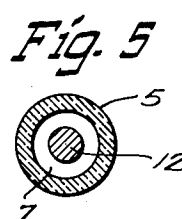
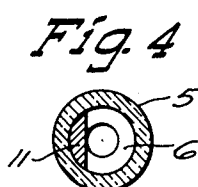
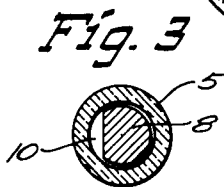
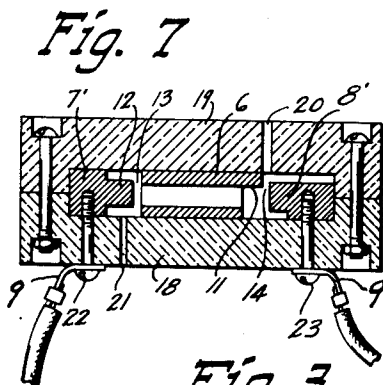
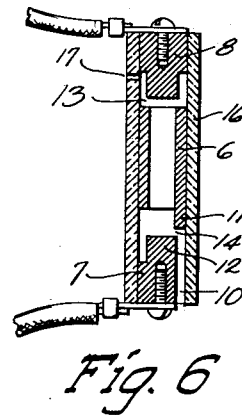
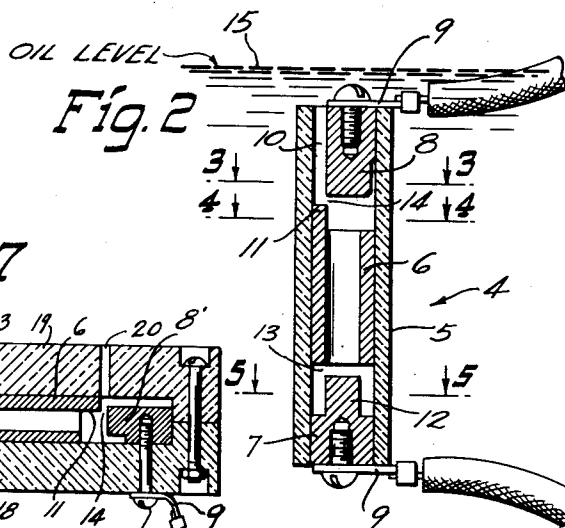
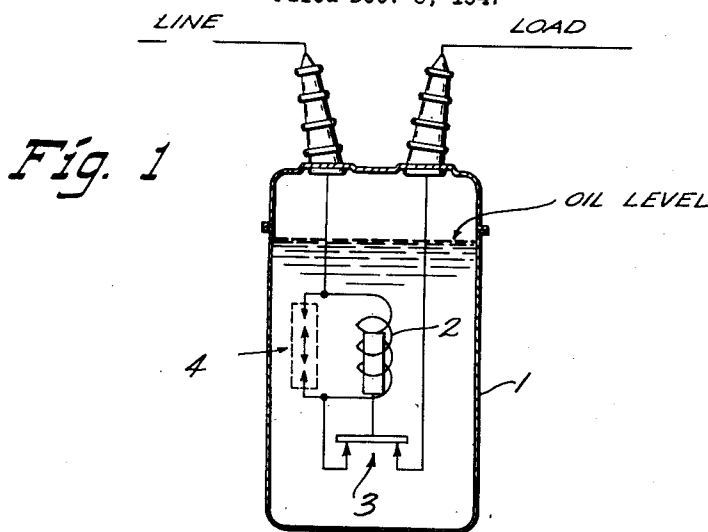


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EXPULSION GAP CONSTRUCTION

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EXPULSION GAP CONSTRUCTION

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2 Claims. (Cl. 313—232)

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This invention relates to an expulsion gap which may be used as a lightning arrester or as a means for limiting the potential across the terminals of an electrical instrumentality.

Objects of this invention are to provide an expulsion gap which is adapted to be submerged in oil or other suitable dielectric and which is so made that it will definitely limit the value to which the potential can rise across the terminals of the gap before the gap will break down, and which is so made that it has one closed end and one open end with a spark gap adjacent each end, the construction providing for the generation of gas pressure adjacent the closed end to force the column of liquid dielectric through the other gap to deionize the other gap so that the arc becomes extinguished at the first current zero of the alternating current wave.

It is customary to put circuit interrupters in a power line and these circuit interrupters, whether of the single shot or repeater type, are provided with an operating coil. When a lightning surge occurs on the line, the operating coil being in series with the line has a high potential difference between its terminals frequently sufficient to injure the coil.

A specific object of this invention is to provide a construction whereby the potential difference between the terminals of the operating coil of the circuit interrupter is limited to a predetermined safe value, and to so construct the expulsion gap that it may be bridged directly across the terminals of the operating coil so that it will arc over when the potential across the terminals of the coil rises above a predetermined value and will interrupt follow-through current so that thereafter the normal flow of current is through the operating coil so as to actuate the circuit interrupter in the normal manner in the event an overload occurs.

Embodiments of the invention are shown in the accompanying drawings, in which:

Figure 1 is a sectional view through a circuit interrupter showing the device in place, such view being partially diagrammatic.

Figure 2 is an enlarged, sectional view through the expulsion gap.

Figures 3, 4, and 5 are sectional views on the lines 3—3, 4—4, and 5—5, respectively, of Figure 2.

Figures 6 and 7 are sectional views through other forms of expulsion gaps.

In the drawings the protective expulsion gap has been shown associated with a circuit interrupter, which latter has been conventionally il-

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lustrated, and may be either a single shot or a repeater type of circuit interrupter.

Referring to the drawings, it will be seen that the circuit interrupter is housed within a casing 1 and comprises an operating coil 2 and the switch means indicated generally at 3. The operating coil is connected in series with the line as shown, and it will be seen that when a surge, for example a lightning surge originating on the line, that the operating coil will have a high potential across its terminals. The expulsion spark gap 4 is connected directly across the terminals of the operating coil 2 of the circuit interrupter as shown in Figure 1 and it is designed to limit the voltage difference between the terminals of the operating coil 2 to a reasonable predetermined value that will not injure the coil.

The specific construction of the expulsion gap is shown in Figures 2, 3, 4, and 5. It will be noted that the expulsion gap indicated generally by the reference character 4 comprises an insulating tube 5 within which is located a central metallic sleeve or electrode 6, a lower electrode 7 and an upper electrode 8. The upper and lower electrodes 8 and 7 are provided with terminal members or connectors 9. The upper electrode 8 has a cutaway portion which provides a passage 10, and adjacent the lower corner portion of the cutaway portion of the upper electrode 8 a lip 11 is formed on the cylindrical central electrode 6. The corner of the lip 11 and the lower corner of the cutaway portion of the upper electrode 8 are the closest portions and provide the minimum sparking distance so that when the gap breaks down, an arc will be formed between these two corner portions.

The lower electrode 7 is provided with an upwardly projecting central portion 12 which is spaced downwardly from the bottom of the tubular central electrode 6 and when the gap breaks down an arc will be formed between the edge of the central electrode 6 and the edges of the central portion 12 of the lower electrode. It will be seen, therefore, that the expulsion gap has an auxiliary spark gap 13 and a main spark gap 14.

The expulsion gap is located below the oil level indicated generally by the reference character 15 in Figure 2 and consequently the interior of the expulsion gap is filled with oil or other suitable dielectric. When a surge occurs an arc is formed at both the main and auxiliary gaps 14 and 13. The heat of the arc at the auxiliary gap 13 will produce gas pressure which will drive the column of oil in the central electrode 6 upwardly

and across the main gap 14 thus deionizing the gap. This will cause extinction of the arc at the first current zero and will prevent follow-through current from passing through the gap. The circuit interrupter thereafter functions in the ordinary capacity and the line current passes through the operating coil 2 of the circuit interrupter.

In the form of the invention shown in Figure 6 substantially the same construction as that shown in Figure 2 is employed except that the expulsion gap is turned upside down and a small auxiliary vent 17 is formed in the insulating tube 16. The purpose of this auxiliary vent 17 is to allow the escape of gases after the device has operated so that it will be refilled with oil.

In the form of the invention shown in Figure 7 the expulsion gap occupies a horizontal position. The intermediate electrode 6 is exactly like that heretofore described and the end electrodes 7' and 8' are substantially like the end electrodes 7 and 8 with the exception that the screws 22 and 23 for connecting the terminal members or connectors 9 enter laterally instead of from the ends. In this form of the invention the electrodes are carried between the two portions 18 and 19 of molded insulating blocks held together in any suitable manner. The main passage through which the oil is forced is indicated at 20 and is so positioned that the oil is forced across the main spark gap 14 as heretofore described. A small auxiliary passage 21 is provided so that the device can refill itself with oil after it has operated.

It is to be understood that the expressions "tube" or "tubular" are not to be limited to a cylindrical structure or cavity but are intended to cover any device having an elongated internal cavity whose cross-section may be round, rectangular, square or of any other shape.

It will be seen that this expulsion gap may be used on the one hand to limit the potential difference between the terminals of an electrical instrumentality and is specifically useful for protecting the operating coil of a circuit interrupter connected in a power line.

It will be seen also that the expulsion gap can be connected between the line and ground to act as a lightning arrester. Under either condition, the expulsion arc gap is submerged in oil or other suitable dielectric and has two gaps in series, one, the auxiliary gap adjacent its closed end for generating gas pressure, and the other, the main gap adjacent its open end, the main gap being deionized by the oil which is forced from adjacent the auxiliary gap through the main gap.

It will be noted that the expulsion gap is a relatively small structure and can be easily installed within the tank of an ordinary circuit interrupter and requires a minimum amount of room.

It is to be noted also that the expulsion gap is a self-clearing gap or a self-restoring gap as it suddenly projects a stream of oil through one of the gaps to thus deionize such gap.

The expression "oil" is intended to cover any suitable liquid dielectric.

Although this invention has been described in considerable detail, it is to be understood that such description is intended as illustrative rather

than limiting, as the invention may be variously embodied and is to be interpreted as claimed.

We claim:

1. In a device of the class described, a container for oil, an expulsion gap mounted within the container below the oil level, said expulsion gap comprising an elongated insulating tube having a first and a second end, said second end being permanently closed, a first end electrode closing the major part of said first end of said tube and having a cut-away portion providing a passageway, a second end electrode adjacent the second end of said tube, and a central electrode spaced from said first and second end electrodes to form main and auxiliary spark gaps with said first and second electrodes, respectively, and having a tongue in close proximity to said first end electrode adjacent the cut-away portion to locate the main spark gap across said passageway, whereby when the expulsion gap functions gas pressure will be generated in the portion of said tube adjacent said auxiliary spark gap and oil will be projected through the main spark gap to deionize said main spark gap.

2. In a device of the class described, a container for oil, an expulsion gap mounted within the container below the oil level, said expulsion gap comprising an elongated insulating tube having a first and a second end, a first end electrode closing the major part of said first end of said tube and having a cut-away portion providing a passageway, a second end electrode permanently closing the second end of said tube, and a central tubular electrode spaced from said first and second end electrodes to form main and auxiliary spark gaps and having a tongue in close proximity to said first end electrode adjacent the cut-away portion to locate the main spark gap across said passageway, whereby when the expulsion gap functions gas pressure will be generated in the portion of said tube adjacent said auxiliary spark gap and the column of oil in said central electrode will be projected through the main spark gap to deionize said main spark gap.

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