

Sept. 14, 1937.

D. RÖNNBERG

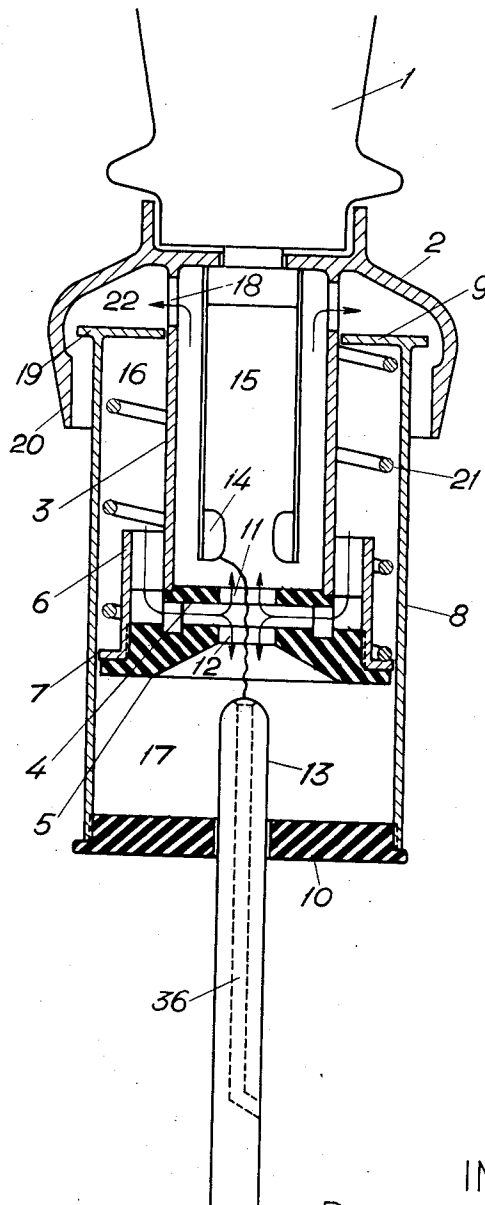
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EXTINGUISHING CHAMBER FOR ELECTRIC CIRCUIT BREAKERS

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3 Sheets-Sheet 1

Fig. 1



INVENTOR
Daniel Rönnerberg
BY *Wm. Waller White*
ATTORNEY

Sept. 14, 1937.

D. RÖNNBERG

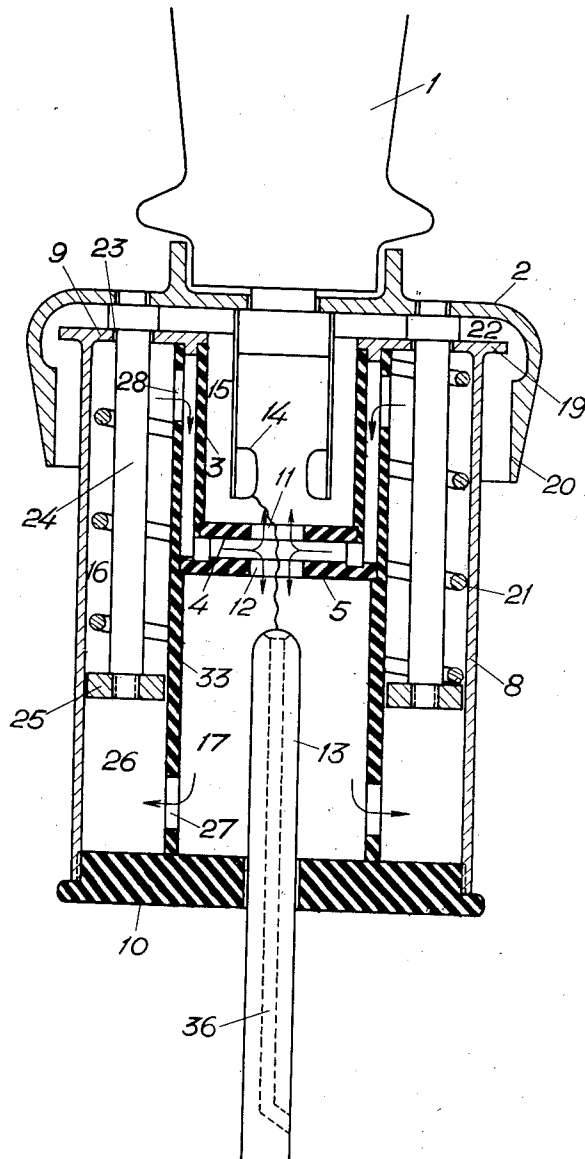
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Fig. 2



INVENTOR
Daniel Rönnerberg
BY *John Wallace Little*
ATTORNEY

Sept. 14, 1937.

D. RÖNNBERG

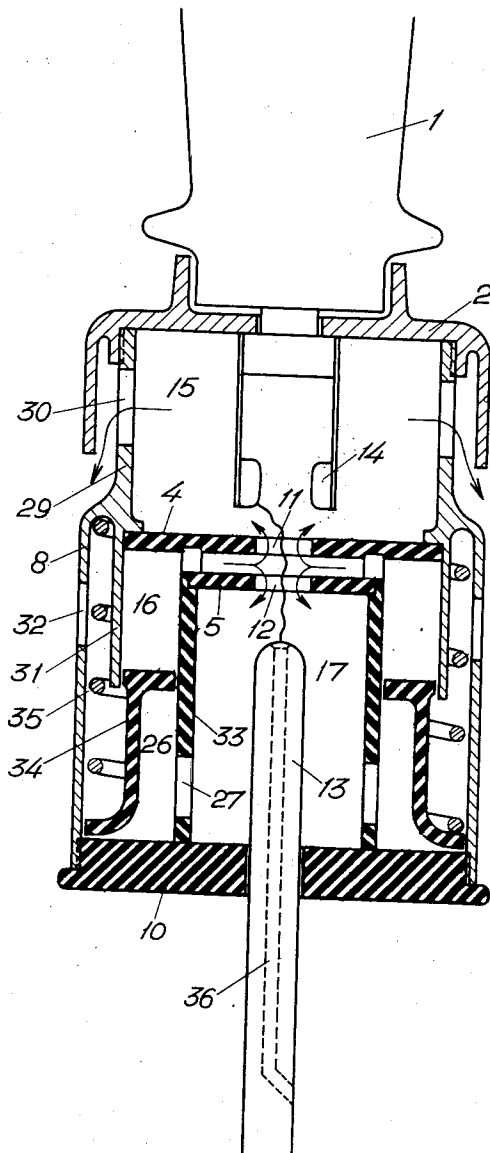
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EXTINGUISHING CHAMBER FOR ELECTRIC CIRCUIT BREAKERS

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Fig. 3



INVENTOR
Daniel Rönberg
BY *Jm. Wallace White*
ATTORNEY

UNITED STATES PATENT OFFICE

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EXTINGUISHING CHAMBER FOR ELECTRIC
CIRCUIT BREAKERSDaniel Rönnerberg, Ludvika, Sweden, assignor to
Allmänna Svenska Elektriska Aktiebolaget,
Vasteras, Sweden, a Swedish corporation

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7 Claims. (Cl. 200—150)

In hitherto known circuit breakers with extinguishing chambers comprising a differential piston for producing a flow of extinguishing liquid against the arc the extinguishing chambers have been practically closed. The present invention concerns a modification of this type of circuit breakers and is especially characterized thereby that the stationary contact is arranged outside of the compartments bounded by the differential piston. The stationary contact may also be enclosed in a compartment of the extinguishing chamber which is separated from the said compartments by an insulated wall provided with a hole for the passage of the movable contact, said compartment being in free communication with the space outside of the extinguishing chamber.

By this arrangement the advantage is reached that the differential piston cannot be set in motion by the pressure generated by an arc which may appear when the breaker is being closed. This is a feature of considerable importance because if the circuit breaker is closed against a short circuit, the circuit breaker may be released immediately after closing. Thus, if the differential piston shall be able to force a flow of fluid against the arc strong enough to extinguish the arc, it must be in or near its starting position when the circuit breaker is released. Further the invention has the advantage that, when closing the circuit breaker against a short circuit, the pressure in the gas and the accompanying arc voltage rise and decomposition of the oil or liquid cannot reach a high value, which would be the case if the extinguishing chamber were quite closed.

Fig. 1 is a sectional view of one form of my invention, and

Fig. 2 is a sectional view of a modified form of my invention, and

Fig. 3 is a sectional view of another modified form of my invention.

In Fig. 1, 1 designates the insulator, which supports the extinguishing chamber. The latter consists of a cap 2 of metal, which is rigidly connected with a cylinder 3, which is arranged inside it and which at the lower end is closed by an insulating intermediary wall 4. In a fixed distance from this intermediary wall is another intermediary wall 5, which has a larger outer diameter than the wall 4 and which is carried by a cylinder 6 with flange 7 connected with the cylinder 3. The flange 7 fits in a cylinder 8, which at its upper end is provided with an inwardly extending collar 9, which fits the cylinder 3. At its lower

end the cylinder 8 is closed by a bottom 10. The intermediary walls 4 and 5 are provided with openings 11 and 12 respectively for the movable contact 13. The stationary contact 14, which is formed as a normal sleeve contact, is arranged in the compartment 15 inside the cylinder 3. The compartment 15 is by means of openings 18 in the cylinder 3 in connection with the space 22 on the underside of the cap 2. The lower part of the cap 2 has a cylindrical part 20 with approximately the same diameter as the collar 19 on the cylinder 8. By means of the spring 21 the cylinder 8 normally is held in its upper position.

The arrangement acts in the following way. When the contact 13 leaves the stationary contact 14, an arc is formed between these contacts. During the first part of the motion of the contact the gas generated by the said arc escapes from the compartment 15 through the openings 18 and passes the edge of the collar 19 to the space outside the extinguishing chamber. The differential piston, which is formed by the cylinder 8 with cover 19 and bottom 10, is still at rest, but when the movable contact 13 has moved down into the chamber 17, the pressure which comes from the evaporating action by the arc on the oil in the extinguishing chamber acts on the piston in the following way and puts it in motion. The pressure in the compartment 17 acts with a downwardly directed force on the bottom 10, and the pressure in the compartment 16 acts with an upwardly directed force on the lower side of the cover 9. As the downwardly acting force is larger than the force acting upwards, the piston moves downwards, thereby compressing the compartment 16, so that a flow of liquid is forced forward between the intermediary walls 4 and 5 and through the openings 11 and 12 in these walls. When the arc does not become extinguished at the first motion of the piston, it will, however, under all circumstances be extinguished during the latter part of the motion of the piston, because the collar 19 fits rather well in the cylindrical part 20 of the cap 2, so that the pressure in the compartment 22 will then be higher, which means that a larger force due to this higher pressure will then act downwardly on the cover 9. Due to this larger force a more powerful stream of liquid is achieved through the openings 11 and 12 during the latter part of the motion of the piston.

In Fig. 2, 1 also designates the insulator supporting the extinguishing chamber, and as in Fig. 1 a cap 2 is fastened to this insulator. The stationary contact 14 is in this arrangement, however, surrounded by a cylinder 3. This cylinder

and two insulated intermediary walls 4 and 5 with openings 11 and 12 for the movable contact 13 are surrounded by another cylinder 33, which is surrounded by another cylinder 8, concentric with it. The three cylinders are at their upper ends joined by a cover 9, and at the lower end the cylinders 8 and 33 are joined by a bottom 10 with an opening for the movable contact. The cover 9 is provided with holes 23 for bolts 24, which are fastened in the cap 2. Said bolts carry a ring 25, which fits in the annular shaped space between the two cylinders 8 and 33. The compartment 15, which contains the stationary contact 14, is in the same manner as shown in the preceding figure during the first part of the contact motion in connection with the space outside the extinguishing chamber, until the piston, i. e. the cylinders 8 and 33 with cover 9 and bottom 10, has moved so far downwards, that the collar 19 comes within the cylindrical part 20 on the cap 2.

In the same manner as described in connection with the preceding figure no high pressure can arise in the compartment 15 due to the free communication with the space outside the extinguishing chamber. Due to this free communication the piston cannot come in motion during the first existence of the arc. Not until the movable contact 13 has moved down into the compartment 17, the pressure generated by it acts on the piston driving it downwards in the following manner. The pressure acting in the compartment 17 has no influence upon the motion of the piston, as the force acting downwardly on the bottom 10 is equal to the force acting upwardly on the intermediary wall 5. The pressure in the space between the intermediary walls has also no influence upon the motion of the piston, as the force acting upwards is equal to that acting downwards. The resulting force, which therefore acts on the piston, is equal to the difference of the force from the pressure in the compartment 26 acting on the bottom 10 downwards and the force from the pressure in the compartment 16 acting on the cover 9 upwards. The latter force is smaller than the first force, because the bolts 24 take a part of the annular surface on the underside of the cover 9, which surface otherwise is equal to the annular surface of the bottom 10, on which the pressure in the compartment 26 acts.

In the arrangement according to Fig. 3, I also designates the insulator supporting the extinguishing chamber. On this insulator a metal cap 2 also is fastened, but in contradiction to the arrangements of Figs. 1 and 2 in Fig. 3 the extinguishing chamber is rigidly fastened to the said cap 2. The extinguishing chamber consists of a cylinder 8 with a bottom 10 of insulating material. The cylinder 8 may of course also be made of insulating material. The cylinder 8 has an upper part 29, which is fastened to the cap 2, for instance by means of threading, and this part is provided with openings 30 connecting the space inside this part with the space outside of the extinguishing chamber. Inside the lower part of the cylinder 8 is another cylindrical part 31 at its upper end connected with the cylinder 8, and in the cylinder 8 openings 32 are provided. The stationary contact 14 is arranged in the space inside the cylindrical part 29, and this space is by an insulating wall 4 separated from the other space enclosed by the cylinder 8. The wall 4 is provided with an opening 11 for the movable contact 13. Immediately below the intermediary wall 4 is another intermediary wall 5 with open-

ing 12 for the movable contact, and this intermediary wall is supported by a cylinder 33 of insulating material. This cylinder extends down to the bottom 10 and is at its lower part provided with openings 27. Between the cylinder 8 and the cylindrical part 31 on one side and the cylinder 33 on the other side is an annular shaped piston 34 arranged, which normally is held at its lower position by means of a spiral spring 35. The compartment which contains the stationary contact is in the same manner as in Fig. 2 designated by 15, and the chamber into which the tip of the movable contact is drawn when opening the circuit breaker is designated by 17. The compartment bounded by the larger surface of the differential piston is designated by 26, and the compartment bounded by its smaller surface is designated by 16.

The arrangement acts in the following way. When the movable contact 13 leaves the stationary contact 14, the gas generated by the arc will escape through the opening 30, but when the arc is drawn down into the compartment 17 when the movable contact 13 moves downwards, the pressure generated by the arc will act on the lower side of the piston 34 upwards, and when it moves upwards, the compartment 16 is reduced and liquid is pressed forward between the walls 4 and 5 and through the openings 11 and 12. In the same manner as by the arrangement shown in the preceding figures a flow of liquid against the arc is achieved, but not until the arc has been drawn into the chamber 17.

If the voltage is sufficiently high, it may occur that an arc appears between the contacts when the circuit breaker is closed, but if the distance between the intermediary wall 4 and the stationary contact 14 is suitably chosen, this arc may not appear before the openings 11 and 12 have been closed by the movable contact. The gas, which is generated by the arc, when the breaker is closed, will therefore entirely escape through the opening 30 and not cause any motion of the piston 26, which therefore will be in its starting position when the breaker is released, and when closing against short circuit the breaker may be released immediately after it has been closed.

The movable contact 13 is in all forms shown provided with a bore 36, which commences at the tip of the contact and reaches to a point on the side of the contact so far from the tip, that the mouth of this bore is outside of the extinguishing chamber, when the circuit breaker is in its closed position.

The arrangements according to Figs. 1 and 2 differ from the arrangement according to Fig. 3 further thereby, that in the arrangements according to Figs. 1 and 2 the compartment which contains the stationary contact only is open during the first part of the motion of the piston and then becomes closed, when the piston moves downwards, whereas in the arrangement according to Fig. 3 the space which contains the stationary contact remains open during the whole time. The chief feature of the invention is that the stationary contact is arranged in a compartment, which at least during the first time of the existence of the arc is in free communication with the space outside the extinguishing chamber but is in communication with the compartments bounded by the differential piston solely by an opening in an insulated intermediary wall, which is traversed by the movable contact and therefore is closed by it when the breaker is in its closed position. In certain cases it may, however,

be advisable to arrange channels in the intermediary wall, which separate the compartment containing the stationary contact from the compartments bounded by the piston, said channels, however, being closed by spring loaded valves.

In spite of that the invention is described with the assumption, that the extinguishing medium is a liquid, it is, however, possible to use a gaseous form of extinguishing medium.

I claim as my invention:—

1. An extinguishing chamber for electric circuit breakers comprising a differential piston actuated by the pressure generated by the arc, said piston serving to force a flow of extinguishing liquid against the arc between the contacts of the breaker, a compartment bounded by the larger surface of said piston, a compartment bounded by the smaller surface of said piston, a stationary contact arranged in a space in free communication with the space outside of the chamber, an insulated wall between said stationary contact and said compartments, an opening in said wall for the passage of a movable contact.

2. An extinguishing chamber for electric circuit breakers comprising a differential piston actuated by the pressure generated by the arc, said piston serving to force a flow of extinguishing liquid against the arc between the contacts of the breaker, a compartment bounded by the larger surface of said piston, a compartment bounded by the smaller surface of said piston, a stationary contact arranged in a space in free communication with the space outside of the chamber, a compartment enclosing said contact, an insulated wall between said compartment and the compartments bounded by the differential piston, an opening in said wall for the passage of a movable contact, openings between the compartment enclosing the stationary contact and the space outside of the extinguishing chamber.

3. An extinguishing chamber for electric circuit breakers comprising a differential piston actuated by the pressure generated by the arc, said piston serving to force a flow of extinguishing liquid against the arc between the contacts of the breaker, a compartment bounded by the larger surface of said piston, a compartment bounded by the smaller surface of said piston, a stationary contact arranged in a space in free communication with the space outside of the chamber, a compartment enclosing said contact, an insulated wall between said compartment and the compartments bounded by the differential piston, an opening in said wall for the passage of a movable contact, an opening between the compartment enclosing the stationary contact and the space outside of the extinguishing chamber, a closing device for said opening operated by the differential piston.

4. An extinguishing chamber for electric circuit breakers comprising a differential piston actuated by the pressure generated by the arc, said piston serving to force a flow of extinguishing liquid against the arc between the contacts of the breaker, a compartment bounded by the larger surface of said piston, a compartment bounded by the smaller surface of said piston, an insulated wall between said compartments, an opening in said wall for the passage of a movable contact, a stationary contact arranged in a space

in free communication with the space outside of the chamber, an insulated wall between said stationary contact and said compartments, an opening in said wall for the passage of a movable contact.

5. An extinguishing chamber for electric circuit breakers comprising a movable cylinder with bottom and cover forming a differential piston, said piston serving to force a flow of extinguishing liquid against the arc between the contacts of the breaker, an opening in said bottom for the passage of a movable contact, an opening in said cover fitting a stationary cylinder, a bottom in the latter cylinder, an opening in said bottom for the passage of the movable contact, a stationary contact arranged inside said stationary cylinder, openings in said stationary cylinder forming a communication between the space inside the cylinder and the space outside of the extinguishing chamber, an insulated wall with an opening for the passage of the movable contact arranged a small distance below the bottom of the cylinder and enclosing the stationary contact, a cap surrounding the upper part of the movable cylinder, a cylindrical part on the inside of said cap fitting an outwardly extending collar on the movable cylinder.

6. An extinguishing chamber for electric circuit breakers comprising a movable cylinder with bottom and cover forming a differential piston, said piston serving to force a flow of extinguishing liquid against the arc between the contacts of the breaker, an opening in said bottom for the passage of a movable contact, an insulating cylinder inside said cylinder, an annular stationary wall between said cylinders, bolts carrying said wall, openings in the cover for the passage of said bolts, a cylinder arranged inside the inner of said cylinders, an insulated bottom of said cylinder, an insulated wall arranged a small distance below said bottom, openings in said bottom and wall for the passage of the movable contact, a stationary contact arranged above said bottom, openings at the upper and lower ends of the cylinder surrounded by the stationary annular wall, a cap surrounding the upper part of the outermost cylinder, a cylindrical part on the inner side of said cap fitting an outwardly extending collar on said movable cylinder.

7. An extinguishing chamber for electric circuit breakers comprising a cylinder with bottom and cover, an opening in said bottom for the passage of a movable contact, a stationary contact arranged in the upper part of said cylinder, openings in the walls of the upper part of said cylinder, an insulated intermediary wall a small distance below the stationary contact, an upwardly extending cylinder on the bottom of said cylinder, a cover of said cylinder a small distance below said intermediary wall, openings in said cover and said wall for the passage of the movable contact, openings in the walls of the lower part of said cylinder, an annular shaped differential piston movable in the lower part of the extinguishing chamber, said piston forcing a flow of fluid between the said intermediary wall and the cover and through the openings for the movable contact.

DANIEL RÖNNBERG.