

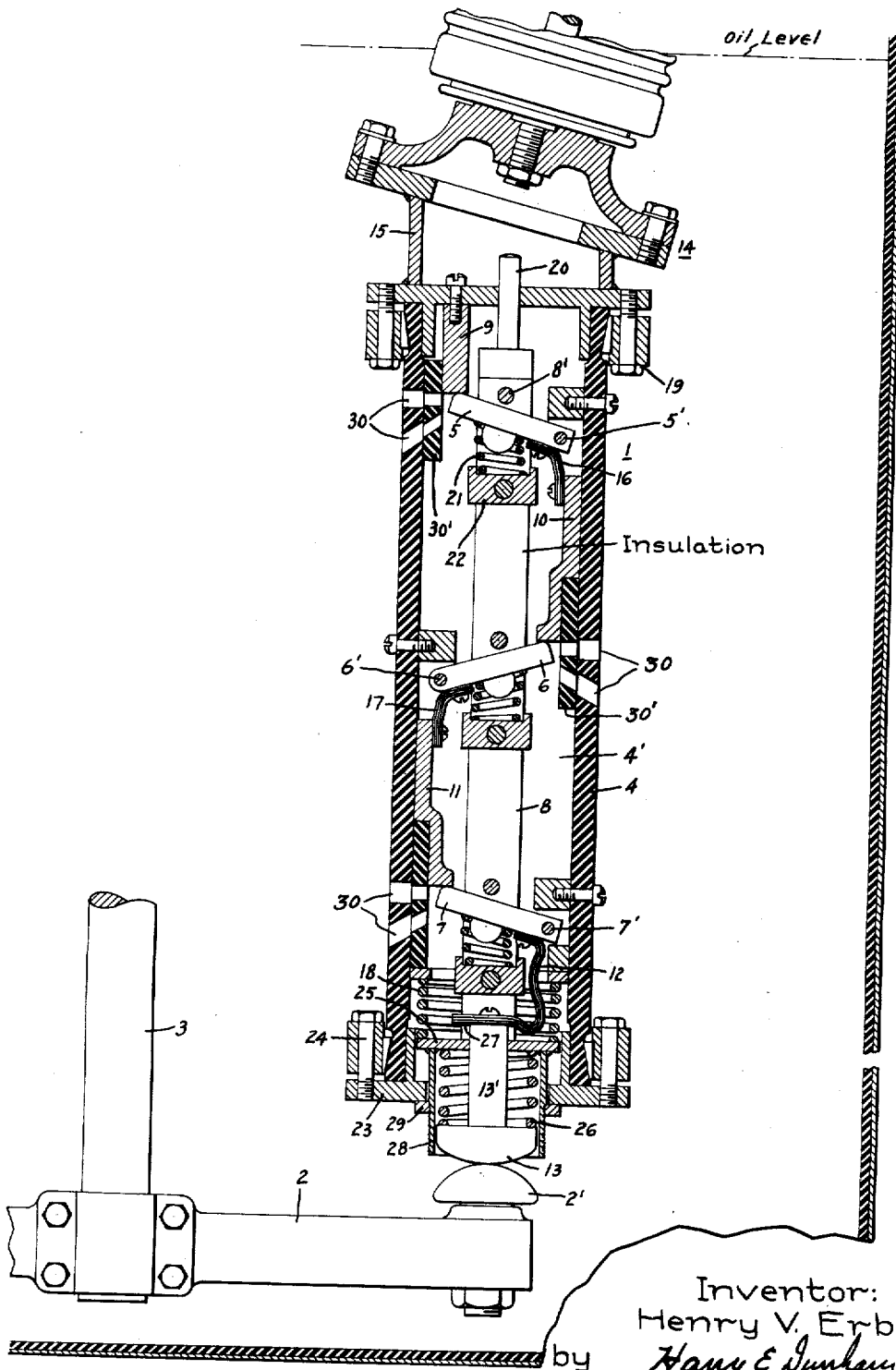
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HIGH VOLTAGE ELECTRIC CIRCUIT INTERRUPTER

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UNITED STATES PATENT OFFICE

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HIGH VOLTAGE ELECTRIC CIRCUIT INTERRUPTER

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8 Claims. (Cl. 200—150)

My invention relates to electric circuit inter-
rupters for high voltage power circuits, more par-
ticularly to high speed electric circuit breakers
of the explosion chamber type for opening a high
voltage alternating current power circuit within
a few cycles.

Multiple break electric circuit interrupters of
the liquid-blast type have heretofore been pro-
posed wherein the arc pressure created for driv-
ing an arc-extinguishing liquid, such as oil,
through a plurality of breaks formed upon open-
ing of the circuit depended upon an initial cir-
cuit opening movement. This initial movement
was prior to formation of the arc or arcs which
were subjected to the liquid blast. Accordingly
in this form of circuit breaker, although the in-
terrupting action is positive and very reliable, the
interrupting blast is not made effective until after
the contact structure has reached a point in its
opening travel appreciably beyond the initial
travel necessary to create the arc pressure. This
is a particularly important consideration where
an interrupting time of but a few cycles is spec-
ified for the breaker, since, in addition to the
time lost due to the inertia of the moving parts,
the interrupting time is further lengthened by the
time required for the movable contact structure
to move through the distance necessitated by the
additional contact separation.

In this type of breaker it is also necessary that
the movable contact structure be separated in
the open circuit position from the fixed or co-
acting explosion chamber structure, so that the
spaced contacts are adequately isolated and insu-
lated by the liquid dielectric with respect to high
voltages. This isolating distance is considerably
greater than the amount of separation required
for actual arc interruption.

The principal object of my invention is the
provision of an improved high speed multiple
break electric circuit interrupter of the explosion
chamber type which is effective to create arc
pressure for interrupting the circuit within the
explosion chamber immediately upon initial sep-
aration of the contact structure within the ex-
plosion chamber and prior to the isolating opera-
tion.

My invention will be more fully set forth in
the following description referring to the ac-
companying drawing, 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 drawing the single figure
thereof is an elevational view, partly in section, of

one pole of an oil circuit breaker embodying the
present invention.

There is illustrated by the drawing one pole
of a tank-type oil circuit breaker in the closed
circuit position wherein a pair of fixed contact
structures, one of which is indicated at 1 are
interconnected by a bridging member 2 in the
closed circuit position. The bridging member 2
is operated vertically in the usual manner by a
lift rod 3 for opening and closing the breaker.

The fixed contact structure 1 comprises es-
sentially a pressure-confining or explosion cham-
ber which is formed in the present instance by a
cylindrical insulating member 4 composed of a
mechanically strong insulating material such as
fiber, for example. The chamber 4 so formed is
substantially closed at its opposite ends and is
immersed as indicated in a suitable insulating and
arc-extinguishing liquid such as oil.

For the purpose of forming a plurality of
breaks in series within the explosion chamber,
contact structure mounted for limited movement
is disposed therein comprising individually piv-
oted contact members 5, 6 and 7. These contact
members are each resiliently connected to an in-
sulating operating carriage 8 with respect to cir-
cuit closing movement and are directly engaged
by said operating carriage through overhanging
pins 8' with respect to movement in the opposite
or circuit opening direction. The movable con-
tact members 5, 6 and 7 coact respectively with
fixed contacts 9, 10 and 11 suitably mounted in
the side walls of the casing 4. The lower contact
7 is electrically connected through a flexible con-
ductor 12 to a butt contact member 13 which is
engaged in the closed circuit position by the butt
contact 2' of the bridging member 2. The butt
contact 13 is mounted on the carriage 8.

The circuit through the breaker in the closed
circuit position beginning with the fixed terminal
structure generally indicated at 14 comprises the
conducting adapter structure 15 to which the con-
tact 9 is connected, pivoted contact 5, flexible
conductor 16, contact 10 and coacting pivoted
contact 6, flexible conductor 17, contact 11 and
coacting pivoted contact 7, flexible conductor 12
and coacting butt contacts 13 and 2'.

The contacts 5, 6 and 7 are preferably con-
nected to the insulating carriage 8 so as to op-
erate simultaneously as a unit which is biased
downward in the circuit opening direction by a
spring 18. It shall be understood that the order
of opening of the pivoted contacts can readily
be varied if desired. The contacts are held in
the closed circuit position by the bridging mem-

ber 2 which engages the carriage unit 8 through the butt contact 13 so as to hold the same against the bias of spring 18 in its upper closed circuit position.

Referring more particularly to the specific structure employed in the present instance, the fixed terminal structure at 14 comprises the adapter 15 which is connected in a well-known manner to the lower end of the lead-in conductor and bushing extending through the circuit breaker tank cover. The insulating cylinder 4 is suitably clamped as at 19 to the adapter so as to extend in vertical depending relation therewith. The upper end of the carriage 8 is provided with a guide extension 20 which is vertically movable in the adapter 15.

The movable contact members 5, 6 and 7 are suitably mounted with respect to the side walls of the casing 4 as by pivotal supports 5', 6' and 7' respectively. In the closed circuit position shown each contact is biased into engagement with its coacting contact by a spring 21 which is seated between a strut 22 secured to the carriage and the pivoted contact. This resilient connection provides, among other things, sufficient "wipe" at the contacts in order to compensate for slight inequalities in spacing of the contacts and in order to prevent excessive shock during the circuit closing position.

The lower part of the casing 4 is substantially closed by the butt contact 13 and an end cap 23 which is suitably secured at 24 to the insulating cylinder. The butt contact 13 is provided with a guide extension 13' movable in a guide plate 25 which forms a part of the carriage 8. The springs 26 provide a resilient mounting for the contact and permit a limited "wipe" at 27 with respect to the carriage 8. The plate member 25, which overhangs the end plate 23 for limiting downward movement, is provided with an annular depending flange 28 having a stop member 29 for limiting upward movement of the carriage with respect to the end cap 23.

For the purpose of utilizing the arc pressure generated within the explosion chamber immediately upon initial separation of the contacts, there are provided exhaust ports in the chamber walls opposite either all or some of the breaks, so that arc pressure created within the chamber is effective to drive oil through the exhaust ports for interrupting the arc at those points. In the present arrangement a pair of diverging ports 30 for splitting the arc into two sections is located adjacent and immediately opposite each of the breaks at the fixed contacts 9, 10 and 11. Accordingly arc pressure within the chamber tends to drive two diverging jets of oil transversely across the arc at each break. Where interrupting requirements make a higher chamber pressure more desirable, the ports opposite the break 6-10 can be closed.

For the purpose of minimizing the concentration of arc gases between various breaks, the exhaust ports are preferably disposed in staggered relation at opposite sides as illustrated. This unbalance in the arrangement of breaks also tends to create pressure behind some arcs so as to drive the oil more effectively through those arcs. The ports within the chamber are faced with suitable arc resisting material indicated at 30'.

Since the interrupting operation above described takes place immediately after the main bridging member 2 has dropped but a short distance, it will be apparent that the time of separation

of the two butt contacts 2' and 13 is immaterial in so far as the speed of arc interruption is concerned. Further lowering of the bridging member 2 in accordance with the circuit opening operation results in separation of the aforesaid butt contacts when the plate 25 limits the lower travel of the contact carriage at the end cap 23. The bridging member can then be separated a desired isolating distance within the oil from the fixed explosion chamber structure.

Although the pins 8' secured to the carriage cause positive opening movement of the pivoted contacts practically immediately upon initial opening movement of the bridging member 2, it will be noted that the pivoted contacts by reason of the resilient connection at 21 can move in advance of the pins 8' when so urged by pressure created by heavy power arcs. This accelerated contact separation tends to open the ports quickly so as to facilitate the arc interrupting oil blast.

When the breaker is closed the bridging member 2 is elevated to engage the butt contact 13 which urges, through the resilient connection at 26, the carriage 8 upward to the closed circuit position shown, so that there is a slight degree of "wipe" as determined by the stop member 29.

It should be understood that my invention is not limited to specific details of construction and arrangement thereof herein illustrated, and that changes and modifications may occur to one skilled in the art 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. An electric circuit interrupter of the explosion chamber type comprising an insulating casing forming a pressure-confining chamber, an arc-extinguishing liquid substantially filling said chamber, a plurality of contact members, each pivotally mounted with respect to said casing disposed within said chamber, coacting fixed contact structure arranged to form with said contact members a plurality of breaks in series in the circuit, said casing having a pressure exhaust port opposite end of said breaks, an operating member for moving said contact members substantially in unison, a butt contact connected in series with said contact members and carried by said operating member at one end of said chamber, and a movable switch member for coacting with said butt contact exteriorly of said chamber.

2. An electric circuit interrupter of the explosion chamber type comprising an arc-extinguishing liquid, an insulating casing forming a pressure-confining chamber immersed in said liquid, contact structure arranged to form a plurality of breaks in series in the circuit within said chamber including a plurality of movable contact members, coacting fixed contacts mounted with respect to said casing and an operating carriage connected to said contact members for moving the same in unison, said casing having exhaust ports adjacent and opposite breaks formed at contact members arranged so that arc pressure created within said chamber causes interruption of the arc at said breaks and a resilient connection between said operating carriage and the contact members opposite said exhaust ports for permitting independent acceleration of the opening movement of said contact members in response to arc pressure.

3. An electric circuit breaker of the explosion chamber type comprising an arc-extinguishing

liquid, an insulating casing forming a pressure-confining chamber immersed in said liquid, relatively movable contact structure mounted within said chamber for forming a plurality of breaks in series in the circuit including a plurality of independently pivoted contact members and coacting fixed contacts, said casing having exhaust ports opposite the breaks formed at said pivoted contact members, said ports being alternately staggered with respect to opposite sides of said chamber, and operating means connected to said pivoted contacts for operating the same substantially in unison.

4. An electric circuit breaker of the explosion chamber type comprising an arc-extinguishing liquid, an insulating casing forming a pressure-confining chamber immersed in said liquid, relatively movable contact structure mounted within said chamber arranged to form a plurality of breaks in series in the circuit including a plurality of independently pivoted contact members and fixed coacting contacts, said casing having exhaust ports adjacent and opposite breaks formed at contact members arranged so that arc pressure within said chamber drives arc-extinguishing liquid through the arc at said breaks, an operating carriage for moving said pivoted contact members substantially in unison including rigid means for effecting immediate and positive opening movement of said contact members and a resilient connection between said carriage and each of said contact members for permitting independent limited opening movement of said contact members in response to arc pressure.

5. An electric circuit breaker of the liquid blast type comprising means forming a pressure confining casing, an arc-extinguishing liquid in which said casing is immersed, relatively movable contacts mounted within said chamber arranged to form at least two breaks in series in the circuit to be interrupted, said casing having an exhaust port disposed adjacent and opposite one of said breaks and arranged so that arc pressure created within said chamber is effective to drive arc-extinguishing liquid through said port to extinguish the arc thereat, and a movable switch member operable within said liquid exteriorly of said chamber for controlling the movable contact structure in said chamber and being in series therewith, circuit opening movement of said switch member causing initially separation of the contact structure within said chamber for interrupting the circuit and subsequently separation of said switch member from said contact structure to form an isolating gap in said liquid.

6. An electric circuit breaker of the liquid blast type comprising relatively movable contact structure separable within an arc-extinguishing liquid, means forming an insulating pressure confining chamber for enclosing a comparatively fixed portion of said contact structure, said fixed portion including a plurality of

contact elements adapted to form a plurality of breaks in series in the circuit, said chamber being provided with exhaust ports disposed adjacent and opposite certain of said breaks so that arc pressure created within said chamber is effective to drive arc-extinguishing liquid through the breaks at said ports, means for biasing said contact elements towards open-circuit position, and movable switch structure coacting with said contact elements exteriorly of said pressure-confining chamber so as to bias said contact elements to the closed circuit position and to break connection therewith subsequent to circuit-opening movement of said contact elements.

7. An electric circuit breaker of the liquid blast type comprising relatively fixed contact structure adapted to form a plurality of breaks in series, an insulating casing forming a pressure-confining chamber for said contact structure, a movable switch member adapted to be connected in series with said fixed contact structure operable exteriorly of said chamber, an arc-extinguishing liquid in which said fixed and movable contact structures are immersed, said insulating casing having exhaust ports adjacent and opposite certain of said breaks so that arc pressure created within said chamber is effective to drive arc-extinguishing liquid through the breaks at said ports, said movable switch member being operative to bias said fixed contact structure to close said breaks in the circuit-closing operation and adapted in the circuit-opening operation to form an isolating break with respect to said fixed structure subsequent to formation of the aforesaid breaks in said chamber.

8. An electric circuit breaker of the liquid blast type comprising a fixed insulating casing forming an explosion chamber, relatively movable contacts mounted for limited movement within said chamber and arranged to form a plurality of breaks in series in the circuit, an arc-extinguishing liquid in which said insulating casing is immersed, said insulating casing having exhaust ports adjacent and opposite certain of said breaks so that arc pressure created within said chamber is effective to drive arc-extinguishing liquid through the arcs at said breaks, means for operating as a unit said contact structure within said explosion chamber and a coacting movable switch member operable in said arc-extinguishing liquid exteriorly of said chamber for biasing said unit to the closed circuit position in accordance with the circuit-closing operation and for controlling opening movement of said unit in accordance with initial circuit-opening movement of said switch member, the circuit-opening operation within said chamber being effective to interrupt said circuit independently of said movable switch member, said movable switch member being movable into said arc-extinguishing liquid so as to form an isolating gap between said member and said explosion chamber.

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CERTIFICATE OF CORRECTION.

Patent No. 2,098,801.

November 9, 1937.

HENRY V. ERBEN.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, line 46, claim 1, for the word "end" read each; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 25th day of January, A. D. 1938.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.

DISCLAIMER

2,098,801.—*Henry V. Erben*, Philadelphia, Pa. HIGH VOLTAGE ELECTRIC CIRCUIT INTERRUPTER. Patent dated November 9, 1937. Disclaimer filed June 16, 1939, by the assignee, *General Electric Company*.
Hereby enters this disclaimer to claim 1 in said specification.
[*Official Gazette July 11, 1939.*]