Nov. 19, 1946. H. C. GILLESPIE 2,411,325

CONTROL OF ELECTRICAL ARCS

Filed July 9, 1943

Fig. 1

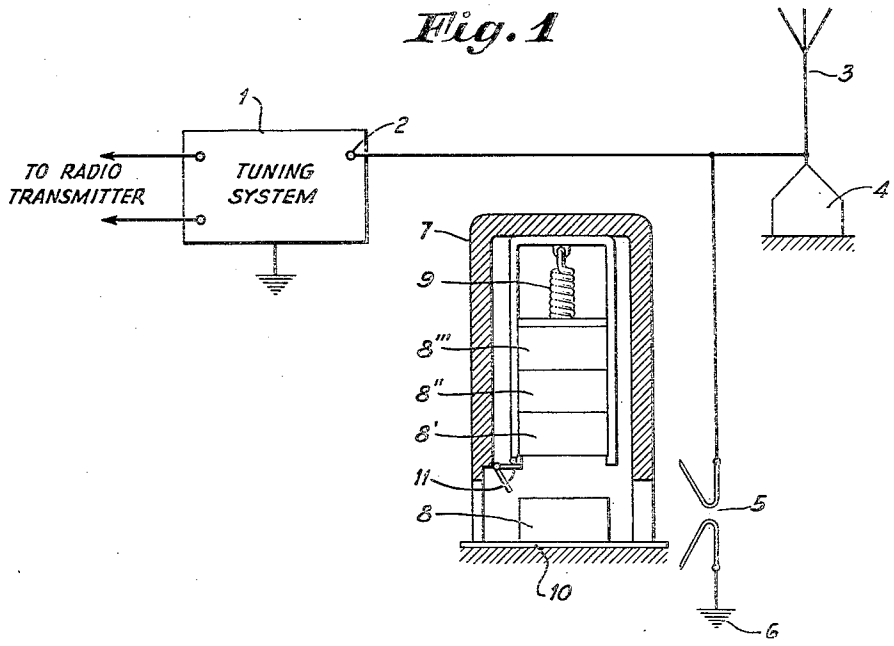
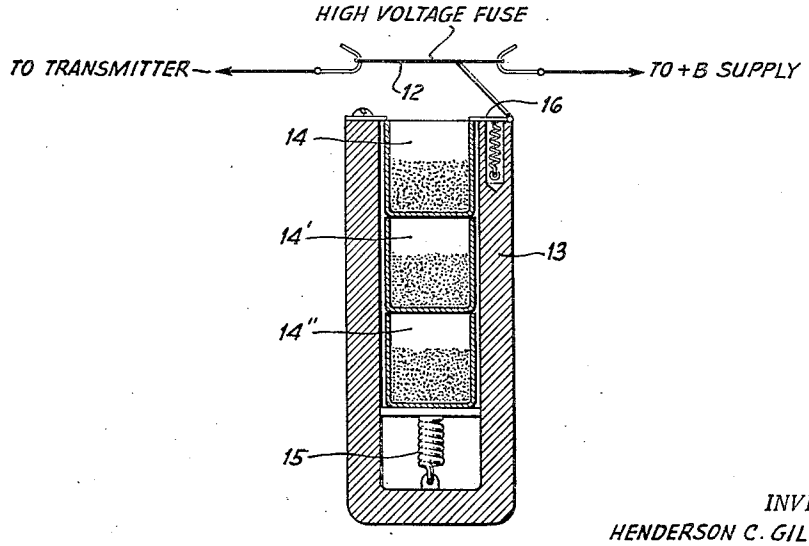


Fig. 2



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CONTROL OF ELECTRICAL ARCS

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6 Claims. (Cl. 315—111)

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This invention relates to a new and useful system of control of electrical arcs and is particularly adapted to rapidly extinguish arcs such as frequently occur in the operation of radio transmitters.

An object of this invention is to provide an improved system for the control of an electric power arc which frequently occurs during periods of thunderstorms, such arcs being caused by atmospheric lightning discharges.

Another object of this invention is to provide a system using a source of rapidly expanding gases to control the direction of an arc discharge and positive interruption thereof.

A feature of this invention is the use of an explosive charge located near the horn gap where electrical discharge occurs.

Another feature of this invention is a modification whereby an explosive charge is located adjacent a high voltage fuse and directed toward it so as to immediately rupture the arc which normally forms when the fuse melts and automatically reloading the charge by means of energy obtained from the explosive discharge.

Interruption of high voltages in high power circuits carrying either direct current or high voltage radio frequency current has always been a problem, particularly such voltages as occur in radio transmitting stations where the arc occurs at the horn gap after a lightning discharge. In the prior art such lightning discharges were frequently extinguished by momentarily shutting down the radio transmitter. This was accomplished by either of two systems. One system was by having a photoelectric cell pointed toward the horn gap and connected through suitable relays to the plate supply of the final radio frequency stage so as to interrupt it when a flash occurred at the gap. I have found that the response of certain explosives to an electric discharge, or light, or heat, provides an automatic actuating means that replaces the photocell and associated relay equipment. By means of my present invention the complexity of this system can be reduced.

The other system, in the operation of a number of radio transmitters form a single rectifier, provided for the fusing of high voltage direct current connections with self-contained fuses to each transmitter as desired. Fuses have been developed to accomplish this operation, but it is found that they suffer from the defect that the vaporized fuse wire when it melts causes a metallic coating on nearby insulators. The conducting film on the insulator thus formed causes

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breakdown to the transmitter. According to my invention this defect can be overcome.

I have found that by employing an external source of rapidly expanding gases (in contrast to the self-contained fuses employed in the second system mentioned) more positive interruptions can be had, with the control of direction of the blast as well.

This invention will best be understood by referring to the accompanying drawing in which:

Fig. 1 shows the arrangement of an explosive charge placed adjacent an antenna horn gap, and

Fig. 2 shows the arrangement of this invention wherein the explosive charge is located near by a high voltage fuse.

Referring now in detail to Fig. 1 of the drawing, a tuning system 1 which connects to a radio transmitter (not shown) is shown as having its antenna terminal 2 connected to the usual antenna 3 which is supported by base insulator 4. Located nearby base insulator 4 and electrically connected to the lead between antenna terminal 2 and antenna 3 is an antenna horn gap 5, the lower portion of which is electrically connected to ground at 6. In accordance with this invention, there is located adjacent the horn gap 5 an explosive magazine 7 which contains a plurality of metal shells 8, 8', 8'', and 8''' each having contained therein an explosive charge, the sheets of explosive charges being assembled one above the other in the magazine 7 and forced downward by means of a spring 9. The magazine 7 has two apertures located diametrically opposite one another in the lower portion thereof. The explosive charge 8 rests upon a support member 10 of fireproof material and is located in such a position relative to the apertures as to control the direction of the electrical discharge and positive rapid interruption thereof by the explosive charge.

In the operation of this system, when an electrical arc occurs at the horn gap 5, the explosive charge 8 is set off and by its rapidly expanding gases immediately extinguishes the arc. The expanding gases of the explosive charge passing through the apertures in magazine 7 at the same time force a spring tensioned pivoted lever or trigger member 11 having any suitable time delay means (not shown) to move, which immediately drops another shell of explosive charge 8' in position after a slight time delay on member 10 to extinguish the next recurring arc discharge.

The modification shown in Fig. 2 is somewhat similar to that shown in Fig. 1 except that the horn gap 5 is dispensed with, and substituted

therefor is a high voltage open fuse 12 which is electrically connected between the anode positive direct current or B supply of the radio transmitter. Located directly below the high voltage fuse there is a magazine 13 having a plurality of metal shells 14, 14' and 14'' containing explosive charges. A spring 15 keeps the shells of explosive charges in the proper position and moves them upward in magazine 13. A spring tensioned trigger member 16 is arranged to have its upper arm bear against fuse 12 to release a successive explosive charge in position for extinguishing the next recurring arc. In the operation of this device the metal shell 14 containing the explosive charge is arranged to have its explosive discharge directed toward the open wire fuse so as to rupture the arc which will normally form after the fuse 12 melts. The explosives employed in the system of this invention are those which are normally more sensitive to spark discharges, also to light and heat. For example gunpowder may be used for spark discharges, and lead azide for heat.

While I have indicated and described a system for carrying my invention into effect, it will be apparent to one skilled in the art that my invention is by no means limited to the particular devices shown and described, but many modifications may be made without departing from the scope of my invention.

What I claim is:

1. A system for rapidly extinguishing an electrical discharge arc comprising an open gap at which point said discharge arc will occur, a magazine containing a plurality of shells each having a rapidly expanding gas charge contained therein and located adjacent said open gap, said magazine having a plurality of apertures in line with said gap, means to retain one of said shells containing said charge in a position near said gap whereby an electrical discharge arc will pass through the apertures in said magazine and cause the charge to be set off and rapidly extinguish the electrical arc.

2. A system for rapidly extinguishing an electrical discharge arc comprising an open gap at which point said discharge arc will occur, a magazine containing a plurality of shells each having an explosive charge contained therein and located adjacent said open gap, said magazine having a plurality of apertures in line with said gap, means to retain one of said shells in a position near said gap whereby an electrical discharge arc will pass through the apertures in said magazine and cause the charge to be set off and rapidly extinguish the electrical arc.

3. A system for extinguishing an electrical discharge arc comprising a horn gap connected in series between a voltage source and ground, a magazine having two apertures therein and containing a plurality of shells each containing an explosive charge, means to retain one of said shells containing an explosive charge in a position near said gap to be set off by the passage of an electrical discharge arc through said apertures, and means to replace another one of said shells containing an explosive charge in a position within said magazine to extinguish a future occurring discharge arc.

4. A system for extinguishing an electrical discharge arc comprising a high voltage horn gap connected in series between a voltage source and ground, a magazine having two apertures therein and containing a plurality of shells each containing an explosive charge, means to retain one of said shells containing an explosive charge in a position near said gap to be set off by the passage of an electrical discharge arc through said apertures, and means including a pivoted trigger to replace another one of said shells containing an explosive charge in a position within said magazine to extinguish a future occurring discharge arc.

5. A system for extinguishing an electrical discharge arc comprising a high voltage horn gap connected in series between a voltage source and ground, a magazine having two apertures therein and containing a plurality of shells each containing an explosive charge, means including a support member of fireproof material to retain one of said shells containing explosive charges in position near said gap to be set off by the passage of an electrical discharge arc through said apertures, and means to replace another one of said shells containing explosive charges in a position within said magazine to extinguish a future occurring discharge arc having a slight time delay from a preceding discharge.

6. A system for rapidly extinguishing an electrical discharge arc comprising an open gap located at a point where said discharge arc will occur, a magazine containing a plurality of shells each containing explosive charges, said magazine being located adjacent said open gap and having a plurality of apertures in line with said gap, means to retain one of said shells in a position near said gap whereby an electrical discharge arc will pass through the apertures in said gap and cause the explosive charge to be set off and rapidly extinguish the electrical arc, and means to replace another one of said shells containing an explosive charge in a position to extinguish a future arc after a slight time delay of a preceding discharge.

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