

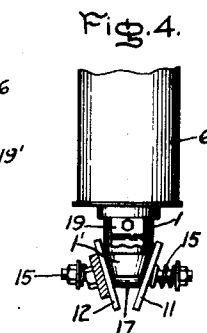
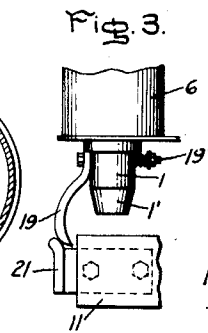
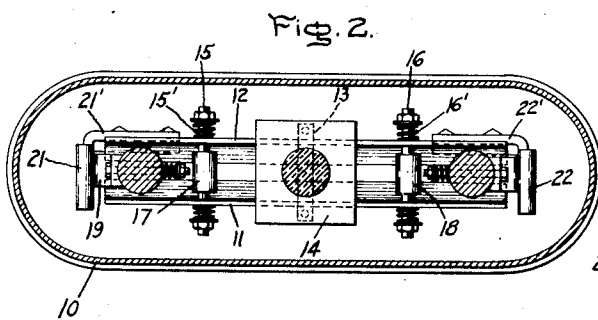
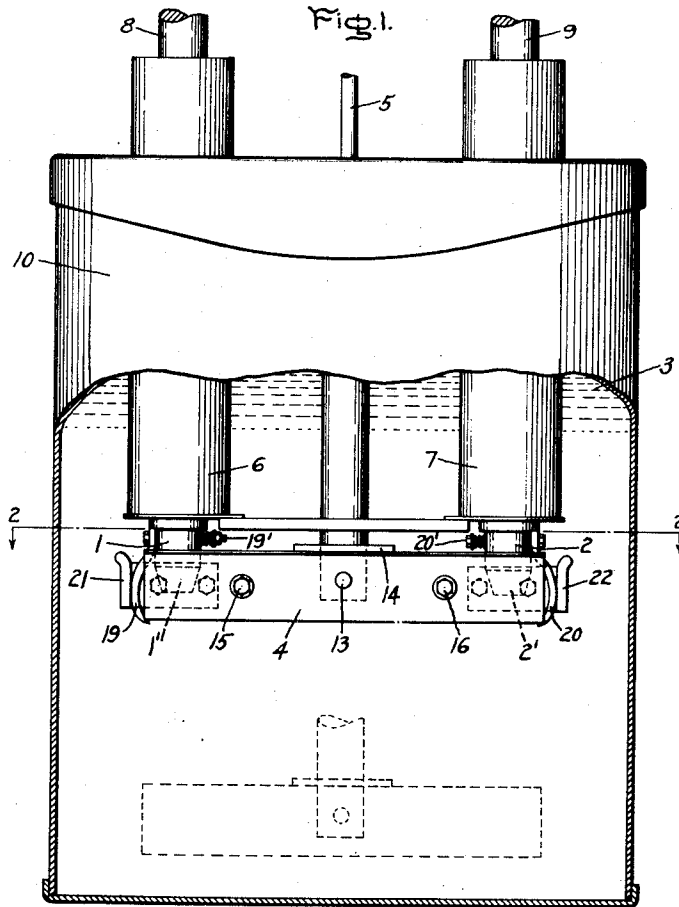
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L. S. WALLE

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ELECTRIC CIRCUIT BREAKER

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## UNITED STATES PATENT OFFICE

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## ELECTRIC CIRCUIT BREAKER

Application filed May 21, 1930. Serial No. 454,442.

My invention relates to electric circuit breakers and more particularly to circuit breakers of the fluid-break type wherein the coacting switch contacts are engaged and disengaged within an insulating fluid such as oil.

It is well known that the rating of a fluid-break switch may be considerably reduced by excessive generation of heat at the switch contacts when the switch is traversed by heavy currents. This heating is caused by too high resistance between the coacting surfaces of the switch contacts when they are in their normally closed circuit positions, and it is therefore desirable that the contact resistance be reduced to a minimum. One factor in determining the resistance between the contacts is the pressure applied to force them together. The contact resistance is reduced when the pressure between the contacts is increased, and vice versa. Excessive contact pressure, however, is undesirable since it may render difficult the opening and closing movement of the switch. There is disclosed in my copending application, Serial No. 285,162, filed June 13, 1928, now Patent No. 1,768,385, issued June 24, 1930, a circuit breaker wherein the switch contact pressure is regulated so that it is increased at a time when most needed, that is, when heavy currents are carried by the switch, and is decreased when comparatively light currents traverse the main switch contacts.

It is a principal object of my invention to provide a circuit breaker which shall have improved means for utilizing the magnetic forces of the currents traversing the switch to regulate the pressure between the switch contacts.

It is a further object of my invention to provide an improved circuit breaker of the fluid-break type which shall be simple and rugged in construction and which shall have high current carrying capacity.

My invention will be more fully set forth in the following description referring to the accompanying drawings, and the features of novelty which characterize my invention will be pointed out with particularity in the claims

annexed to and forming a part of this specification.

Referring to the drawings, Fig. 1 is an elevational view, partly in section, of a fluid-break switch embodying my invention in the closed circuit position thereof; Fig. 2 is a cross-sectional view taken along the line 2—2 of Fig. 1; Fig. 3 is a fragmentary view illustrating the switch contacts in partly open position, and Fig. 4 is a fragmentary end view of the switch contacts illustrating the same in the closed circuit position.

By way of example but without limitation thereto my invention is illustrated as embodied in a fluid-break switch of the type wherein a pair of contacts connected in the circuit to be controlled are suspended within a body of insulating fluid such as oil and are bridged by movable contact structure including main and auxiliary contacts within the insulating fluid in the closed circuit position of the switch. As illustrated in Fig. 1, the stationary contacts 1 and 2 are immersed within an oil body 3 and are adapted to be bridged by the movable contact structure 4 having an operating rod 5 for lowering or raising the same within the oil body to the open or closed circuit positions respectively. The contacts 1 and 2 are mounted upon the insulating bushings 6 and 7 through which the circuit conductors 8 and 9 extend, the bushings extending through and being secured to the cover of the oil tank or casing 10.

The movable contact structure 4 for bridging the stationary contacts 1 and 2 comprises a pair of comparatively rigid parallel blades, or the like, 11 and 12, spaced from each other and adapted to engage opposite sides of the stationary contacts. The contact blades 11 and 12 are suitably connected to the operating rod 5 as by a pin 13 extending through the lower part of the rod and through the blades, and a collar or the like 14 is mounted on the operating rod for preventing tilting of the contact blades.

The stationary contacts 1 and 2 are wedge-shaped at their lower portions as at 1' and 2' these wedge-shaped portions being adapted to extend between and make contact with the blades 11 and 12. To this end, the blades

11 and 12 are guided for lateral movement with respect to each other by the bolts 15 and 16 extending therethrough, on which are mounted spacing members 17 and 18 interposed between the blades. The contact blades are normally resiliently biased toward each other by springs 15' and 16', the blades being maintained apart by the spacing members 17 and 18, and are freely guided on the bolts 15 and 16 so that they are free to align with the wedge-shaped stationary contacts as illustrated in Fig. 4. The spacing members 17 and 18 maintain the contact blades such a distance apart that there is a camming action thereon by the stationary contacts when they are engaged so as to force the contact blades further apart against the tension of the springs 15' and 16'.

In the closed position of the switch illustrated in Figs. 1, 2 and 4 the current traversing the bridging structure between the stationary contacts flows in parallel paths through the blades 11 and 12. As is well known, the magnetic forces of currents flowing in the same direction in parallel conductors tend to attract the conductors toward each other, this attraction increasing as the current increases. It will therefore be observed that the current flowing through the blades 11 and 12 tends to press the blades toward each other and into better contacting engagement with the stationary contacts. Accordingly, when the switch is subjected to heavy rushes of current, the powerful magnetic forces set up tend to increase the contact pressure at the contact surfaces, thereby reducing the contact resistance so that the amount of heat generated will not be excessive.

For the purpose of further increasing the current carrying capacity of the switch, the contacting surfaces of the stationary contacts and the movable contact blades may be faced with silver, since this metal is not only a good conductor but the oxide film formed thereon is little higher in resistance than the silver itself and is much lower than copper oxide, for example.

When the circuit breaker is to be opened to interrupt the circuit, the operating rod 5 is moved by suitable means downwardly to lower the bridging structure to the dotted line position illustrated in Fig. 1. During this operation, particularly when heavy currents are to be interrupted, arcing through the oil generally occurs between the main stationary and movable contacts unless the current is shunted in a well known manner to auxiliary or arcing contacts.

The auxiliary contacts for this purpose in the present instance comprise the stationary auxiliary contacts 19 and 20 mounted upon and electrically connected, as by the resiliently mounted bolts 19' and 20', to the main stationary contacts 1 and 2. The stationary

auxiliary contacts are preferably curved so as to cam against the movable auxiliary contacts 21 and 22 during the circuit opening and closing operations and are of sufficient length to insure contact with the movable contacts subsequent to separation of the main contacts. The movable auxiliary contacts are each transversely mounted, as by the offset portions 21' and 22', to one of the movable contact blades 12, there being no electrical connection in the open circuit position of the switch between the auxiliary contacts 21 and 22 and the other movable contact blade 11. As illustrated in Fig. 1 in the closed circuit position, the stationary contacts 1 and 2 are engaged and bridged by the blades 11 and 12 and the stationary auxiliary contacts 19 and 20 are engaged by the coacting auxiliary contacts 21 and 22 connected only to the blade 12. Upon downward or opening movement of the bridging structure, the blades 11 and 12 move as a unit out of engagement with the stationary main contacts as illustrated in Fig. 3 prior to disengagement of the auxiliary contacts. Accordingly, the entire current through the switch is shunted as is customary from the main to the auxiliary contacts prior to actual interruption of the circuit.

With this arrangement, the current that is shunted to the auxiliary contacts prior to separation thereof and subsequent to separation of the main contacts, flows only through the blade 12 so that large magnetic forces are not being exerted on the blades 11 and 12 tending to force them together and possibly damage the same. In other words, the necessity for forcing the contact blades together to increase the switch contact pressure no longer exists after separation of the main contacts, so that the use of a single contact blade is sufficient for handling the arcing current which is generally of brief duration. Also during the circuit closing operation when the auxiliary contacts engage prior to engagement of the main contacts, the current is carried by a single contact blade so that the closing movement is not rendered more difficult by high contact friction.

The wedge-shaped stationary contacts not only are effective to produce a wiping or cleaning action when the switch is closed thereby decreasing the contact resistance, but also render the opening movement of the switch easier than in the case where the stationary contacts have parallel opposite faces which tend to cause sticking of the contact blades, particularly when they are very tightly pressed against the stationary contacts. This enables the switch to be readily opened by a reasonable opening force notwithstanding the fact that large currents are traversing the switch when it is to be opened.

The arrangement above described is particularly adapted for normal operation of

the switch, that is, when the switch is in its closed circuit current carrying position, and the variation in pressure between the contact blades varies with the variation in the current traversing the switch so that the contact resistance is regulated to a certain extent by the current itself. This feature therefore obviates high contact pressure when it is not needed so that the opening and closing switch movements during light currents are not made more difficult by great contact friction.

It shall be understood that my invention is not limited to oil circuit breakers but is applicable to other types of switches without departing from the spirit of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. A circuit breaker comprising a stationary contact, a pair of movable contact blades adapted to engage opposite sides of said stationary contact, said blades being biased toward each other, an auxiliary contact connected to said stationary contact, and a coacting auxiliary contact connected to and mounted upon one of said contact blades whereby arcing current during the switch opening movement traverses but one of said contact blades.

2. A circuit breaker comprising a pair of stationary contacts, a pair of movable contact blades adapted to bridge said stationary contacts in the closed circuit position of the switch, said contact blades adapted to be moved laterally with respect to each other to engage opposite sides of the stationary contacts, an auxiliary contact connected to and mounted upon each of said stationary contacts, and coacting auxiliary contacts connected to opposite ends of one of said contact blades whereby said stationary auxiliary contacts are bridged by but a single contact blade during the initial switch closing movement.

3. A circuit breaker comprising an insulating fluid, a pair of stationary contacts immersed in said fluid, said contacts having wedge-shaped contacting surfaces, a pair of movable contact blades adapted to engage and disengage said stationary contacts in said insulating fluid, said contact blades being guided for lateral movement and resiliently biased to engage said stationary contacts between the end portions thereof, a stationary auxiliary contact connected to each of said stationary contacts, said auxiliary contacts adapted to extend between said contact blades in the closed circuit position of the switch, and coacting auxiliary contacts connected to one of said contact blades and extending transversely of the contact blades.

4. The combination with a circuit breaker of the fluid-break type comprising an insulating fluid and stationary contacts suspended within said fluid, of bridging structure for coacting with said stationary con-

tacts comprising a pair of substantially parallel contact blades, means for spacing said blades and for guiding the same for lateral movement, said contact blades adapted to engage and align with opposite sides of the stationary contacts in the closed circuit position of the switch, a stationary auxiliary contact connected to each of said stationary contacts, and coacting auxiliary contacts connected to and extending transversely of one of said contact blades whereby the arcing current between the auxiliary contacts during initial opening movement of the breaker subsequent to separation of said contact blades from the stationary contacts is carried by said one contact blade.

In witness whereof I have hereunto set my hand this 17th day of May, 1930.

LUDVIG S. WALLE.