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CIRCUIT BREAKER

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Fig. 1.

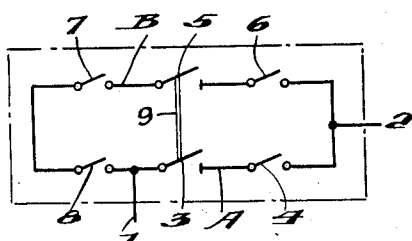


Fig. 2.

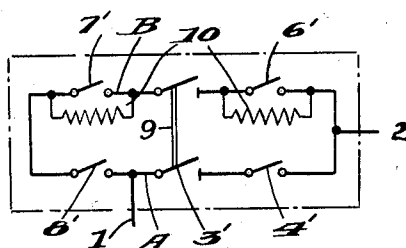
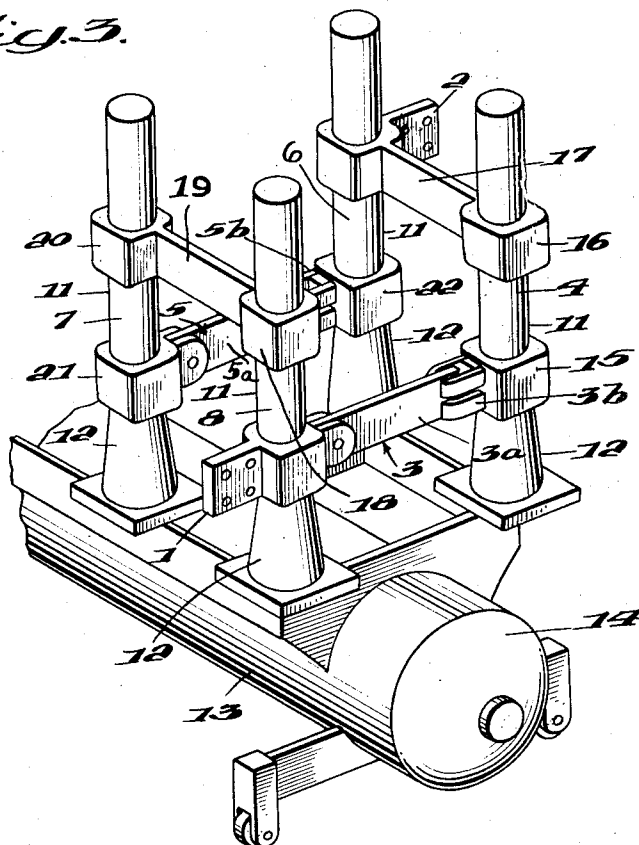


Fig. 3.



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CIRCUIT BREAKER

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5 Claims. (Cl. 200—146)

The present invention relates to circuit breakers and more particularly to circuit breakers for use on high potential, alternating current lines, such breakers being arranged with two or more branches in parallel and with each branch including a power interrupting switching point and a voltage disconnecting or isolating switching point connected in series.

It has been known to make circuit breakers with a plurality of breaking or switching points in order to better disconnect high potential currents. Thus, for example, several power interrupting switching points have been arranged in a side-by-side manner. These switching points can be opened simultaneously so that the breaking capacity is distributed as uniformly as possible on the switching points. In order to be able to master high rated currents which must be able to pass through a switch contact structure on a continuous duty basis without unduly heating the contacts, it is necessary to shape the profile of the conductive pieces of the contact structure to appropriately large size. This, however, requires comparably large explosion chambers to house the contact structure and large driving power and thus high stresses of the material. Furthermore, the dynamic forces produced by the current become very high with increasing breaking capacity which results either in additional stress of the material or in a diminution of the switch velocity.

It has also been known to make circuit breakers with a plurality of branches arranged in parallel in order to reduce the load current per branch and with each branch containing a power switching point. The disadvantage of such an arrangement is that the breaks effected in the various branches cannot be executed simultaneously with the result that one branch will be subjected to an over-voltage. As known, very insignificant resistance differences in the breaking electric arc are able to transmit the entire stress to only one branch. Thus, additional devices, for example, impedances must be provided for achievement of a uniform load distribution in the parallel branches. However, these additional devices necessarily enlarge the size of the circuit breaker.

In order to eliminate this disadvantage, the present inventive concept proposes that with a circuit breaker having a plurality of branches arranged in parallel, a first one of the branches is to contain only one power interrupting switching point and one voltage disconnecting switching point arranged in series while a second branch is to be provided with a plurality of power interrupting switching points and a voltage disconnecting switching point arranged in series, the arrangement being such that the power interrupting switching point in the first branch is the first to operate thus opening the first branch and transferring the load current to the second branch which then proceeds to break the current at the plurality of series arranged power interrupting switching points in that branch. Thus, when the circuit breaker is closed in both branches, the load current is desirably divided between the branches thus making it possible to make the conductive pieces of the contact structure relatively small for a continuous

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duty operating design. When the circuit breaker is to be opened, the plurality of series arranged power interrupting switching points in the second branch are enabled to distribute the breaking capacity between themselves so that the advantage of the parallel circuit breaker and the multiple break can be obtained in one and the same structure.

One practical embodiment of the improved circuit breaker according to the invention will become more apparent from the following detailed description and from the accompanying drawings wherein:

Fig. 1 is a schematic circuit diagram showing the improved circuit breaker with its branches in parallel;

Fig. 2 is also a schematic circuit diagram similar to Fig. 1 but showing a modification wherein impedances are connected in parallel with some of the power interrupting switching points in one of the branches; and

Fig. 3 is a view in perspective of one practical design for a circuit breaker according to the circuit arrangement depicted in Fig. 1.

With reference now to the drawings and to Fig. 1 in particular, it will be seen that the circuit breaker is comprised of first and second branches A and B arranged in parallel between an input terminal 1 and an output terminal 2. Branch A contains a voltage disconnecting switching point 3 and a single, power interrupting switching point 4 connected in series. Branch B also contains one voltage disconnecting switching point 5 but instead of one power interrupting switching point as in branch A, there are a plurality, for example three, power interrupting switching points 6, 7 and 8, the switching points of this branch also being arranged in series between the input and output terminals. Conveniently, the voltage disconnecting or isolating switching points 3 and 5 can be mechanically coupled together for simultaneous operation. These two switching points are opened after the power interrupting switching points in both branches have been opened in order to provide for the necessary voltage isolation while the circuit breaker is in open circuit position.

When the circuit breaker is in closed position, i.e. when all switching points in the two branches are closed, the load current divides between the branches A and B. When the circuit breaker is to be opened, the first step in the operating sequence is to open the circuit in branch A at the power interrupting switching point 4. This transfers the load current to branch B and the power interrupting switching points 6, 7 and 8 are then opened thus to break the load current between the input and output terminals 1, 2. After this has been accomplished, the voltage interrupting switching points 3 and 5 are opened thus isolating the input and output terminals as long as it is desired to maintain the circuit breaker in open position.

In circuit breakers of the type wherein the power interrupting switching points are reclosed after the opening phase, such as contacts which are spring loaded to closed position but are opened upon the application of pressure gas thereto, as in the well known gas blast type of circuit breaker, and closure of the circuit at the breaker is effected through closing of the voltage disconnecting points, it is expedient to mechanically couple the voltage disconnecting points 3 and 5 so as to permit their closing and opening simultaneously. This is indicated schematically in Fig. 2 by the bridge 9 between the two switching points. By closing the switching points 3 and 5 simultaneously, the current upon closing and the dynamic forces associated therewith are then distributed equally between branches A and B.

The power interrupting switching point 4 in branch A being the first to open needs to commutate only the short circuit current and therefore need not be exposed to the full continuity potential. It can then be constructed in

a simpler manner than the corresponding power interrupting switching points 6, 7 and 8 in branch B.

As is already known, circuit breakers of the power interrupting type having a plurality of interrupting points are often provided with impedances connected in parallel across the points for purposes of potential control. These impedances may be in the form of capacitances, high or low ohmic resistances or resistances having an exponential characteristic. Fig. 2 illustrates schematically an embodiment of the invention wherein two of the power interrupting switching points 6' and 7' are provided with resistances 10 arranged permanently in parallel therewith. The third power interrupting switching point 8' is not provided with such a parallelling resistance and hence is preferably switched open after the points 6' and 7' are opened and must be able to interrupt the residual current flowing in branch B through the two resistances 10 connected in series.

It is also possible to arrange for low ohmic resistances to be temporarily switched in parallel to the power interrupting switching points 6' and 7' by means of an auxiliary spark gap, the gap being bridged after the power switching points have opened.

One practical embodiment of the improved circuit breaker according to the present invention is illustrated in Fig. 3. With reference to this view it is seen that the arrangement is generally rectangular, the power interrupting switching points 4, 6, 7 and 8 being located at the corners and extending upright within cylindrical housings 11 of insulating material and which are in turn supported upon upright insulator columns 12 mounted upon a carriage 13 which includes a tank 14 containing compressed gas such as compressed air, for operating the power switching points. The power interrupting switch points 4, 6, 7 and 8 may be of the gas blast type including relatively movable nozzle and pin contacts which are spring loaded so as to normally engage each other but which are separated when pressure gas is applied. However, since this type of contact structure is well known, it has not been considered necessary to include such details here.

The input terminal to the circuit breaker is indicated by terminal plate 1. Articulated to this plate is the blade member 3a of the voltage disconnecting switch 3 and the cooperative contact fingers 3b for the blade are mounted to the conductive supporting member 15 for one of the contacts of the power interrupting switching point 4. From another conductive supporting member 16 connected to the other contact of switching point 4, a conductive strap 17 extends horizontally to the output terminal plate 2 located at the diagonally opposite corner from input terminal 1. The circuit from input terminal 1 to output terminal 2 through the voltage disconnecting switching point 3 and the power interrupting switching point 4 in series constitutes branch A of the circuit breaker as shown schematically in Fig. 1.

The power interrupting switching point 8 of branch B has one contact thereof connected to input terminal 1. The other contact thereof is connected to a conductive supporting member 18 from which a conductive strap 19 extends horizontally and parallel with strap 17 to a conductive supporting member 20 connected to one contact of the power interrupting switching point 7. Another, lower conductive supporting member 21 connected to the other contact of the power interrupting switching point 7 at the same level as input terminal 1 has articulated to it the blade member 5a of the voltage disconnecting switch 5, and the cooperative contact fingers 5b for the blade are mounted upon a conductive supporting member 22 for one of the contacts of the power interrupting switching point 6, the other contact of the latter being

connected to the output terminal 2. Thus, branch circuit B contains the power interrupting switching points 6, 7 and 8 and the voltage disconnecting switching point 5 connected in series between the input and output terminals 1, 2.

As indicated schematically in Fig. 1, the blade members 3a and 5a of the voltage disconnecting switching points 3 and 5 may be mechanically coupled by bridging means, not shown, to effect operation of the two switching points simultaneously.

The resistors paralleling the contacts of the power interrupting switching points have not been illustrated but can be added in a suitable practical manner, for example according to the circuitry shown in Fig. 3.

It will be evident from the rectangular arrangement shown in Fig. 2 that a neat grouping and constructively simple device can be obtained notwithstanding the presence of an unequal number of power interrupting switching points in the two parallel branches of the circuit breaker.

In conclusion it is to be understood that while one practical embodiment of the invention has been described and illustrated, various changes in the construction and arrangement of component parts may be made without, however, departing from the spirit and scope of the inventive concept as defined in the appended claims.

I claim:

1. In an electrical circuit breaker for use on a high potential, alternating current line the combination comprising first and second switching branches arranged in parallel between an input terminal and an output terminal, said first branch including a single power interrupting switching point of the gas blast actuated type and a voltage disconnecting switching point of the movable blade type connected in series and said second branch including a plurality of power interrupting switching points of the gas blast actuated type and a voltage disconnecting switching point of the movable blade type connected in series, said power interrupting switching point of said first branch being arranged to open first thereby to transfer the load to said second branch for interruption by the power interrupting switching points therein and means for actuating said movable blades of said voltage disconnecting points simultaneously to open and closed position.

2. An electrical circuit breaker as defined in claim 1 wherein said power interrupting switching point of said first branch has a smaller interrupting capacity than the power interrupting switching points of said second branch.

3. An electrical circuit breaker as defined in claim 1 wherein at least some of the power interrupting switching points of said second branch are provided with impedances connected in parallel therewith.

4. An electrical circuit breaker as defined in claim 3 wherein all excepting one of the power interrupting switching points of said second branch include impedances connected in parallel therewith.

5. An electrical circuit breaker as defined in claim 1 wherein said power interrupting switching point of said first and three power interrupting switching points of said second branch are arranged as the corners of a rectangular grouping and mounted upon a tank containing gas under pressure, said voltage disconnecting switching points being arranged parallel to each other on opposite sides of the rectangular grouping.

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