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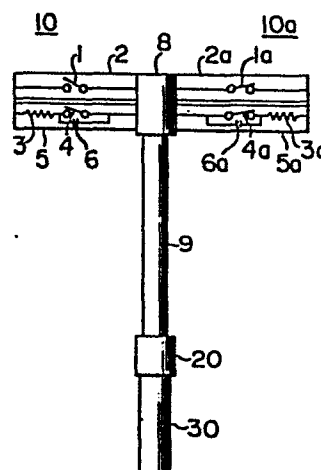
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54 Circuit breaker of porcelain insulator type.

57 Disclosed is a circuit breaker of the porcelain insulator type provided with a main breaking section having a plurality of series connected breaking contacts (1;1a), and a resistor contact device including a series connection of a resistor (3;3a) and a resistor contact (4;4a) and a capacitor device (6;6a) which are connected in parallel with each of the breaking contacts, in which each breaking contact (1) is mounted in a porcelain insulator (2) and the resistor contact device (3,4) and the capacitor device (6) associated with the breaking contact (1) are mounted in another porcelain insulator (5) disposed in parallel with the first-mentioned porcelain insulator (2).

FIG. 1



CIRCUIT BREAKER OF PORCELAIN INSULATOR TYPE

1 The present invention relates to a circuit breaker
of the porcelain insulator type, and more particularly
to a circuit breaker of the porcelain insulator type
having a capacitor means and a resistance contact means
5 which are electrically connected in parallel with a breaking
section.

A high-voltage gas-filled circuit breaker of the
porcelain insulator type has a main breaking section
having a plurality of series-connected breaking contacts;
10 a resistance contact means including a series connection of
a resistor and a resistor contact and connected in parallel
with each of the breaking contacts in order to insert the
resistor prior to closing of the main breaking section
for preventing a switching overvoltage in closing of the
15 main breaking section (pre-insertion resistor), or
prior to opening of the main breaking section for moderating
the recovery voltage condition in opening of the breaking
section (opening resistor); and a capacitor means connected
in parallel with each of the breaking contacts in order
20 to make the voltage distribution uniform among the break-
ing contacts when the main breaking section is opened.
In the conventional circuit breaker of this type, as
disclosed for example in U.S. Patent No. 4,365,126 issued
to Oshima et al. and entitled "GAS CIRCUIT BREAKER",
25 the main breaking section, the resistor contact means and

1 the capacitor means are mounted in three separate
porcelain bushings, respectively, which are disposed
in parallel to each other so as to constitute one breker
unit. A circuit breaker is arranged by a suitable
5 number of such breaker units corresponding to the number
of desired breaking contacts, for example, two breaker
units, which are mounted to a bracket supported by an
upright porcelain bushing.

Thus, the conventional circuit breaker of the
10 porcelain insulator type employs three porcelain insu-
lators for every unit. Each of the porcelain insulators
for a circuit breaker of 500 kv class, for example, has
a diameter of about 30 cm, a length of about 200 cm and
a large weight and therefore there arises a problem
15 such that the supporting porcelain insulator and the
bracket are required to be sufficiently large and strong
for supporting the breaker units of the breaker, result-
ing in higher producing cost and large mounting space.

An object of the present invention is to
20 provide a more economical circuit breaker of the
porcelain insulator type.

According to the present invention, in a cir-
cuit breaker of the porcelain insulator type provided
with a main breaking section having a plurality of
25 breaking contacts, and a resistor contact means and a
capacitor means which are connected in parallel with
each of the breaking contacts, each of the breaking
contacts is mounted in a porcelain insulator, and both of

1 the resistor contact means and the capacitor means,
which are connected in parallel with the breaking contact,
are mounted in another porcelain insulator, so that a
circuit breaker unit composed of each of the breaking
5 contacts and the associated resistor contact means and
capacitor means is mounted in two porcelain insulators.

The features and advantages of the present
invention will be fully understood from the following
description taken in conjunction with the accompanying
10 drawings in which:

Fig. 1 is a schematic diagram illustrating
the basic arrangement according to the present invention;

Fig. 2 is a cross-section of a porcelain
insulator in which a resistor contact means and a
15 voltage dividing means are mounted;

Figs. 3 and 4 are cross-sections illustrating
various arrangements of capacitors of the voltage divid-
ing means; and

Fig. 5 is a cross-section along the V - V
20 line of Fig. 4.

Referring to Fig. 1, the basic arrangement of
the present invention will be described. Fig. 1 shows
an example in which a main breaking section of a breaker
is constituted by two series-connected breaking contacts
25 1 and 1a. A resistor contact means including a resistor
3 and a resistor contact 4 connected in series with each
other and a capacitor means including a capacitor 6 are
connected in parallel with the breaking contact 1 so as

1 to constitute one breaker unit 10. Similarly, another
resistor contact means and a capacitor means are connected
in parallel with the other breaking contact 1a so as to
constitute another breaker unit 10a. The electrical
5 connection between each breaking contact and the associ-
ated resistor contact means and capacitor means are
performed basically in the same manner as that in the
conventional one.

The breaking contact 1 is mounted in a porcelain
10 insulator 2, and the associated resistor contact means
and capacitor means are mounted in another porcelain
insulator 5 disposed in parallel with the porcelain
insulator 2. Similarly, the other breaking contact 1a
and the associated resistor contact means and capacitor
15 means are respectively mounted in porcelain insulators
2a and 5a disposed in parallel with each other. The
breaker unit 10 including the porcelain insulators 1 and
5 and the breaker unit 10a including the porcelain
insulators 1a and 5a are symmetrically supported by an
20 upright supporting porcelain insulator 9 through a
bracket 8. The supporting porcelain insulator 9 is
fixed on a base structure including a supporting base
30 and a housing 20 containing therein an actuator device
of the breaker. The actuator device in the housing 20
25 serves to actuate the main contacts 1 and 1a and the
resistor contacts 4 and 4a through a connecting mecha-
nism mounted in the porcelain insulator 9 and a link
mechanism mounted in the bracket 8. In the arrangement

1 as described above, the detailed description with respect
to the construction other than the porcelain insulators
5 and 5a in which the resistor contact means and the
capacitor means are mounted is omitted here because it
5 is the same as that in the conventional apparatus
disclosed, for example, in the above-mentioned U.S. Patent
No. 4,365,126.

According to the present invention, the resistor
contact means and the capacitor means are mounted in one
10 porcelain insulator. An embodiment of such an arrange-
ment will be described by referring to Fig. 2. The
opposite ends of the porcelain insulator 5 are hermetic-
ally sealed by end plates 15 and 16, respectively and
an insulating gas such as SF₆ is filled in the porcelain
15 insulator 5. An end of the resistor 3 is fixed to the
end plate 15. A terminal plate 13 and a fixed contact
11 are attached on the other end of the resistor 3. An
electrically conductive guide cylinder 17 is fixed on
the end plate 16. A movable contact 12 is slidably
20 supported in the guide cylinder 17 so as to perform
closing and opening operation with respect to the fixed
contact 11. The guide cylinder 17 is electrically
connected to the movable contact 12 and a terminal plate
14 is fitted or fixed on the outer periphery of the
25 guide cylinder 17. A capacitor 6 having a predetermined
capacitance is provided between the terminal plates 13
and 14. The arrangement excepting the terminal plates
13 and 14 and the capacitor 6 is the same as the

1 conventional resistor contact means. According to the
present invention, in order to mount the capacitor 6
in the porcelain insulator 5 together with the resistor
contact means, the capacitor 6 is supported between the
5 electrically conductive terminal plate 13 mechanically
fixed on and electrically connected to the other end
of the resistor 3 or the neighborhood thereof and the
electrically conductive terminal plate 14 mechanically
fixed to and electrically connected to the guide
10 cylinder 17.

In the embodiment of Fig. 2, the capacitor 6 is
constituted by a plurality of annular capacitor elements
6-1 stacked in a generally cylindrical form to provide
a space for containing the resistor contact mechanism
15 4 inside the capacitor 6. The capacitor elements 6-1,
each provided at opposite end surfaces with metal
layers, are electrically connected in series to each
other. The junction portion between the capacitor 6
and the terminal plate 13 is shown in Fig. 3. The
20 terminal plate 13 is formed in its inner side with an
annular groove 21 and the end annular capacitor element
6-1 is loosely fitted into the groove 21. A spring 23
and a metallic annular plate 29 are disposed between
the end annular capacitor element 6-1 and the bottom
25 surface of the groove 21 so as to urge the capacitor
6 against the terminal plate 14 on the opposite side
thereby to ensure the electrical connection between the
capacitor 6 and each of the terminal plates 13 and 14.

1 The junction portion between the capacitor 6 and the
terminal plate 14 is arranged similarly to that between
the capacitor 6 and the terminal plate 13 except that
the end of the capacitor 6 is directly inserted into
5 the annular groove formed in the terminal plate 14
with no metallic plate and no spring. Further, three
or more insulated rods, of which only two rods 28a and
28b are shown in Fig. 3, are provided for assuring
alignment of the capacitor elements. Each of the rods
10 has a threaded end which is fixedly screwed into a
threaded hole of the terminal plate 13, as shown in
Fig. 3, and another threaded end which is inserted into
a through-hole of the terminal plate 14 and fixed by a
nut (not shown). The rods are circumferentially
15 disposed so as to be tightly in contact with the inner
surfaces of the capacitor elements thereby assuring
alignment of the capacitor elements. It will be under-
stood, however, that any other suitable method may be
used for holding the capacitor elements between the
20 terminal plates 13 and 14.

A modification of the capacitor 6 is shown in
Figs. 4 and 5. In this embodiment, the capacitor 6 is
constituted by four stacks of capacitor elements 6a, 6b,
6c and 6d circumferentially disposed around the resistor
25 contact 4. Any number of the stacks, however, may be
used, as a matter of design choice and may be disposed
in any positional relationship so long as they do not
adversely affect the resistor contact 4. Fig. 4 shows

1 the junction portion between the terminal plate 13 and
each stack. Each of the capacitor element stacks 6a,
6b, 6c and 6d is contained in an insulator tube 24.
Four annular grooves 26 are formed in the inner surface
5 of the terminal plate 13 at its circumferential periphery.
Each annular groove 26 is formed to have a dimension
such that the end portion of the insulator tube 24 can
be loosely fitted therein and an island portion 27
encircled by the annular groove 26 facilitates the
10 electrical contact with the capacitor stack 6a-6d.
Similarly, annular grooves for receiving the respective
capacitor stacks are formed in the terminal plate 14.
A spring 25 and a metallic plate 30 are provided between
the island portion 27 and the stack 6a-6d for urging
15 the stack against the terminal plate 14, while no spring
and no metallic plate are required at the terminal 14
side.

In the arrangement of the above-mentioned
embodiment, as seen in Fig. 1, a series connection of
20 the resistor 3 and the capacitor 6 is electrically
connected in parallel with the breaking contact 1, while
each of the capacitor and the resistor is connected in
parallel with the main breaking contact in the prior
art breaker.

25 Generally, the capacitance of the capacitor
is selected to be several hundreds to several thousands
pico farads (PF) which is sufficiently large relative to
the stray capacitance between the main breaking section

1 1 and the resistor contact 4 and the stray capacitance
between the bracket 8 and the earth, which are totally
in an order of several tens PF. This capacitance of
the capacitor provides an impedance value of about
5 $10^6 \sim 10^7 \Omega$ with respect to an A.C. high voltage of
commercial frequency. The resistor 3 is generally
several hundreds Ω for the pre-insertion purpose.
Accordingly, even if the capacitor and the resistor are
connected in series with each other, the impedance is
10 not so different from the case where only the capacitor
is connected and substantially the same effect can be
obtained in voltage distribution.

As described above, according to the present
invention, one porcelain insulator can be reduced for
15 every breaker unit so that an economical circuit breaker
of the porcelain insulator type can be produced. Further,
it will be easily understood for a skilled person in the
art that the present invention is not limited to the
embodiments described above but various modifications
20 can be made without deviating from the scope of the
invention. For example, the capacitor 6 may be connected
to an intermediate portion of the resistor 3, while it
is connected between the resistor 3 and the resistor
contact 4 in the embodiment described above.

CLAIMS

1. A circuit breaker of the porcelain insulator type provided with a main breaking section having a plurality of series connected breaking contacts (1;1a),
5 resistor contact means connected in parallel with each of said breaking contacts and including a series connection of a resistor (3;3a) and a resistor contact (4;4a), and capacitor means (6;6a) connected in parallel with each of said breaking contacts, said circuit
10 breaker comprising:

a first porcelain insulator (2;2a) mounting therein each of said breaking contacts; and

a second porcelain insulator (5;5a) mounting therein said resistor contact means (3,4;3a,4a) and said
15 capacitor means (6;6a) and being disposed in parallel with said first porcelain insulator.

2. A circuit breaker of the porcelain insulator type according to claim 1, in which said main breaking section includes two series connected breaking contacts
20 (1;1a); and in which a first breaker unit including a first porcelain insulator (2) mounting therein one (1) of said two breaking contacts and a second porcelain insulator (5) mounting therein said resistor contact means (3,4) and said capacitor means (6) respectively
25 associated with said one breaking contact (1) and a second breaker unit including another first porcelain insulator (2a) mounting therein the other (1a) of said two breaking contacts and another second porcelain

insulator (5a) mounting therein said resistor contact means (3a,4a) and said capacitor means (6a) respectively associated with said other breaking contact (1a) are symmetrically supported by a single upright supporting
5 porcelain insulator.

3. A circuit breaker of the porcelain insulator type according to claim 1, in which said capacitor means (6;6a) is constituted by a plurality of annular capacitor elements (6-1) piled up to form a stack having
10 therein a cylindrical space, and in which said resistor contact (4) of said resistor contact means is disposed in said cylindrical space.

4. A circuit breaker of the porcelain insulator type according to claim 3, in which one end of said
15 resistor (3) is fixed at one end portion of said second porcelain insulator (5) and said resistor contact (4) includes a fixed contact (11) connected to another end of said resistor (3) and a movable contact (12) slidably supported in and electrically connected to an electrically
20 conductive guide tube (17) connected to another end portion of said second porcelain insulator (5), and in which said capacitor means (6) is supported between a first terminal plate (13) fixed and electrically connected to said resistor (3) and a second terminal plate (14)
25 fixed and electrically connected to said guide tube (17).

5. A circuit breaker of the porcelain insulator type according to claim 1, in which said capacitor means (6) includes a plurality of capacitor units (6a,6b,6c,6d),

each of said capacitor units being constituted by a plurality of capacitor elements piled up to form a stack, said plurality of capacitor units being disposed so as to form a space surrounded by them said resistor contact
5 (4) of said resistor contact means being disposed in said space.

6. A circuit breaker of the porcelain insulator type according to claim 5, in which one end of said resistor (3) is fixed at one end portion of said second
10 porcelain insulator (5) and said resistor contact (4) includes a fixed contact (11) connected to another end of said resistor (3) and a movable contact (12) slidably supported in and electrically connected to an electrically
conductive guide tube (17) connected to another end
15 portion of said second porcelain insulator (5), and in which said capacitor means (6) is supported between a first terminal plate (13) fixed and electrically connected to said resistor (3) and a second terminal plate (14) fixed and electrically connected to said guide tube (17).

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FIG. 1

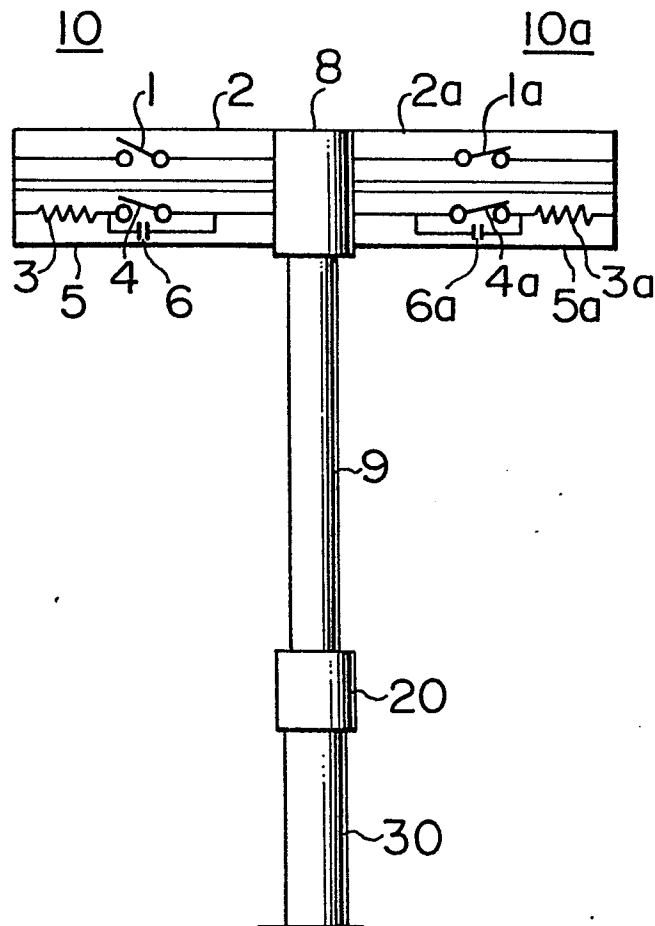


FIG. 2

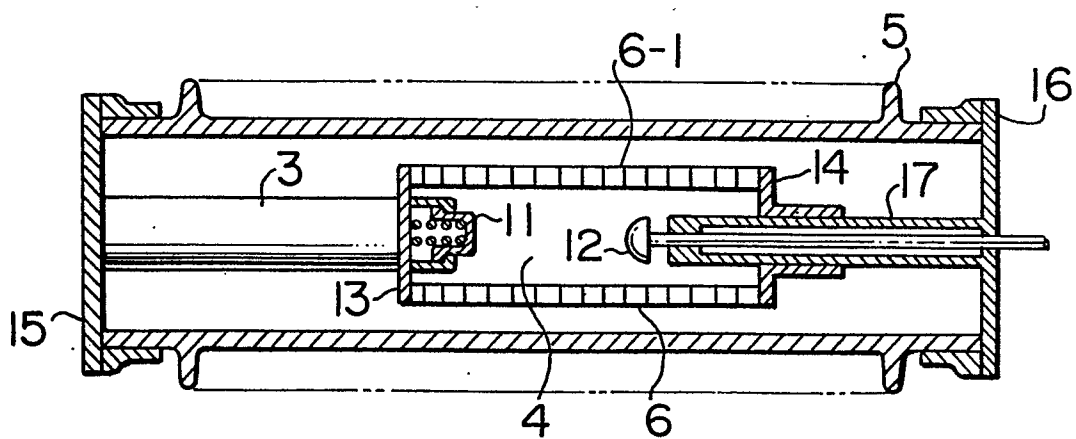


FIG. 3

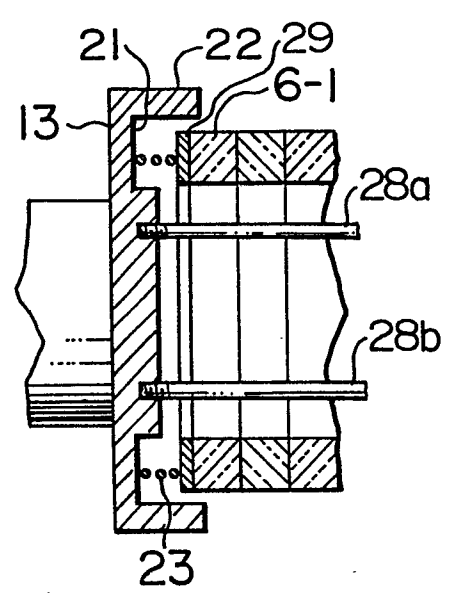


FIG. 4

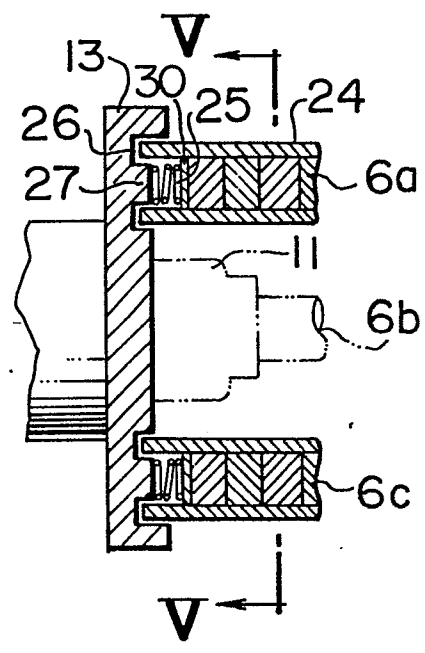
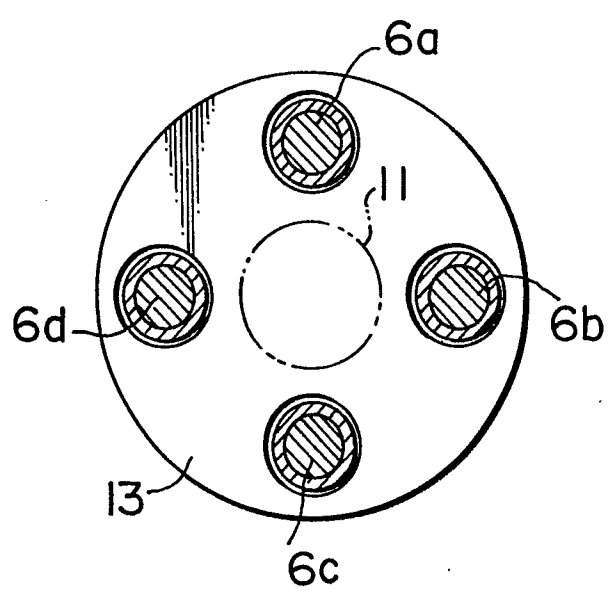


FIG. 5





European Patent
Office

EUROPEAN SEARCH REPORT

0106315

Application number

EP 83 11 0179

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Y	CH-A- 242 103 (MASCHINENFABRIK OERLIKON) * Page 4, lines 34-86 *	1	H 01 H 33/16
Y	CH-A- 460 907 (ASSOCIATED ELECTRICAL INDUSTRIES) * Figure 7; column 4, line 62 - column 5, line 32 *	1,2	
A	CH-A- 578 244 (SKODA) * Column 1, line 67 - column 2, line 56 *	3	
A	DE-B-1 149 073 (INSTITUT PRUEFFELD FÜR ELEKTRISCHE HOCHLEISTUNGSTECHNIK) * Figure *	1	
A	EP-A-0 024 252 (SIEMENS) * Figure 2 *	1	H 01 H 33/00
A	FR-A-2 196 516 (GRATZMULLER) * Figure 1 *	1	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 25-01-1984	Examiner JANSSENS DE VROOM P.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			