No. 780,024. PATENTED JAN. 17, 1905.

F. CONRAD.

CIRCUIT MAKING AND BREAKING RELAY.

APPLICATION FILED DEC. 29, 1902.

*Fig. 1.*

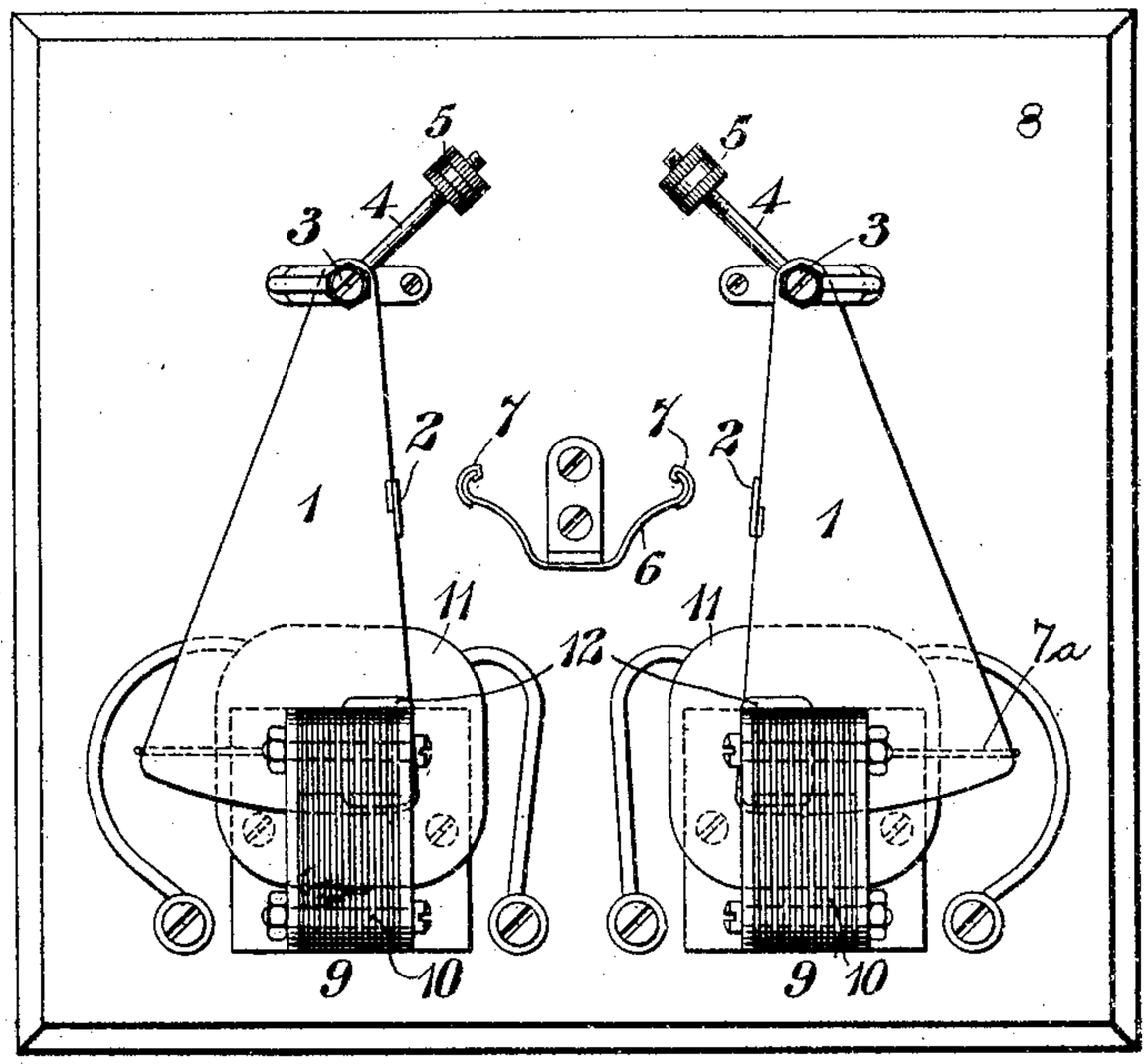


*Fig. 2.*

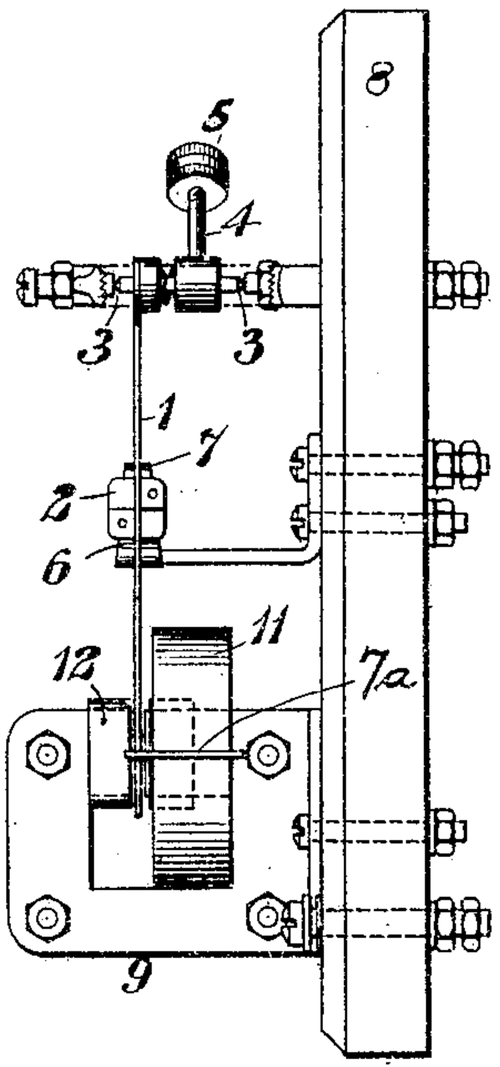


*Fig. 4.*

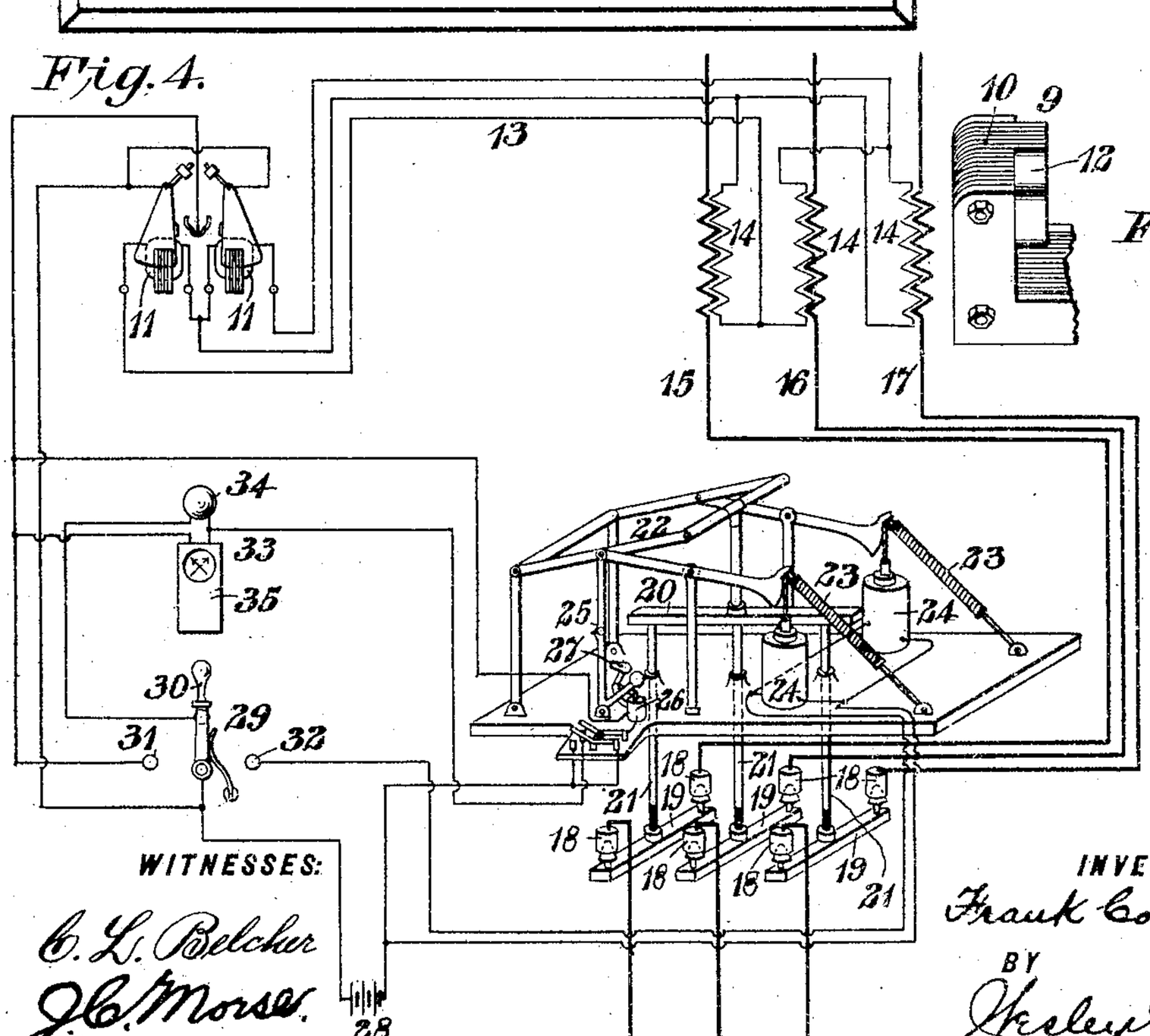


*Fig. 3.*




WITNESSES:

C. L. Belcher

J. B. Morse.

INVENTOR

Frank Conrad

BY

Stanley & Clarke

ATTORNEY.

No. 780,024. Patented January 17, 1905.

# UNITED STATES PATENT OFFICE.

FRANK CONRAD, OF EDGEWOOD PARK, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

## CIRCUIT MAKING AND BREAKING RELAY.

SPECIFICATION forming part of Letters Patent No. 780,024, dated January 17, 1905.

Application filed December 29, 1902. Serial No. 137,073.

*To all whom it may concern:*

Be it known that I, FRANK CONRAD, a citizen of the United States, residing at Edgewood Park, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Circuit Making and Breaking Relays, of which the following is a specification.

My invention relates to relays for making and breaking electric circuits; and it has for its object to provide a simple and effective device of this character which shall be suitable for operation by either single or polyphase alternating currents in order to make and break either direct or alternating current circuits.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a front elevation of a relay adapted for either two or three phase alternating-current circuits. Fig. 2 is a side elevation of the apparatus shown in Fig. 1. Fig. 3 is a detail perspective view of a portion of one of the electromagnets embodied in the relay; and Fig. 4 is a diagram of a three-phase circuit, a circuit-breaker therefor operated by current from a separate source, and a relay actuated from the three-phase circuit to make and break the circuit which effects the opening and closing of the circuit-breaker.

The relay here shown comprises several parts which are duplicates of each other and only one set of which need be used in connection with a single-phase circuit. It will therefore be understood that the illustration and description of the device are not intended to limit its use to circuits of any specific number of phases.

The movable members of the relay severally comprise a disk segment 1, which is made of some light metal—such, for example, as aluminium—and is provided on one edge with a contact-piece 2 and is pivotally supported at its upper end, as indicated at 3. It is also provided with a counterweight which tends to move it in one direction, the counterweight in the present instance being shown as comprising an inclined rod 4, which is provided with a screw-thread for at least a portion of its length, and one or more nuts 5, which constitute the main portion of the weight and may be adjustable on the rod to vary their action upon the segment. Between the two segments is mounted a curved spring 6, forming or being provided with contact-terminals 7 at its ends in position to be engaged, respectively, by the contact-pieces 2 as the segments are swung inward. The degree of movement of each of the sectors away from the corresponding terminal 7 is limited by a stop-piece $7^a$, against which the sector is normally held by the action of the weight 5.

The parts thus far described are mounted upon a suitable base 8, which may be a marble or slate switchboard-panel, or it may be made of other suitable non-conducting material, whether constituting a part of the switchboard or not. Mounted upon this base 8 are the electromagnets 9, which act upon the segments 1, each of these consisting of a laminated core 10, between the poles of which project the segments. Mounted upon one of the polar projections is the main actuating-coil 11, which is connected to a source of current in a manner to be hereinafter described, and the other polar projection is provided with an unsymmetrically-located closed coil 12, this location at one side and around only a portion of the pole-piece being such as to distort a portion of the magnetic field, and thus produce a shifting field which acts upon the segment so as to move it toward the corresponding stationary contact-terminal 7 when the strength of the field is sufficient to overcome the force of the counterweight.

The coils 11 are connected together in series and are also connected, by means of three conductors 13, to the secondary windings of three transformers 14, the primaries of which are connected in series in a three-wire, three-phase circuit 15, 16, and 17.

It will be understood from the description already given that in case of an overload or short circuit in the three-phase circuit 15, 16, and 17 the currents flowing through one or both of the coils 11 of the relay will be sufficient to overcome the pull of the correspond-

ing weight or weights 5 and move the segment or segments inward, so as to bring the contact piece or pieces 2 into engagement with the stationary contact terminal or terminals 7. This action serves to close a circuit which may control or actuate the movement of any suitable breaker for opening the main circuit 15, 16, and 17. As one example of a suitable circuit-breaker I have here shown a device for effecting a double break of each conductor of the circuit, each pair of stationary contact-terminals 18 being engaged by corresponding movable terminals which are supported upon and electrically connected by a bar 19. The bars 19 are suspended from a beam 20 by means of rods 21, the said beam being connected to a system of levers 22, which are actuated by the joint pull of gravity and springs 23 to separate the movable from the stationary contact-terminals and by electromagnets 24 to move said terminals into engagement.

When the circuit-breaker is closed, the operating parts are locked in position by means of a toggle-lever 25, the tripping of which to permit gravity and the springs 23 to act is effected by means of an electromagnet 26 and a tripping-hammer 27, actuated thereby.

The magnets 24 and 26 are energized by means of direct current from a suitable source 28, the closing of the circuit through the magnet 26 being effected by one or both of the relays above described when an excessive current flows in the three-phase circuit, provided the manually-operated switch 29 is in the position indicated.

In case it is desired to trip the circuit-breaker irrespective of the condition of the main alternating-current circuit the switch-arm 30 of the switch 29 may be moved into engagement with the stationary contact 31, and thus close the circuit of the source 28 through the electromagnet 26.

When it is desired to close the circuit-breaker, the switch-arm 30 is moved into engagement with the contact-terminal 32, thus closing the circuit of the source 28 through the closing-magnets 24.

I have also shown a double indicating device 33, the lamp 34 of which serves to indicate the automatic opening of the circuit-breaker and the electromagnetic member 35 serving by its indicating-pointer to show under all circumstances whether the circuit-breaker is open or closed.

The details of the circuit-breaker and indicating mechanism above described are unessential, so far as my present invention is concerned, and may be replaced by any circuit-breaker having a tripping-coil designed and connected so as to be energized from an auxiliary circuit.

I claim as my invention—

1. An alternating-current circuit making and breaking relay comprising an electromagnet having an unsymmetrically-located closed coil, a metal plate the upper end of which is pivotally supported and the lower end of which projects into the field of said magnet and one edge of which is provided with a contact-piece, a stationary contact-terminal located in the path of movement of said contact-piece and an adjustable counterweight that serves to normally hold said plate and its contact-piece in open-circuit position.

2. A polyphase, alternating-current circuit making and breaking relay comprising two electromagnets each provided with an unsymmetrically-located closed coil, two metallic sectors the upper ends of which are pivotally supported and the lower ends of which project respectively into the fields of the magnets and the edges of which are provided with contact-pieces, a stationary contact-terminal located in the paths of movement of said sectors and their contact-pieces and adjustable counterweights serving respectively to normally hold the sectors and their contact-pieces in open-circuit positions.

3. A polyphase, alternating-current overload-relay comprising two electromagnets provided with energizing-windings and with unsymmetrically-located, closed coils, metallic sectors the upper ends of which are pivotally supported and the lower ends of which project into the fields of said magnets, stationary contact-terminals in position to be engaged by terminal pieces with which the sectors are provided and adjustable counterweights for normally holding the sectors in open-circuit positions.

4. A polyphase, alternating-current overload-relay comprising two electromagnets having energizing-windings and provided with unsymmetrically-located closed coils, metallic sectors the upper ends of which are pivotally supported and the lower ends of which project between the poles of said magnets, limiting-stops for the sectors, a stationary contact-terminal located in the paths of movement of said sectors and adjustable counterweights for normally holding the sectors in open-circuit positions.

In testimony whereof I have hereunto subscribed my name this 10th day of December, 1902.

FRANK CONRAD.

Witnesses:
JAMES B. YOUNG,
BIRNEY HINES.