

[72] Inventor **Takashi Kunugi**  
Tokyo, Japan  
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[73] Assignee **Kabushike Kaisha Sankosha**  
Tokyo, Japan  
represented by **Yolo Takeuchi**

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*Primary Examiner*—Robert K. Schaefer  
*Assistant Examiner*—William J. Smith  
*Attorney*—Wenderoth, Lind & Ponack

[54] **HIGH VOLTAGE ARRESTER**  
1 Claim, 6 Drawing Figs.  
[52] U.S. Cl. .... 317/31,  
315/35, 317/70  
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16, 31; 313/150, 325; 315/35, 36

**ABSTRACT:** A safety device for safeguarding communications equipment and other electrical machines and instruments when an abnormal voltage is impressed on a system of lines lightening or other phenomena. The safety device comprises two arresters of different capacities for withstanding discharge contained in an arrester casing as a unit and connected in parallel between a line and ground whereby the safety device can cope with a wide range of abnormal voltages.

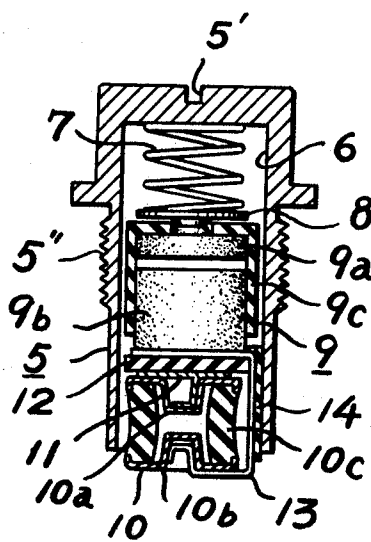


Fig. 1

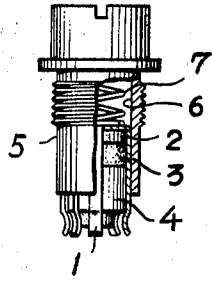


Fig. 2

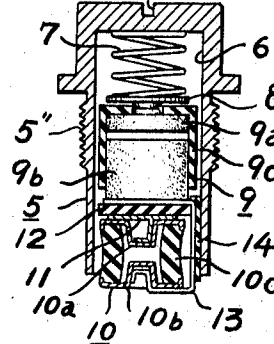


Fig. 3b

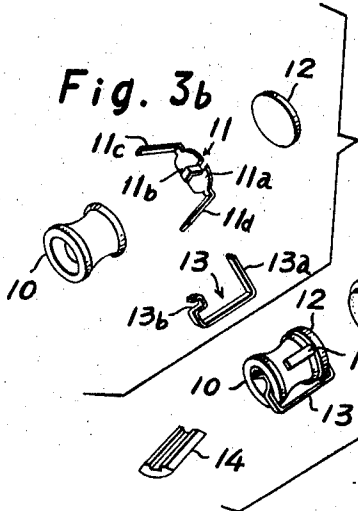


Fig. 3a

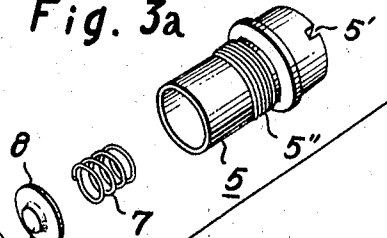


Fig. 4

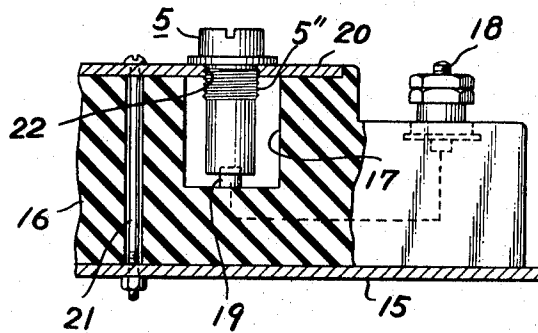
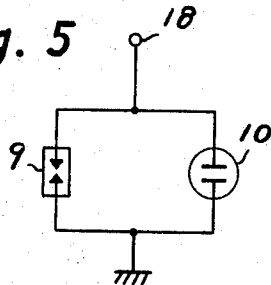


Fig. 5



INVENTOR.  
Takashi Kimugi  
BY  
Wendell B. Bird & Pomeroy  
attys

## HIGH VOLTAGE ARRESTER

### BACKGROUND OF THE INVENTION

In one type of safety device known in the art, a cage-shaped short circuiting conductor for grounding 1, in which are housed one over another a conducting disc 2, a carbon disc 3, and a carbon member 4 covered on its peripheral surface with an insulating material, such as ceramic or the like, so as to electrically insulate same from said short circuiting conductor for grounding 1, is mounted through the agency of spring 7 in a cylindrical space 6 of a conducting arrester casing 5 with one closed end.

In the safety device of this type, discharge is not generally initiated when the voltage of the circuit is at a predetermined level, but when a voltage in excess of a predetermined level or an abnormal voltage due to lightning or other phenomena is impressed on the device, an arc is formed between said carbon disc 3 and said carbon member 4 so as to discharge said abnormal voltage to ground through the arrester casing 5, which abnormal voltage might otherwise flow to the line. Since the prior art safety device contains only one discharge element for causing discharge of an abnormal voltage, it has a disadvantage in that it can cope with only a limited narrow range of abnormal voltages. An additional disadvantage is that when the discharge element is damaged, the safety device has to be replaced by an entire new unit.

The present invention provides a novel safety device which obviates these disadvantages of the prior art safety device.

### SUMMARY OF THE INVENTION

According to the present invention, there is provided a safety device comprising a carbon arrester and a gas-filled arrester differing from each other in their capacity to withstand discharge and connected together by connecting means so as to be contained as a unit in a grounded arrester casing in such a manner that the two arresters are connected in parallel between a line and ground. The present invention makes it possible to obtain an overall compact size in a safety device which safeguards a line, such as communications line, for example, and effect discharge of a wide range of abnormal voltages impressed thereon.

### OBJECTS OF THE INVENTION

A principal object of the invention is to provide a safety device which permits, when an abnormal voltage is applied by lightning or other phenomena to a system of lines, a stream of electricity of such abnormal voltage to proceed to ground so as to thereby protect electrical machines and instruments connected to said system of lines.

Another object of the invention is to provide a safety device comprising a carbon arrester and a gas-filled arrester differing from each other in their capacity to withstand discharge which are connected in parallel between one line and ground to cope with a wide range of abnormal voltages.

Still another object of the invention is to provide a safety device comprising a carbon arrester and a gas-filled arrester differing from each other in their capacity to withstand discharge and connected in parallel by connecting means to be contained in a grounded arrester casing as a unit so as to thereby provide an overall compact size in a lightning protector. Other objects and advantages of the invention will become apparent from consideration of the description set forth hereunder when considered in conjunction with the accompanying drawings.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front view of a safety device of the prior art with certain parts being shown in section;

FIG. 2 is a longitudinal sectional front view of a safety device embodying the present invention;

FIGS. 3a and 3b when taken together are an exploded view of the safety device according to this invention shown in FIG. 2;

FIG. 4 is a longitudinal sectional view showing the manner in which the safety device according to this invention shown in FIG. 2 is mounted on an insulating terminal stand; and

FIG. 5 is a circuit diagram of the safety device according to this invention.

### DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of the invention will now be explained with reference to the drawings. In FIGS. 1, 2 and 3 in which like reference characters designate similar parts, an arrester casing 5 is formed on the top of its head with a screwdriver engaging groove 5'. The arrester casing 5 has also on its external surface below the head an externally threaded portion 5''. A carbon arrester 9 (capacity to withstand discharge, 500 to b 1,000 volts) is inserted in a hollow cylindrical space 6 of the arrester casing 5 through the agency of a spring 7 and a conducting lead disc 8 having a projecting center portion 8'.

The carbon arrester 9 consists of a carbon disc 9a, a carbon member 9b spaced apart from said carbon disc a predetermined distance, and an insulating member 9c connecting said carbon disc and said carbon member together as a unit while keeping them electrically insulated from the arrester casing 5. The carbon disc and carbon members are both exposed at one end, and the carbon disc 9a is electrically connected through said lead disc 8 and said spring 7 to the arrester casing 5 to be grounded.

10 refers to a gas-filled arrester of smaller capacity to withstand discharge (200 to 450 volts) than the carbon arrester 9. The gas-filled arrester 10 comprises two electrodes 10a and 10b spaced apart a distance selected as desired and secured to openings at opposite ends of an insulating tube 10c to provide a seal to the interior of the tube. A projection 11b formed in a planar portion 11a of a short circuiting conductor for grounding 11 is brought into engagement with the concave portion of the electrode 10a of the gas-filled arrester 10 so that one surface of the planar portion 11a may be positioned against the arrester electrode 10a. An insulating disc 12 is positioned against the other surface of the planar portion 11a of the short circuiting conductor 11 opposite to its electrode engaging surface. A generally channel-shaped lead conductor 13 is mounted such as to press against the insulating disc 12 and the electrode 10b of the gas-filled arrester 10 at its bent opposite ends 13a and 13b to hold the gas-filled arrester 10, short circuiting conductor 11 and the insulating disc 12 as a unit.

The unit formed in the manner described above is inserted into the arrester casing 5 in such a manner as to bring the insulating disc 12 into engagement with the carbon arrester 9 already mounted in the arrester casing 5. The bent end portion 13a of the lead conductor 13 is brought into contact with the carbon member 9b of the carbon arrester 9, while the lead conductor 13 is electrically insulated by an insulating member 14 from the arrester casing 5. The short circuiting conductor for grounding 11 has bent opposite ends 11c and 11d which resiliently bear against the inner walls of the arrester casing 5.

In mounting the safety device constructed as described above according to the present invention on an insulating terminal stand 16 of a terminal box 15 disposed at a household service entrance of telephone line, the terminal stand 16 is formed with a recess 17 for inserting the cylindrical portion of the arrester casing 5 therein and an abnormal voltage lead-in terminal 19 connected to a line connector terminal 18 secured to the top of the terminal stand 16 is mounted on the bottom of said recess 17 to project upwardly therefrom as shown in FIG. 4. An earth plate 20 is placed on the upper surface of the portion of the terminal stand 16 in which the recess 17 is formed, and the earth plate 20 and the terminal stand 16 are mounted as a unit by through bolts 21 on a grounded terminal

box. When the arrester casing 5 is inserted in the recess 17, the external threaded portion 5'' thereof threadably engages an opening 22 formed in the earth plate 20 and concentric with the recess 17 so that the arrester casing may be grounded. At the same time, the electrode 10b of the gas-filled arrester 10 and the lead conductor 13 are brought into contact with the abnormal voltage lead-in terminal 19 so that they may be urged upwardly against the biasing force of the spring 7 and the arresters may be connected at one end to the line.

From the foregoing description, it will be seen that the carbon member 9b of the carbon arrester 9 is connected to the terminal 18 through the lead conductor 13 and the abnormal voltage lead-in terminal 19, while the carbon disc 9a thereof is grounded through the conducting lead disc 8, spring 7, arrester casing 5, earth plate 20, through bolt 21 and terminal box 15.

On the other hand, the electrode 10b of the gas-filled arrester 10 is connected to the terminal 18 through the abnormal voltage lead-in terminal 19, and the electrode 10a thereof is grounded through the short circuiting conductor for grounding 11, arrester casing 5, earth plate 20, through bolt 21 and terminal box 15. Thus, the carbon arrester 9 and gas filled arrester 10 are connected in parallel as shown in FIG. 5, so that the line connector terminal 18 is grounded through two arresters differing from each other in their capacity to withstand discharge and connected in parallel.

The safety device provided by the present invention comprises, as aforementioned, a carbon arrester and a gas-filled arrester differing from each other in their capacity to withstand discharge and contained in an arrester casing in such a manner that they are connected in parallel between a line and ground so as to protect the communications line by two arresters. The safety device constructed as aforementioned offers many advantages. It can protect electrical machines and instruments against a wide range of abnormal voltages. Even if one arrester is damaged, the device can cope

with an abnormal voltage by the other arrester, thereby providing increased safety to electrical machines and instruments. The device has particular utility in installations at positions where abnormal voltages often occur or where inspection must often be performed.

I claim:

1. A safety device comprising an elongate metal casing adapted to provide a ground connection, said casing being closed at one end and open at the other; a carbon arrester within said casing and electrically insulated therefrom, a conductive spring located intermediate the closed end of said casing and one electrode of said carbon arrester to provide an electrical connection therebetween; a gas-filled arrester positioned within said casing adjacent the open end thereof, said gas-filled arrester including a pair of electrodes secured to the opposite open ends of an insulating tube, a ground connection conductor in contact with one of said electrodes of the gas-filled arrester remote from said open end of said casing, an insulating plate placed against said ground connection conductor, and a channel-shaped conductive member having its one limb bearing against said insulating plate and its other limb bearing against the other of said electrodes to hold the insulating plate, the ground connection conductor and the gas filled arrester together integrally in abutting relationship, said conductive member being in electrical contact with the other electrode of the carbon arrester and being electrically insulated from the casing, said ground connection conductor having a pair of limbs extending in a direction away from said insulating plate and flaring out to resiliently bear against the diametrically opposite walls of said casing, whereby said both arresters are resiliently held in place within said casing and said conductor is in electrical contact with said casing, said conductive member being adapted to be electrically connected with an electrical line or apparatus to be protected.

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