Dec. 3, 1940. G. SCARPA 2,223,901

OIL CIRCUIT BREAKER

Filed March 4, 1939

Fig. 1

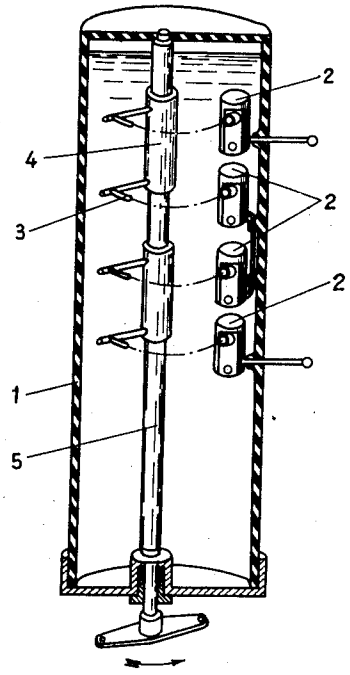



Fig. 4

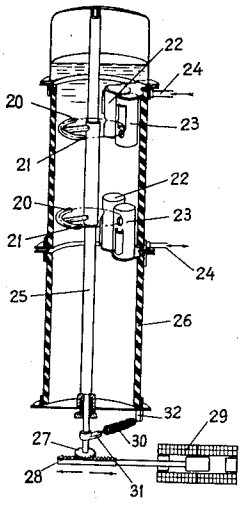



Fig. 2

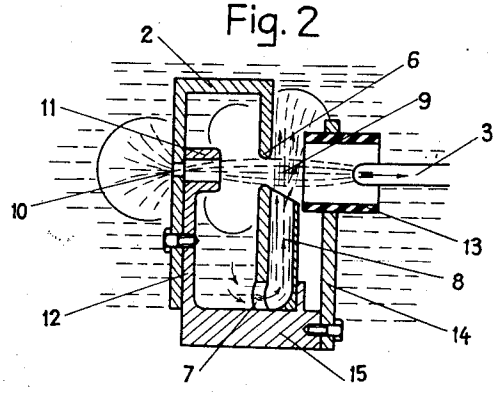
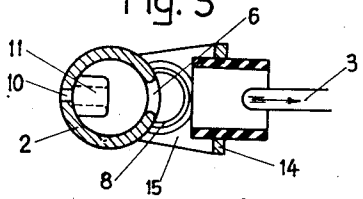



Fig. 3




Inventor,
G. Scarpa

By: Glascock Downing & Seebold
Attys.

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# UNITED STATES PATENT OFFICE

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## OIL CIRCUIT BREAKER

Giuseppe Scarpa, Savona, Italy

Application March 4, 1939, Serial No. 259,873
In Italy March 9, 1938

2 Claims. (Cl. 200—150)

This invention relates to oil circuit breakers for high-voltage alternating current of the type employing a reduced oil volume and breaking boxes. An object of this invention is to improve said boxes in order to reduce the power dissipated in the breaking arc and stresses transmitted to the oil circuit breaker unit.

A further object of this invention is to provide the breaking box on the side of the stationary eye-shaped contact opposite the arc zone with an opening through which part of the vapours produced by the arc, mainly the hottest vapours, are discharged. A further object of this invention is to damp the expansion of the vapours and reduce the shock transmitted to the walls of the main breaker tank by providing a tube of insulating material which surrounds the portion of the arc set up outside the breaking box.

A further object of this invention is to provide a circuit breaker of the type referred to above, by which it is possible to break the circuit of a transmitting line for extinguishing arcs and thereupon immediately re-establish the circuit, in order to prevent synchronous generators connected in said circuit to come out of parallelism, with a maximum breaking period of $\frac{1}{10}$ second. For this purpose each movable contact of the circuit breaker comprises two opposite contact plugs arranged to successively cooperate with breaking boxes at the end of the stroke of the movable contact in one direction and in the opposite direction, respectively.

The accompanying drawing shows by way of example a construction of the oil breaker according to my invention.

Figure 1 is an axial vertical section.

Figure 2 is a cross vertical section on an enlarged scale of the breaking box.

Figure 3 is a horizontal section thereof.

Figure 4 is an axial vertical section of a circuit breaker, by means of which it is possible to open and close circuits in a rapid sequence.

Referring to the drawing, 1 denotes the tank of insulating material of an oil breaker.

The tank 1 encloses the breaking boxes 2 carrying the stationary contacts cooperating with the movable contacts 3, supported by pairs of sleeves of conducting material 4 slipped on a shaft 5 of insulating material rotatably mounted in supports eccentrically arranged in the cover plate and bottom of the tank 1.

Each breaking box 2 is provided in its front wall with a hole 6, through which extends with a small clearance the movable contact 3 and below with a hole 7, through which oil is caused to flow by the gases evolving within the box on breaking and reaches through the conduit 8 the arc zone 9.

Each breaking box 2 is provided with a further hole 10 bored in its rear wall in alignment with the eye 11 of the stationary contact 12 and with the hole 6 in the front wall; in this manner, connection is established through the eye 11 and hole 10 between the arc zone and the portion of the tank situated behind the box.

A sleeve 13 of insulating material is arranged outside the front portion of the box in alignment with the hole 6 and a certain distance therefrom and is supported by the plate 14 secured to the foot 15 of the stationary contact 12.

As the movable contact 3 is released from the eye 11 on breaking, an arc is formed which vaporises a portion of the oil and the gases produced exert a pressure on the oil contained in the lower portion of the box, causing it to rise in the conduit 8 and flow through the arc, when the movable contact is withdrawn from the box. To ensure an actual and efficient oil flow through the arc, the jet of pressure gas issuing from the hole 6 should not be too violent. I obtain this by providing a rear hole 10 which allows a portion of the gases to escape, thereby reducing the pressure in the box 2 and violence of the gas jet through the hole 6. Moreover, the rear hole 10 is directly in communication with the central portion of the gas bubbles and discharges the gas portion nearer the arc zone, which is the hotter portion, thus improving the deionising action of the oil from the conduit 8.

When the arc extends beyond the hole 6, the prompt vaporisation of oil on its contact therewith produces a very rapid movement of the oil which is still further accelerated by the rapid expansion of the gas; this objectionable action is lessened by the sleeve 13 which damps the gas expansion, thereby reducing the shock transmitted to the tank 1 enclosing the above described unit.

The advantageous effect of the sleeve 13 is more particularly effective when a number of breaking boxes are arranged in one tank, more particularly in the case of coupled breaking boxes, as in the case of quick opening and closing circuit breakers as shown in Figure 4. Each movable contact comprises two plugs 20 and 21 adapted to cooperate with the breaking boxes 22 and 23, respectively, of which the stationary contacts are connected to one lead 24. The shaft 25, on which the movable contacts are

mounted, is provided externally of the tank 26 with a pinion 27 meshing with a rack 28 to which is imparted an alternating motion by means of a twin-coil electromagnet 29.

A spring 30 connected to an arm 31 secured to the shaft 25 and anchored at 32 to a stationary part of the tank 26 tends to return the movable contacts at half-length of their stroke and to maintain them in their open position.

As the rotating contacts open, they break the circuit over a series of stationary contacts and as they reach the end of their stroke they reclose the circuit over another series of stationary contacts.

The above described circuit breaker may be held in its open position through the spring 30 and may perform a similar function as the type shown in Figures 1 to 3.

I wish to be understood that I do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

What I claim is:

1. An oil circuit breaker comprising a tank of insulating material filled with oil, breaking boxes immersed in the oil of said tank, a stationary eye-shaped contact in each of said boxes, the front and rear walls of said boxes having holes therein in alignment with the hole in said contact, a shaft rotatably mounted in said tank, movable plug contacts carried by said shaft and insulated thereon and arranged to cooperate with each of said contacts through one of the holes in said boxes, a protecting sleeve in said tank outside each box adjacent and in alignment with the front hole in said box, said plug contacts moving through the associated sleeve, and an outer tubular expansion conduit on each of said boxes with the axis thereof perpendicular to the common axis of the hole in the receptacle and the hole in the box walls, said tubular expansion conduit communicating at one end with the box bottom and opening at its other end near the axis of said holes.

2. An oil circuit breaker comprising a tank of insulating material filled with oil, a plurality of coupled breaking boxes immersed in the oil of said tank, eye-shaped contacts in each of said boxes, the opposite walls of said boxes having holes therein in alignment with the holes in said stationary contact, a shaft rotatably mounted in said tank and a plurality of movable contacts each having two opposite plugs, one of said plugs being adapted to engage with the stationary contact in one of said coupled boxes through one of said holes at the end of the stroke of the movable contacts in one direction and the other plug being adapted to engage the stationary contact in the other of said coupled boxes through one of said holes in the boxes at the end of the stroke of the movable contacts in the opposite direction, an outer tubular expansion conduit on each of said boxes with the axis thereof perpendicular to the common axis of the hole in the stationary contacts and of the holes in the box walls, said tubular expansion conduit communicating at one end with the bottom of the box and opening at its other end near the axis of said holes, a protecting sleeve in said tank outside each box adjacent and in alignment with the front hole in said box, and said plug contacts moving through the associated sleeve.

GIUSEPPE SCARPA.