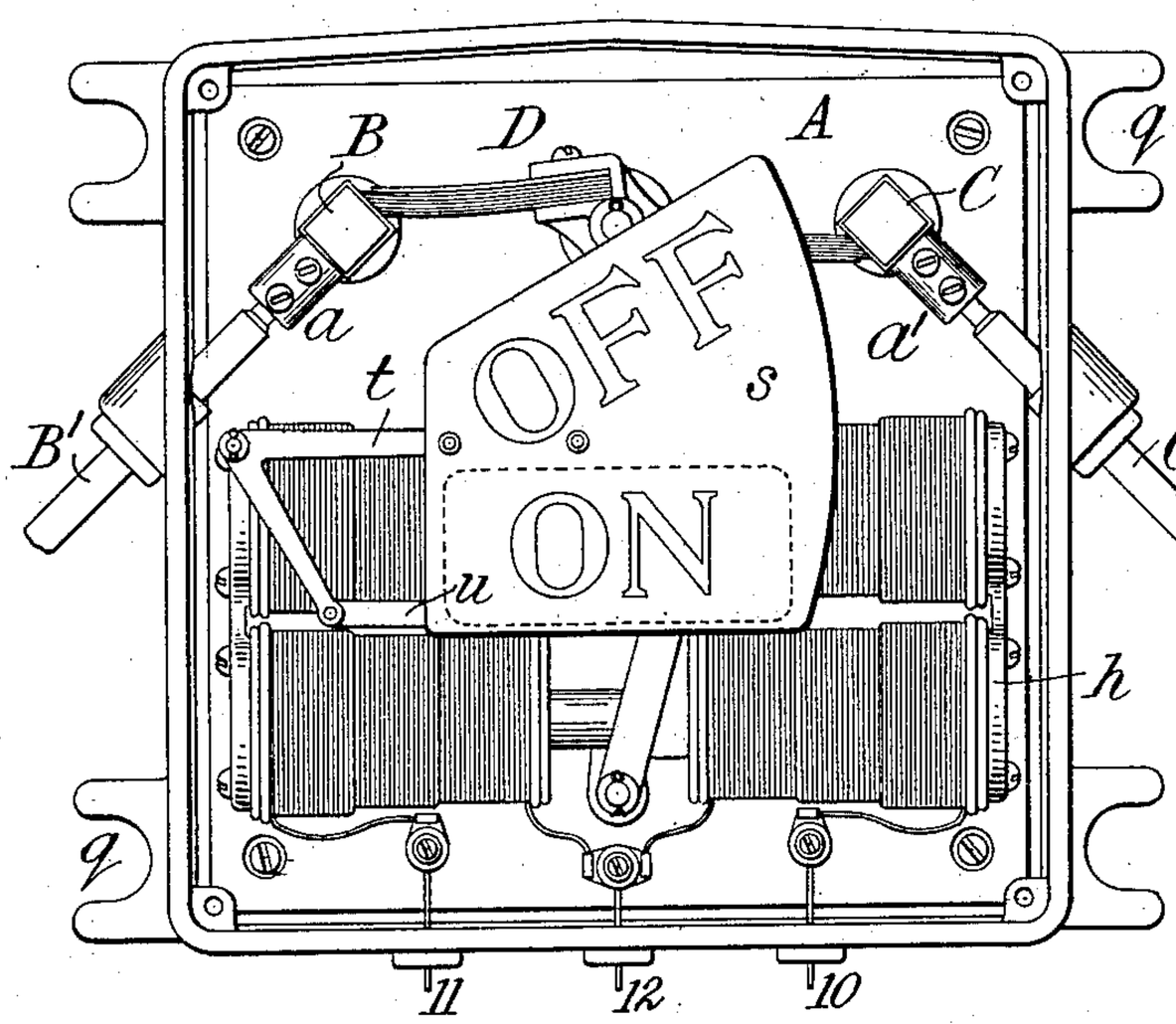


FIG. 2.

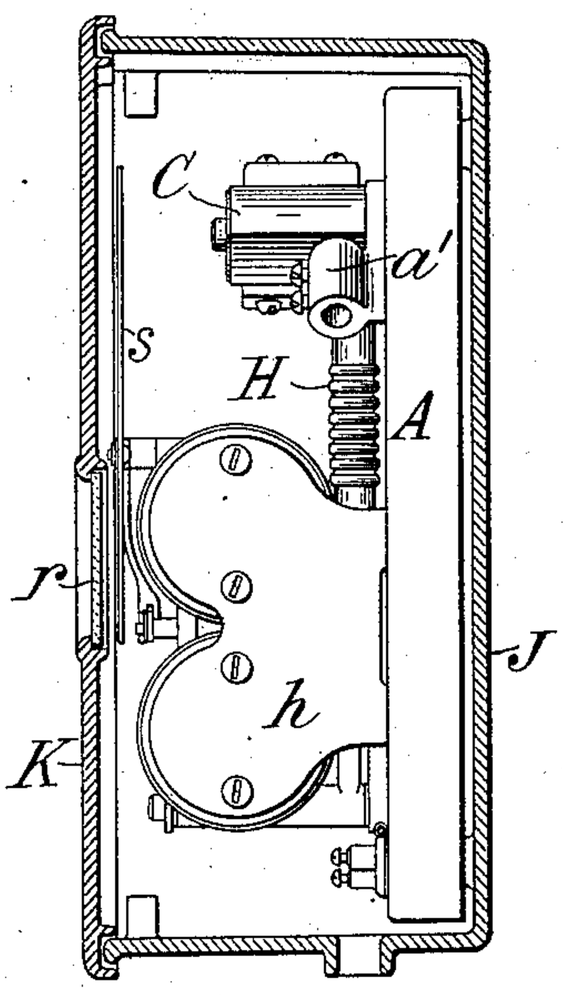


FIG. 3.

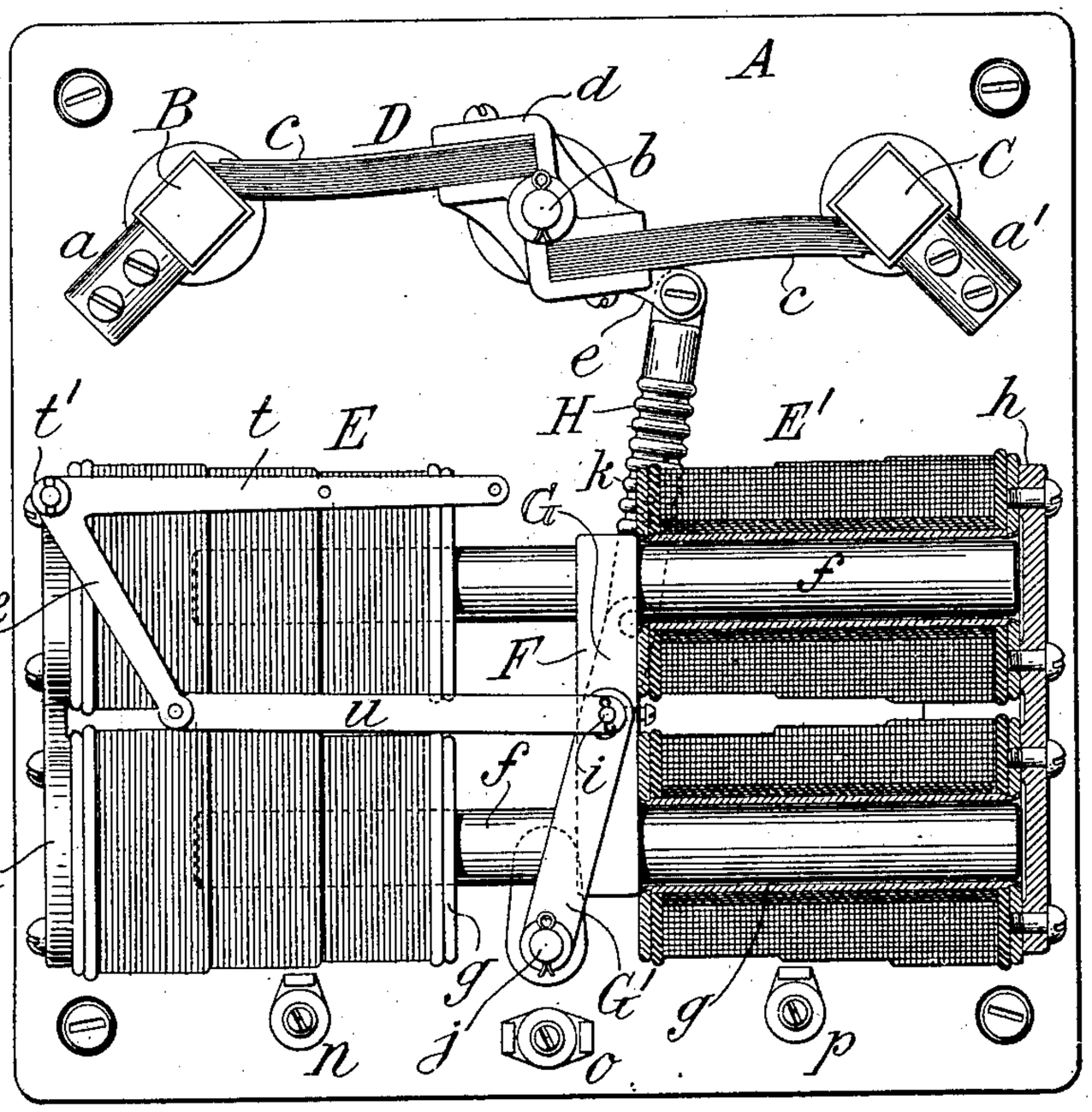
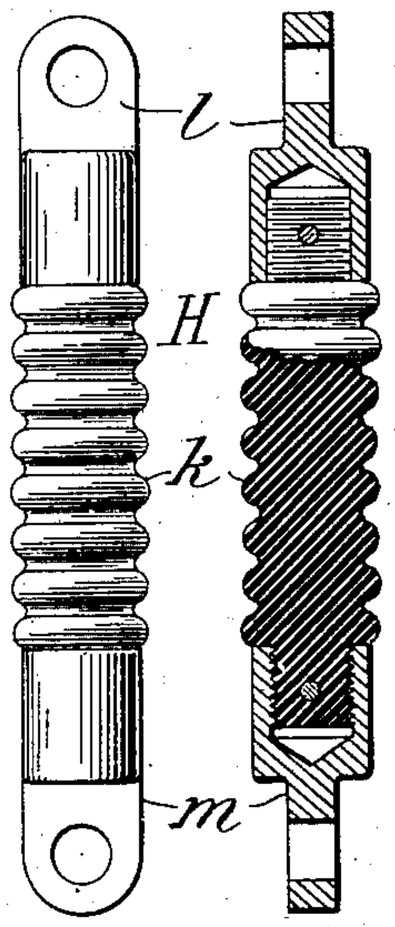


FIG. 8. FIG. 9.



INVENTOR:

James J. Wood,

By Attorneys,

Dustin G. Fraser & Co.

WITNESSES:

Fred Whitty

Thomas F. Wallace

No. 721,410. PATENTED FEB. 24, 1903.

J. J. WOOD.

SWITCH FOR ELECTRIC CIRCUITS.

APPLICATION FILED JUNE 28, 1901.

NO MODEL. 2 SHEETS—SHEET 2.

FIG. 4.

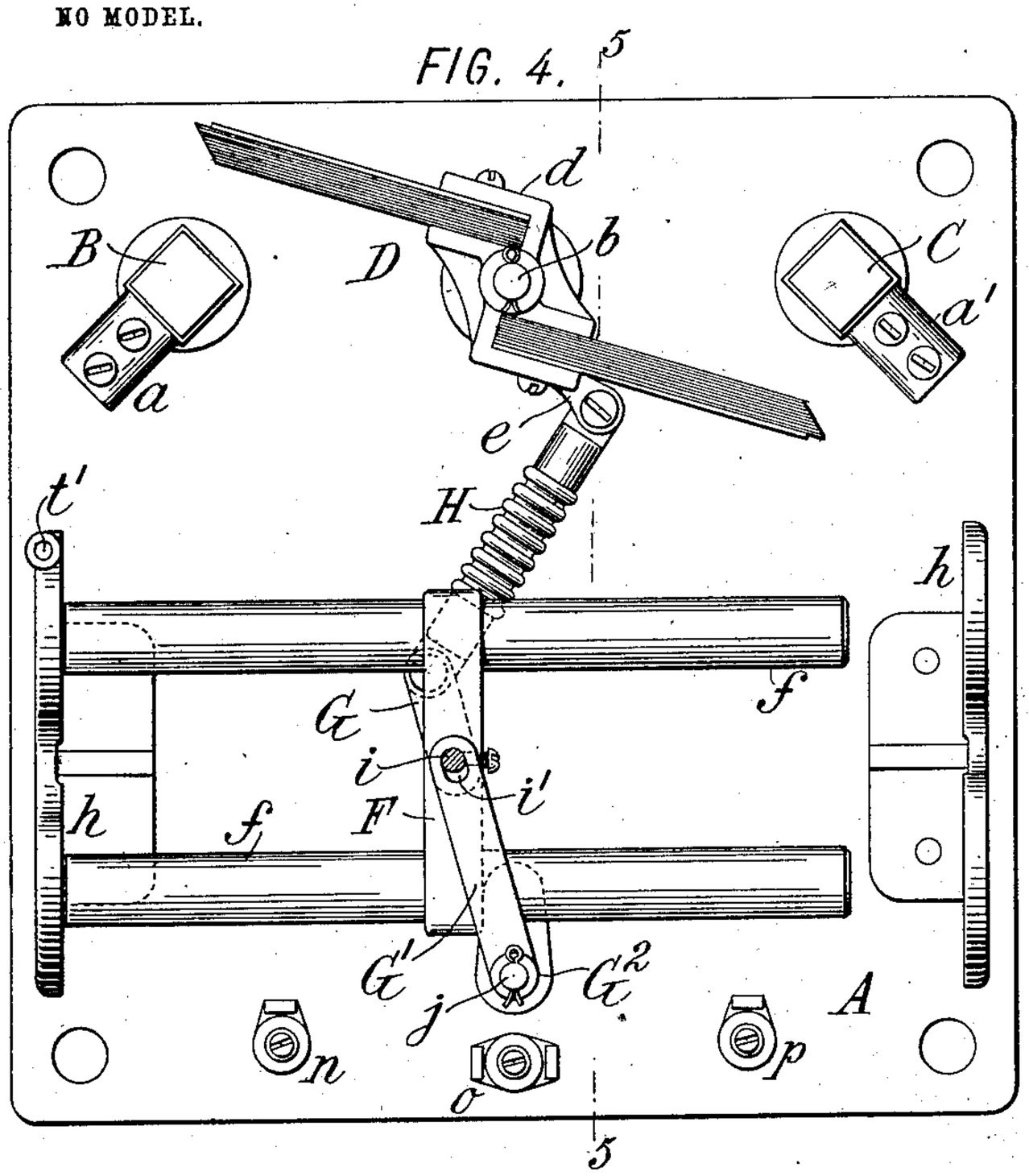


FIG. 5.

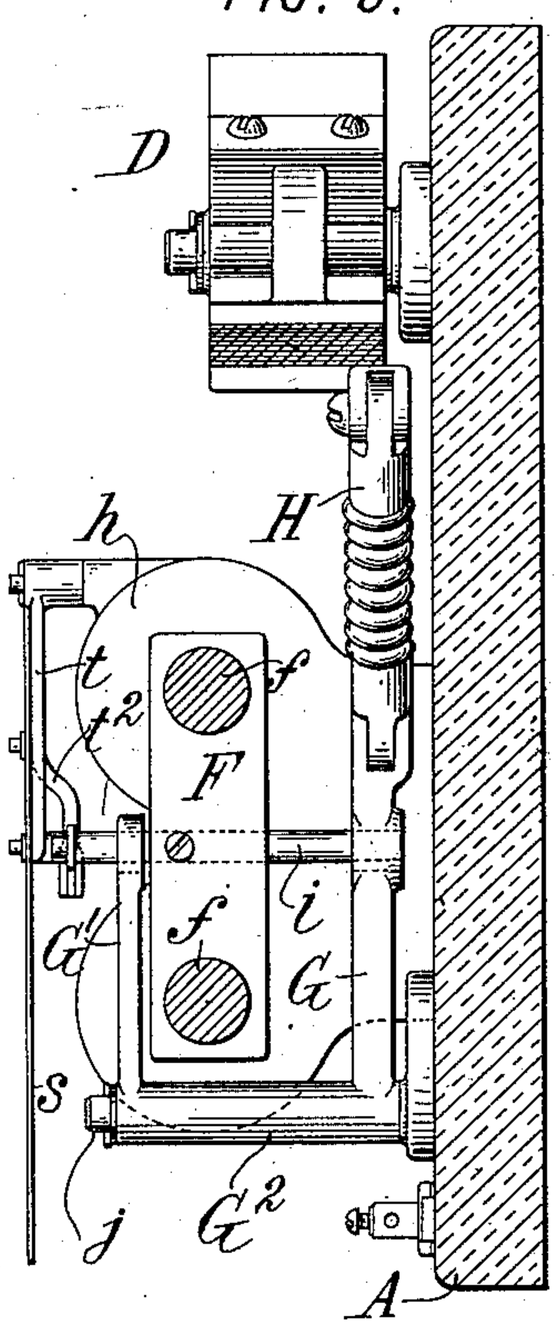


FIG. 6.

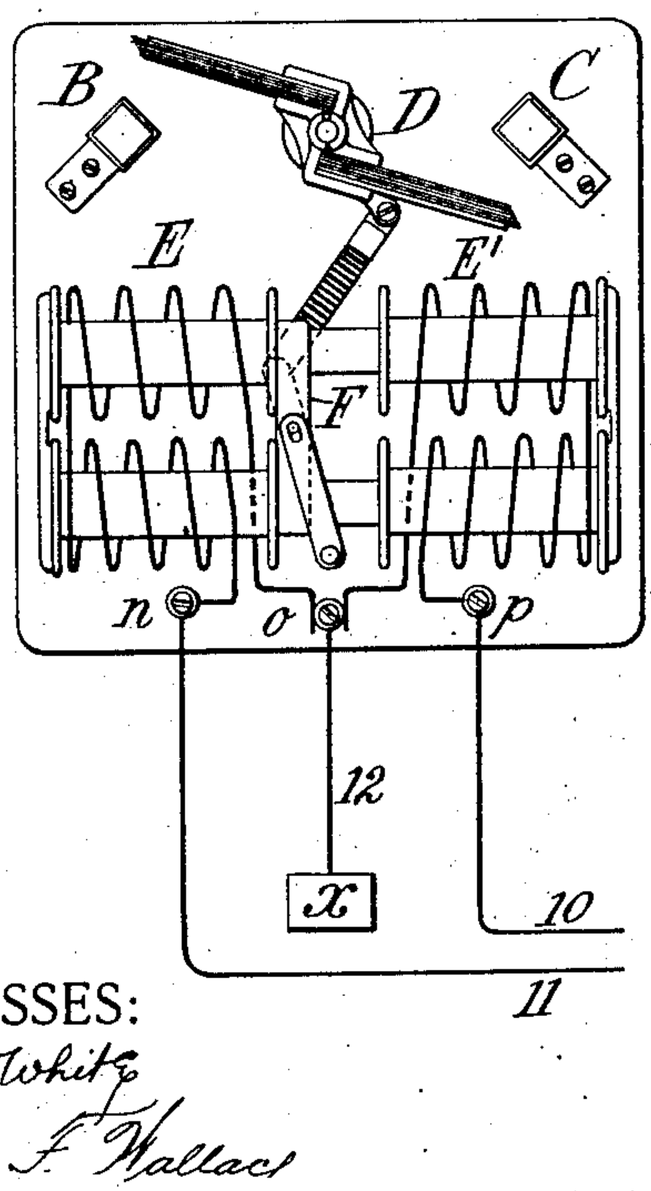
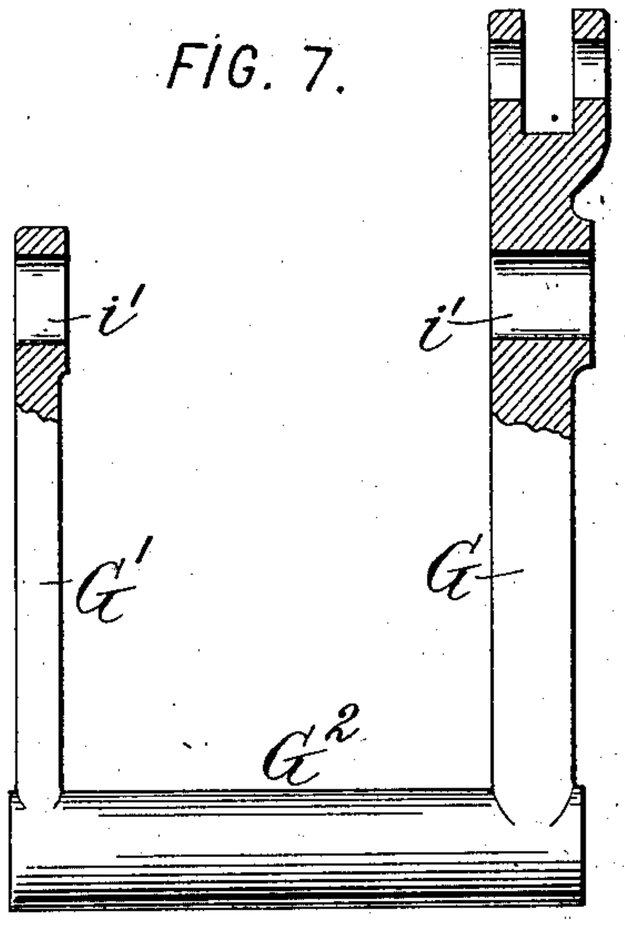


FIG. 7.



WITNESSES:

Fred White

Thomas F. Wallace

INVENTOR:

James J. Wood,

By Attorneys,

Munn & Fraser & Co.

UNITED STATES PATENT OFFICE.

JAMES J. WOOD, OF FORT WAYNE, INDIANA.

SWITCH FOR ELECTRIC CIRCUITS.

SPECIFICATION forming part of Letters Patent No. 721,410, dated February 24, 1903.

Application filed June 28, 1901. Serial No. 66,335. (No model.)

To all whom it may concern:

Be it known that I, JAMES J. WOOD, a citizen of the United States, residing at Fort Wayne, in the county of Allen and State of Indiana, have invented certain new and useful Improvements in Switches for Electric Circuits, of which the following is a specification.

This invention relates to switches or circuit-closers especially adapted and designed for what are known as "power-circuits" or those employed principally in electric-railway service, although applicable also for other uses.

One object of the invention is to enable such switches to be operated from a distance. To this end suitable motive devices are provided operatively connected to the movable switch member and suitably connected to the distant point or transmitting-station for operation thereof. The motive devices may be any means adapted under control from a distance to exert force sufficient to operate the switch. Thus pneumatic or hydraulic motors may be employed connected by suitable tubes to the transmitting-point and there provided with suitable means for generating sufficient pressure; but preferably I employ electromagnetic means as the motor devices and connect them by conducting-wires with the transmitting-point, where I provide a suitable circuit-closer for directing the current from a dynamo, battery, or other generator into one or the other wire in order to energize one or the other of two oppositely-acting magnets, the movements of the armature or movable member of which are communicated through suitable mechanical intermediaries to the movable switch member. I provide as such intermediaries means whereby in closing the circuit the switch member is pressed firmly to the closed position, and upon completing the movement by which the switch is closed the stress or back pressure exerted by the switch member is resisted in a practically unyielding manner, so that the switch is held closed by positive means and beyond peradventure of being thrown to the open position by its own stress or by external vibrations or by any causes other than the normal operation of the motive device or electromagnet by which it is thrown to the open position.

In the accompanying drawings I have shown my invention constructed according to its preferred form, the motor devices for actuating the switch being electromagnets.

Figure 1 of the accompanying drawings is a front elevation of my improved switch with the front plate or cover of its inclosing case removed, the switch being shown in the "on" or closed position. Fig. 2 is a side elevation of the internal parts of the switch, the inclosing case being in vertical mid-section. Fig. 3 is a front elevation of the switch, the case being omitted and the right-hand electromagnet being shown in vertical mid-section and the switch being shown in the closed position. Fig. 4 is a similar front elevation to Fig. 3, except that the spools and windings of the electromagnets are wholly omitted and the switch is shown in the open or "off" position. Fig. 5 is a vertical section of Fig. 4 on the line 5 5 therein. Fig. 6 is a skeleton front view of the switch, showing the electric connections in diagram. Fig. 7 is a detached view of one of the details of the indicating mechanism; and Figs. 8 and 9 are views of another detail, showing the insulating of the connecting-link, of which Fig. 8 is a side elevation, and Fig. 9 a transverse section.

Referring to the drawings, let A designate any suitable support, which may be a plate of insulating material on which are mounted opposite terminal contacts B and C, which are shown as constructed as posts fastened to the base-plate and having projecting sockets *a a'*, respectively, in which are fastened by set-screws the ends of the conducting wires or cables B' C' of the circuit to be controlled by the switch. The circuit is completed between the terminals B C by a movable switch member or bridge D, which may be variously constructed, but which is shown as pivoted centrally on a stud *b*, so that by a rotary movement its two ends can be pressed against the terminals, as shown in Figs. 1 and 3, or drawn away therefrom, as shown in Figs. 4 and 6. To afford the requisite conductivity for carrying heavy currents and to insure the making of a good contact between the ends of the

switch member and the switch-terminals, I construct the switch member of metal laminæ, preferably copper, which are stiffened by leaf-springs *c c* on their outer sides. The laminated portions of the switch member are shown as carried in a socket-piece *d*, having suitable means for clamping the bundles of laminæ or copper brushes. Where the switch member or bridge is designed to oscillate around a pivot, as is shown, the socket-piece *d* is formed with a hub turning on the stud *b*, and is also provided with an arm *e*, projecting from it in a suitable direction and by which to engage the bridge-piece for communicating to it the requisite movements.

The bridge-piece or movable member of the switch is operated through the medium of two oppositely-acting motive devices, which as a whole are lettered E and E′ and which act upon a movable part F to move it in contrary directions. The movable part F is connected mechanically in some suitable way to the bridge-piece D, such that when moved by the motive device E it shall open the switch, while when moved by the device E′ it shall close the switch. Each motive device E and E′ is connected to a distant point or transmitting-station through any suitable intermediation, whereby impulses may be transmitted from such distant point to actuate the motive devices E or E′, according as it is desired to close or open the switch, and whereby the desired operation of the switch is accomplished.

Preferably the motive devices E and E′ are electromagnetic devices and are connected with the distant transmitting-point by means of circuit-wires. I have shown the devices E E′ as electromagnets and the movable part F as an armature responding to the excitation of either electromagnet. The preferable form of electromagnet is the solenoid form, wherein a stationary coil is provided into which is attracted a movable core. As shown, the solenoids are preferably double, the coils of the two magnets being arranged opposite and in line, so as to be entered by the same cores *f f*, and these two cores are connected through the armature F, so as to form an H-shaped iron, which can move toward or from either magnet and is guided in its rectilinear movement by the cores *f*, sliding in the supporting-spools *g* of the coils. Thus the excitation of either solenoid draws the cores away from the opposite pair of coils and into the coils of the excited solenoid, the movement being limited by the cross-bar or armature F, which plays between the spools of the respective solenoids. The solenoid-spools are fixed firmly in position by being mounted on projecting brackets *h h*, which have feet or flanges resting against the face of the base-plate A and fastened securely to such plate. The specific solenoid and solenoid-core construction thus described is simple, cheap, and substantial and is deemed the preferable form of electromagnetic actuating device, but may readily be substituted by other forms of electromagnetic devices, as will be understood by any electrical engineer.

For communicating movement from the armature or movable member of the electromagnetic device to the switch member D, it is essential that intervening mechanism be provided which shall not only transmit the reciprocating (or other) movement of the armature into the requisite opening and closing movements of the switch member, but which shall also force the switch member on its closing movement beyond a single contact, and so as to press it forcibly into intimate contact with the fixed terminals, and having done so shall effectively resist the back thrust exerted by the movable member without communicating this back thrust to the electromagnet or requiring a continuation of the excitation of the magnet in order to hold the switch closed. Various mechanical movements are known which will attain these results; but a toggle device best fulfils the requirements imposed by my invention. Accordingly I prefer to employ a toggle arranged to buckle when the switch is opened and to straighten in the act of closing the switch and to move slightly beyond the straightened position in order that the back thrust imparted from the switch member shall be resisted by the nearly straight toggle-arms and shall tend to thrust them and through them the armature beyond its extreme position, so that there shall be no tendency to thrust the armature in the contrary direction, such as would open the switch. I will proceed to describe this toggle construction in detail. The armature F has a transverse hole through its middle in which is fixed a rod *i*, which projects beyond the armature and enters slots *i′* in arms G and G′, which arms are connected together through a hub G^2, which turns freely on a fixed stud *j*. The connected parts G G′ G^2, which are shown separately in Fig. 7, thus constitute a rocker, of which the arm G constitutes one of the toggle-arms, being jointed at its upper end to the other arm H, which consists of a link the upper end of which is jointed to the arm *e* on the switch member D. The pivotal stud *j* is so placed and the toggle-arms G H are of such length that the toggle is straightened during the closing movement of the switch at approximately the point at which the switch member D first makes contact with the fixed terminals, the parts, however, being movable beyond this position to press the switch member into the flexed position indicated in Figs. 1 and 3 and to carry the toggle-arms slightly out of alinement to preferably the extent there indicated. When the switch is open, the weight and friction of the parts are sufficient to retain it in the open position, although, if desired, a spring may be added, tending to press the parts toward this position. It is desirable to insulate the electromagnetic mechanism from the switch member D, and to this end the toggle-link H may be constructed in whole or in part of insulating material. I

have shown this link as having its middle portion of insulating material, its construction being shown in detail in Figs. 8 and 9, where *k* is the middle or insulating section, and *lm* are the opposite end sections, which are formed with the joint-ears and which are shown as screwing upon the ends of the insulating-section, which latter may be made of insulating fiber or any suitable material.

For making connection with the solenoid-windings I have shown binding-posts *n o p*, one terminal of the coil of the magnet E being connected to *n* and the other to *o* and one terminal of E′ being connected to *p* and the other to *o*. In Fig. 6 the circuit-wires are shown, wires 10 and 11 being extended to the transmitting-station, wire 10 connecting to binding-post *p* and wire 11 to binding-post *n*, while a return or ground wire 12 leads from post *o* to earth *x* or otherwise back to the transmitting-station. At the transmitting-station I have shown a dynamo or other generator 13, connected at one side to earth at *x′* and on the other side to some suitable circuit-closer and which as a simple example I have shown as a switch-arm 14, movable to make contact with the terminal of either the wire 10 or wire 11, according as the current is to be passed through one of the electromagnets or the other.

The entire switch mechanism is preferably inclosed in a suitable weatherproof casing J, having a removable front plate K. The casing J has suitable ears *q* for attaching it to any desired support and has inclined orifices for admitting the passage of the main-circuit conductors or feeder-cables B′ C′. It also has bottom openings for the passage of the wires 10, 11, and 12. In order that the condition of the switch thus inclosed may be observed from the exterior, the front plate K is formed with a window *r*, behind which is a movable indicator-plate *s*, bearing the words "On" and "Off" or other characters adapted to indicate the condition of the switch. This plate is shown as carried on an arm *t*, pivoted at *t′* on one of the spool-supporting brackets *h* and deriving motion from some suitable part of the mechanism, preferably by being formed as an elbow-lever with an arm t^2, connected by a link *u* with the pin *i*.

It is to be understood that my invention is not necessarily limited to the specific details of construction herein shown and described, but that these details may be greatly varied without departing from the essential features of my invention.

What I claim is—

1. In an electric switch, the combination with fixed terminals, of a bridge-piece pivoted between them and movable around its pivot to bring its end portions into or out of contact with said terminals, oppositely-acting motor devices having means for actuating them from a distant point, and a movable connection between said motor devices and bridge-piece adapted upon the actuating of one of said devices to move said bridge-piece to open the circuit, and upon the actuating of the other device to move it in the opposite direction to close the circuit, said connection comprising an arm on said bridge-piece, a link connected to said arm, and a second arm operated directly by said devices and forming with said link a toggle for moving said bridge-piece.

2. In an electric switch, the combination with fixed terminals, of a bridge-piece pivoted between them and movable around its pivot to bring its end portions into or out of contact with said terminals, and having its contact portions formed of yielding laminæ, oppositely-acting motor devices having means for actuating them from a distant point, and a movable connection between said motor devices and bridge-piece adapted upon the actuating of one of said devices to move said bridge-piece to open the circuit, and upon the actuating of the other device to move it in the opposite direction to close the circuit, the proportions of said parts being such that in the closed position said connection holds the bridge-piece pressed against the terminals to flex said laminæ and receive a back thrust therefrom, said connection including a swinging arm adapted to swing past its dead-center in said closed position and to be held there by the back thrust from said flexed bridge-piece.

3. In an electric switch, the combination with fixed terminals, of a bridge-piece pivoted between them and movable around its pivot to bring its end portions into or out of contact with said terminals, oppositely-acting motor devices having means for actuating them from a distant point, and a mechanical connection between said motor devices and bridge-piece comprising a pair of toggle-arms arranged to straighten in moving the bridge-piece toward the closed circuit position, and to move slightly beyond alinement, the proportions of said parts being such as to hold the laminæ flexed against the terminals and to induce a back thrust therefrom, and said toggle-arms being arranged to swing past the dead-center in the closed circuit position and to be held there by the back thrust from said flexed bridge-piece.

4. A bridge-piece for an electric switch comprising in combination two bundles of straight laminæ and a pivoted holder having a pair of sockets in which said laminæ are carried.

5. The combination with a movable switch member and motor devices for actuating it, of intermediate toggle-arms G and H, the latter formed as an insulating-link having metallic joint-ears *l* and *m* at its ends and an intervening insulating portion K screwing into each of said ears.

6. In an electric switch, the combination with a movable switch member and electromagnetic means for operating it comprising oppositely-acting magnets and a movable

member actuated thereby and connected to said switch member, of a casing inclosing the switch mechanism having an opening, and an indicator-plate moving behind said opening, a lever carrying said plate, and a link connecting said lever with the movable member of said magnets.

7. In an electric switch, the combination with a movable switch member and electromagnetic means for operating it comprising oppositely-acting magnets and a movable member actuated thereby and connected to said switch member, of a casing inclosing the switch mechanism having an opening, and an indicator-plate moving behind said opening, a lever t carrying said plate and having an arm t^2, and a link u connecting said arm with the movable member of said magnets.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

JAMES J. WOOD.

Witnesses:
ARTHUR L. HADLEY,
FRED S. HUNTING.