H. PIERSON.

ELECTROMAGNETIC MECHANISM.

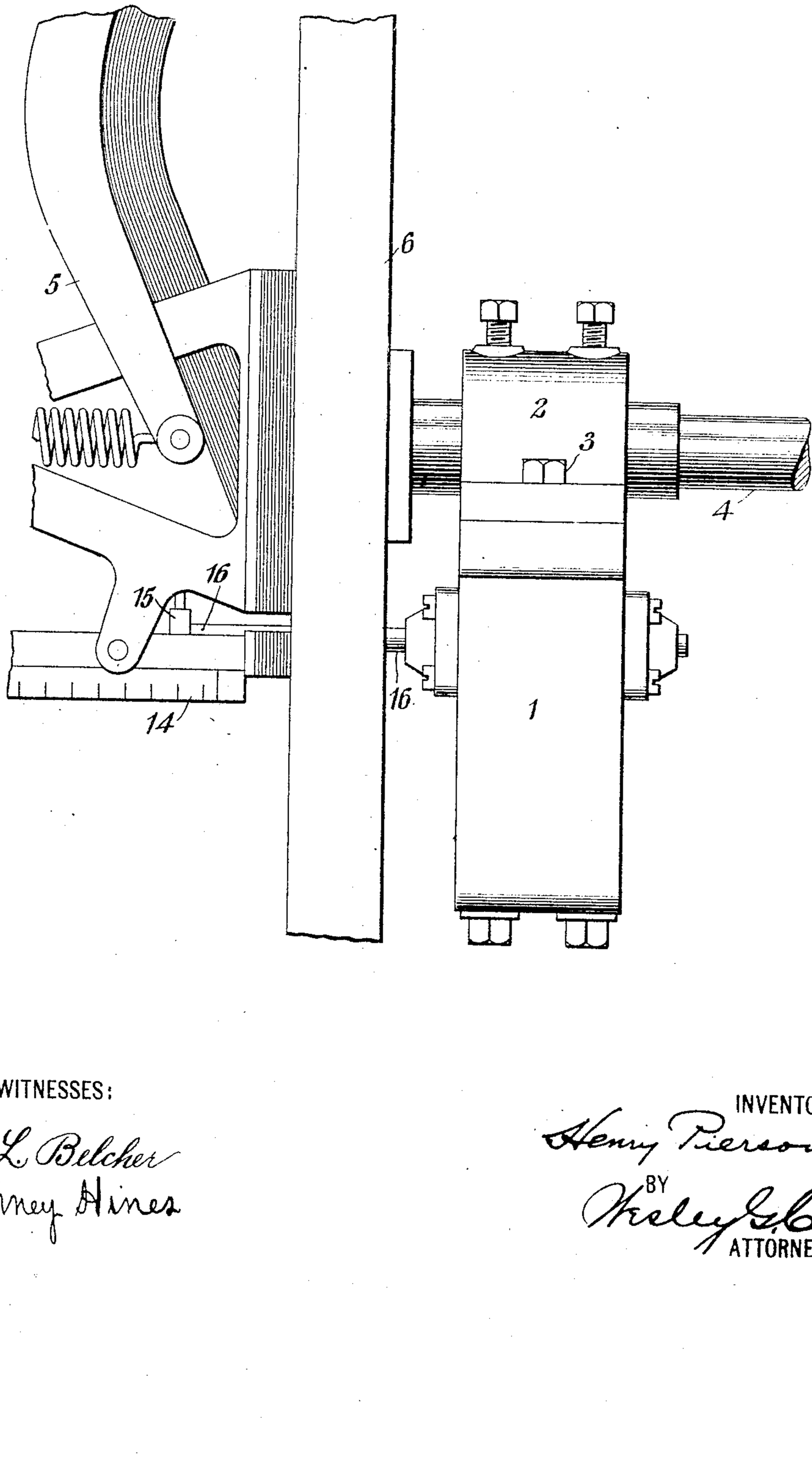
APPLICATION FILED OCT. 3, 1906.

969,493.

Patented Sept. 6, 1910.

2 SHEETS—SHEET 1.

Fig. 1.



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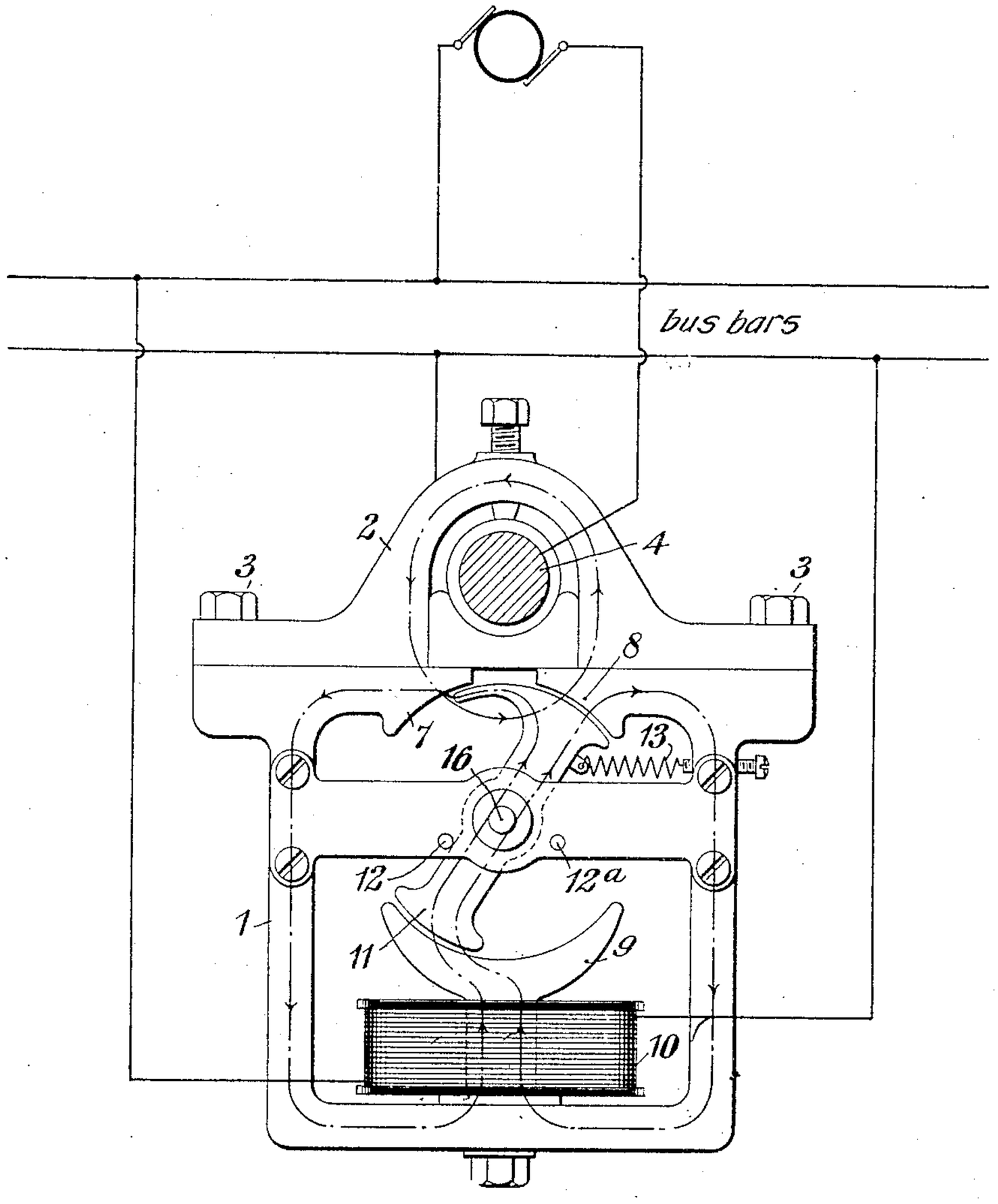
2 SHEETS—SHEET 2.

Fig. 2.



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HENRY PIERSON, OF MANCHESTER, ENGLAND, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

ELECTROMAGNETIC MECHANISM.

969,493. Specification of Letters Patent. Patented Sept. 6, 1910.

Application filed October 3, 1906. Serial No. 337,328.

To all whom it may concern:

Be it known that I, HENRY PIERSON, a subject of the King of Great Britain, and a resident of Manchester, in the county of Lancaster, England, have invented a new and useful Improvement in Electromagnetic Mechanism, of which the following is a specification.

This invention relates to an improved form of electro-magnetic mechanism and has for its object to provide a device of this character which shall be responsive to certain predetermined conditions of current flow in an electric circuit or circuits.

The device comprises stationary and movable members, and the movement of the latter member due to a change in the flow of current in the circuit or circuits is utilized to give a visible or audible signal or to actuate a circuit-breaker or perform a like function either directly by mechanical means or indirectly by closing or opening a relay circuit.

According to this invention, an iron yoke is employed having three inwardly projecting pole pieces in two of which a magnetic flux is induced by a coil or conductor carrying either the whole or a shunted portion of the current in the main circuit while the remaining pole piece has a flux induced therein by a coil connected in shunt across the main circuit or across the terminals of an auxiliary source of current, such as a battery. A movable armature is located in the fields produced by these fluxes and is mechanically or electrically restrained in one direction against a stop but is free to move in the opposite direction.

One form of the invention is illustrated in the accompanying drawings in which—

Figure 1 is a side elevation of the mechanism applied to a circuit-breaker of a well-known type, a part of which, with a switch board panel, is also shown. Fig. 2 is a rear elevation of the electro-magnetic mechanism shown in Fig. 1.

Referring to the said figures of the drawing, the device comprises a magnetizable yoke or frame constructed in two parts 1, 2, secured together by bolts 3 so that the same can be mounted upon or suspended from one of the leading-in studs 4 of a circuit-breaker 5, preferably at the rear of the switch board 6. The portion 1 of the yoke or frame has three inwardly projecting pole pieces 7, 8, 9 having curved polar faces, the pole pieces 7 and 8 being located near together with the leading-in stud 4 between them and opposite to the third pole piece 9, which latter is furnished with a shunt winding 10. Within the fields produced by said pole pieces is pivoted a magnetizable armature 11 that is held normally in a predetermined position against a stop 12 by a spring 13, a weighted lever or other mechanical restraining means, a stop 12^a being provided to limit the movement of the armature in the other direction. The force exerted by the restraining means may be adjusted to limit the movement of the armature and to vary the conditions under which the mechanism is to operate, a screw being shown applied to the spring 13 for this purpose.

Normally, the direction of the flux induced in the poles 7 and 8 by the main current flowing through the stud 4 is such that, if combined with the flux produced in the pole piece 9 by the shunt winding 10, it tends to maintain the armature 11 in the position in which it is mechanically held, the armature being so shaped that the reluctance of the magnetic circuit is a minimum. This condition of the flux is indicated in the several parts by the arrows. On the other hand, when the direction of the flux produced by the main current is reversed by a reversal of said current, said main current flux will combine with the shunt flux at the pole piece 7, where previously they were opposed, and will oppose at the pole piece 8, where previously they were combined, with the result that the armature 11 turns upon its pivot and mechanically operates the trip gear of the circuit-breaker; in this instance, through the medium of what may be either an underload or an overload attachment 14 of the circuit-breaker, an arm or cam 15 being secured to an extension 16 of the armature pivot for coöperation with the attachment 14.

The foregoing action will result when only a very small current flows in reverse direction, the shunt coil being normally energized. In the case of a heavy reversal of current and non-excitation or slight excitation of the shunt coil, owing to drop of bus-bar pressure, the flux produced by the current in the main circuit is sufficient to cause

the armature 11 to turn against its restraining means, viz. the spring 13, until the reluctance at both of the pole pieces 7 and 8 becomes equalized, the angular movement depending upon the relative values of the air-gaps between the armature and the pole pieces and also upon the shape of the armature. With a reasonable overload current in the normal direction and excitation of the shunt coil, the device will not operate, but with an abnormal overload of dangerous proportions accompanied by a fall of bus-bar pressure and consequent weakening of the current flowing in the shunt coil 10 (such as may be caused by a dead short-circuit in the system) the device will operate in exactly the same manner as in the case of heavy reversal accompanied by a fall of bus-bar pressure, the field produced by the main current simply being changed in direction.

It will be understood that the operation hereinbefore described obtains when a plurality of dynamo-electric machines are operated in parallel. Under such conditions, a reversal of current in the main circuit of the breaker, with which any one of the machines is equipped, will not be attended by a reversal of current in the shunt circuit which includes the coil 10 because the bus-bar pressure will be maintained by the other generators of the set.

Obviously, the details of construction may be variously modified. For instance, the main current pole pieces 7 and 8 may be excited by independent windings carrying either the whole or a shunted portion of the current in the main circuit. The device is furthermore capable of general application and its use is not restricted to operating a switch or for breaking circuits as shown, this being merely one use to which the device may be put.

I claim as my invention:

1. In an electro-magnetic apparatus, the combination with a stationary magnetizable member having two side-by-side pole pieces, an opposite pole piece, means for producing a magnetic flux through said side-by-side pole pieces and a separate means for producing a flux through said opposite pole piece, of a movable, magnetizable member that is subjected to said magnetic fluxes and is movable thereby when that through the side-by-side pole pieces is reversed or greatly exceeds that through the opposite pole piece.

2. The combination with a magnetizable frame having two side-by-side pole pieces and one opposite pole piece, a series-connected conductor for magnetizing the side-by-side pole pieces and a shunt-connected conductor for magnetizing the opposite pole piece, of a pivoted armature having its ends adjacent to the respective pole pieces, and yielding means for normally holding said armature in a position corresponding to normal currents in the magnetizing conductors.

3. The combination with a frame or yoke different parts of which are provided with magnetizing conductors that are independently energized and have different magnetic circuits, of a movable armature having an unsymmetrical relation to said magnetic circuits, and a yielding restraining means that holds the armature in a given position when the magnetizing currents are normal in amount and direction and is overcome when one of the currents becomes abnormal in direction or excessively abnormal in amount.

4. The combination with a magnetizable member having two magnetizing conductors the magnetic circuits of which intersect at two points, of a movable armature that projects into the points of intersection of the magnetic fluxes and is held in one position when the magnetizing currents are normal in direction and amount but is moved to another position when one of the currents is reversed in direction or becomes excessive in amount.

5. The combination with a stationary magnetizable member having two separately energized magnetizing conductors the magnetic circuits of which intersect at two points, of a movable armature that is traversed by the flux produced by one of said conductors and one end of which projects into the said intersection points, whereby the said armature is moved from one position to another when the current in one of the conductors is reversed in direction or is greatly increased in amount as compared with that in the other.

6. The combination with a magnetizable yoke or frame having a pair of inwardly-projecting pole pieces at one side and a single inwardly-projecting pole piece at the opposite side, a conductor for oppositely magnetizing the pair of pole pieces and a separately excited conductor for magnetizing the single pole piece, of an armature pivotally mounted to bridge the space between the pair of pole pieces and the single pole piece, and restraining means for the armature that is overcome when the normal direction of one of the magnetizing currents is reversed or when said current greatly exceeds its normal amount.

7. The combination with a stationary magnetizable member having a pair of pole pieces at one side and a single pole piece at the opposite side the face of which spans an arc of approximately the same length as that spanned by the pair of pole pieces, a series conductor for oppositely magnetizing the pair of pole pieces and a shunt conductor for magnetizing the single pole piece, of an armature pivotally mounted between

said pole pieces, limiting stops for said armature, and a yielding means for normally holding the armature in one of its extreme positions.

8. The combination with a stationary magnetizable member having two arc-shaped adjacent polar faces and a single arc-shaped polar face opposite thereto, a single conductor for producing a magnetic flux between said adjacent polar faces and a separately excited conductor for producing a magnetic flux between said opposite polar face and each of said adjacent faces, of an armature that is pivotally mounted and restrained to conduct the flux produced by the separately excited conductor and the position of which depends upon the direction of the flux between the adjacent polar faces or the relative amounts of the two fluxes.

9. The combination with a stationary magnetizable member having a pair of adjacent polar faces separated by a gap and oppositely polarized by a single circuit, and a single polar face opposite said adjacent faces and a separately excited conductor for producing a flux between said single polar face and each of said pair of polar faces, of a pivoted armature having a limited range of movement and yielding means that tends to hold said armature in one of its extreme positions.

In testimony whereof, I have hereunto subscribed my name this 17th day of September, 1906.

HENRY PIERSON.

Witnesses:
W. J. P. ORTON,
WALTER F. JONES.