March 28, 1939. O. B. FREEMAN 2,152,586

SAFETY DEVICE FOR ELECTRICAL APPARATUS

Filed May 4, 1938

Fig. 1.

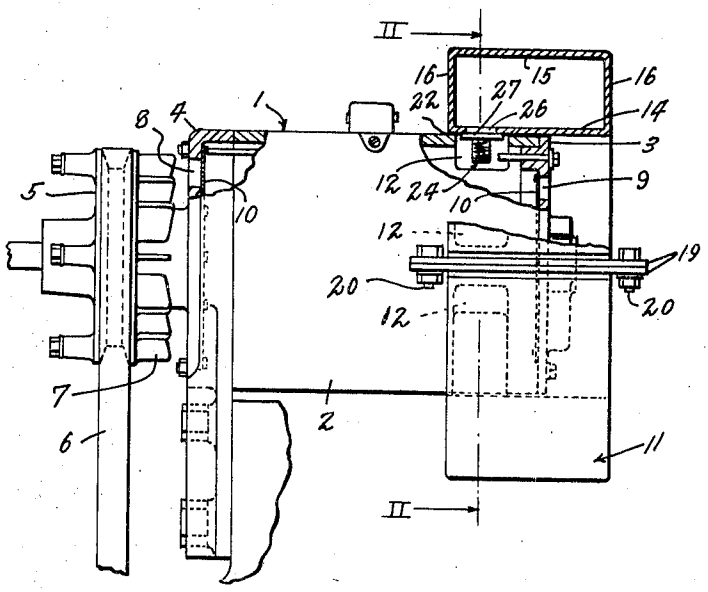


Fig. 2.

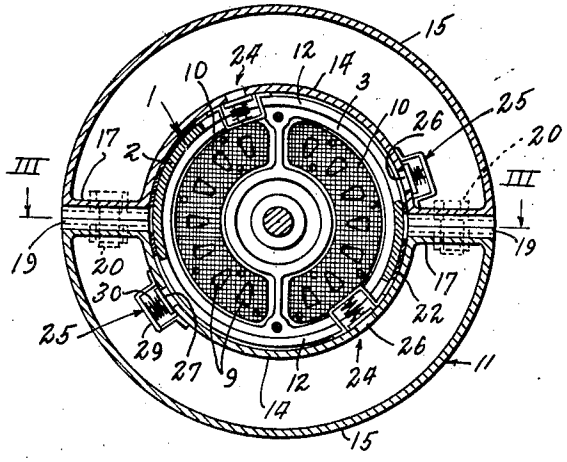
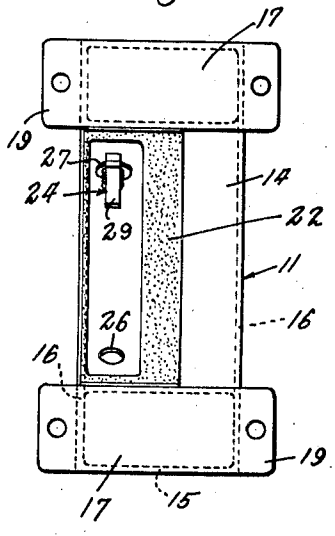


Fig. 3.



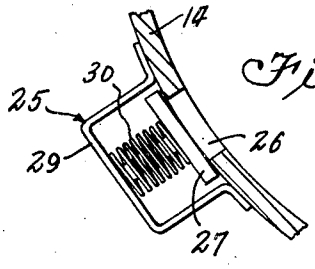


Fig. 4.

Inventor

Orville B. Freeman

By Lyon & Lyon

Attorneys

Patented Mar. 28, 1939 2,152,586

UNITED STATES PATENT OFFICE

2,152,586

SAFETY DEVICE FOR ELECTRICAL APPARATUS

Orville B. Freeman, Ventura, Calif.

Application May 4, 1938, Serial No. 206,091

4 Claims. (Cl. 172—36)

This invention relates to safety devices and constructions for electrical devices having sparking contacts or brushes, when used where explosive gas mixtures may exist.

Many electrical devices are so designed that to avoid overheating they must be ventilated by circulating air through them. If such a device has contacts or brushes subject to sparking, and the cooling air for any reason contains inflammable gases or vapors, the mixture may be exploded by sparks. Such an explosion may wreck the apparatus and/or cause an explosion in the room or other confined space in which the apparatus is located.

This danger has been recognized heretofore, and attempts have been made to minimize it by covering the ventilating openings in the apparatus with wire gauze, or the like. As has been well known since the invention of the Davey safety lamp, a wire gauze will usually prevent the passage of a flame and prevent ignition of an explosive mixture on one side of the gauze by a flame on the other side. However, in order to be thoroughly effective under all conditions, the gauze must be of relatively fine mesh under which condition it is usually lacking in mechanical strength, and a violent explosion within an electric generator having openings covered with wire gauze, may disrupt the gauze. On the other hand, if the gauze is of very fine mesh and relatively strong, there is a possibility that the pressure created by an explosion within the generator cannot be dissipated through the gauze rapidly enough to prevent disruption of the solid walls of the generator.

A broad object of the present invention is to reduce the maximum pressure that can be developed within a closed machine, thereby eliminating danger of disruption of the machine by an explosion, or, if the air openings in the machine are sealed with wire gauze, to prevent the development of pressures sufficiently great to disrupt the gauze.

I achieve this object by providing an auxiliary chamber normally out of communication with the interior of the machine to be protected, but provided with valves which open to permit excess pressure in the machine to escape into the auxiliary chamber, thereby limiting the maximum pressure that can possibly be developed within the machine casing in response to an explosion. In order to subsequently reduce the pressure in the auxiliary chamber to render it operative to control subsequent explosions, I provide other valves between the auxiliary chamber and the machine which open in response to pressure in the chamber in excess of the pressure within the machine to permit the explosion gases to return to the machine and escape through the machine to the atmosphere.

The invention will be better understood from the following detailed description of a particular modification of the invention, with reference to the drawing.

In the drawing:

Fig. 1 is a side elevational view of an electric generator, equipped with the present invention, with portions broken away to better show the construction.

Fig. 2 is a cross section, taken approximately in the plane II—II of Fig. 1;

Fig. 3 is a plan view, looking at the inside face of one half of the explosion chamber shown attached to the generator in Figs. 1 and 2; and

Fig. 4 is an enlarged detailed view of the valve structure employed.

The drawing discloses my invention attached to a standard type of battery-charging generator, such as is employed on automobile engines. Ordinarily such generators are not exposed to explosive gases, and they can be safely cooled by circulating air through the generator casing from one end to the other through openings provided in the end plates. However, it is quite common practice now to employ automobile engines equipped with generators of the type described as stationary engines, which may be located, for example, in a gasoline refinery or in a mine, under which conditions explosive mixtures may frequently exist in the air that is forced through the generator for cooling it. Under such conditions, it is necessary to modify the generator structure if the possibility of dangerous explosions resulting from ignition by sparks at the brushes of the generator is to be prevented.

Referring to the drawing, there is shown a generator 1 having a substantially cylindrical casing 2, the ends of which are closed by end plates 3 and 4. The casing 2 supports the field windings and the end plates 3 and 4 rotatably support the shaft upon which the armature and commutator (not shown) are mounted. A drive pulley 5 is mounted on the shaft exterior of the end plate 4 and may also support a fan (not shown) for circulating air through the cooling radiator for the gasoline engine with which the generator may be associated. It will be understood that the pulley 5 may be driven through a V-belt 6 from a pulley on the engine shaft. The

pulley 5 may also have fan blades 7 mounted on its inner face, which function to produce a suction adjacent the end plate 4 and withdraw air from the interior of the case 2 through openings 8 provided in the end wall 4. Similar openings 9 in the opposite end plate 3 provide for the entry of air into the casing to replace that exhausted through the openings 8.

In order to prevent an explosion within the casing 2 from igniting an explosive mixture surrounding the casing by passage through the openings 8 and 9, these openings are closed by sheets of wire gauze 10 riveted or otherwise secured against the inner surfaces of the end plates 3 and 4, as shown to better advantage in Fig. 2. This gauze is of sufficiently fine mesh to eliminate any possibility of an explosion flame passing therethrough and for this reason an explosion within the case would normally create dangerous pressures therewithin, which might either blow out the gauze 10 or disrupt the casing 2.

To limit the explosion pressures that can be developed within the casing, I provide an expansion chamber, indicated generally at 11, which fits about the casing 2 adjacent the brush end of the generator and closes the openings 12 which are normally provided in the casing 2 at points juxtaposed to the brushes and commutator, to permit inspection, adjustment and replacement of the brushes. These openings or windows 12 are normally closed by a band which is clamped around the generator in overlapping relation with respect to the windows 12. In accordance with the present invention, I replace this customary band with the expansion chamber 11.

For convenience in installing, the expansion chamber 11 is made in two separate and distinct sections, both of which may be identical and each of which is of annular shape to extend substantially half-way around the casing 2. Thus each section may comprise a cylindrically curved inner wall 14 and a cylindrically curved concentrically disposed outer wall 15, which are connected together at their sides by semiannular flat side walls 16 and at their ends by flat end walls 17. The end walls 17 may have welded, or otherwise attached thereto, flanges 19 and the juxtaposed flanges on the two sections of the expansion chamber may be bolted together, as by bolts 20, to clamp the two sections around the casing 2 of the generator. Each of the sections of the chamber is provided with a gasket 22 of some resilient material for effecting a seal around the window 12 which it covers.

Each section of the explosion chamber 11 is provided with two spring-actuated valves 24 and 25 (Fig. 2), respectively, which are juxtaposed to the opening in the gasket 22 and in juxtaposed relation to the windows 12 in the casing 2. Valve 25 opens inwardly into the expansion chamber in response to pressure within the generator casing 2 in excess of a predetermined value, and valve 24 opens outwardly from the expansion chamber in response to excess pressure in the expansion chamber. The valves 24 and 25 may be of identical construction, each consisting merely of a valve plate or disc 27 normally forced into sealing engagement with its associated opening 26 by a helical compression spring 30 compressed between the disc 27 and a bridge member 29. The structure of each of the valves 24 projects into the associated window 12 of the generator, since there is ample room within the generator for the valve.

The springs 30 on the valves 25 may be set to open in response to any desired pressure differential between the generator and the expansion chamber. In practice it is found convenient to set these valves to open in response to a pressure differential of four pounds per square inch. The return valves 24 preferably have very light springs so that they open in response to a very slight differential pressure in the expansion chamber over the pressure in the generator.

The device operates as follows:

Assume that the generator is running and that air is being circulated by the fan blades 7 inwardly through the openings 9, longitudinally through the generator casing, and out through the ventilating openings 8. Now assume that the air surrounding the generator becomes saturated with an explosive vapor or gas so that an explosive mixture results. This mixture is of course drawn into the generator through the openings 9 and is usually immediately ignited by the sparks at the brushes, whereupon all of the explosive mixture within the casing explodes. The gauze 10 prevents the explosion from passing out of the generator and igniting the explosive mixture in the surrounding space and the valves 25 are immediately opened by the force of the explosion, permitting the flow of exploding gases into the explosion chamber sufficiently rapidly to prevent the pressure within the generator casing from reaching any dangerous value. Immediately following the explosion, the burnt gases escape to the atmosphere through the openings 8 and 9, quickly reducing the pressure within the generator substantially to atmospheric, whereas the gases within the expansion chamber will still be at a higher pressure. This pressure differential immediately opens the valves 24, permitting the burnt gases within the expansion chamber to leak back into the generator casing until the pressure within the expansion chamber has again been reduced to substantially atmospheric.

A new explosion cannot occur within the generator until the burnt gases have been exhausted therefrom and a fresh supply of explosive mixture drawn in. It is found that by the time a sufficiently rich mixture to produce a second explosion can be created within the generator housing that the expansion chamber will have reduced its pressure substantially to atmospheric so that it is in condition to absorb the subsequent explosion.

In actual tests when running the apparatus as described continuously in an explosive mixture, it is found that explosions within the generator occur at intervals from three to five minutes and that the gauge pressure developed within the generator did not exceed from one to four pounds per square inch.

Of course the volume of the expansion chamber must be proportionate to the volumetric capacity of the generator. In most instances, it is sufficient if the volumetric capacity of the expansion chamber be of the same order or twice as great as the volumetric capacity of the generator. However the maximum intensity of any explosion that might be produced within the generator can be diminished to any desired value by making the expansion chamber sufficiently large.

For purposes of explaining the invention a particular embodiment thereof has been described in detail. It is to be understood, however, that various changes may be made in the apparatus described to meet special conditions, particularly to handle other generators or machines other

than generators that may have cases of radically different shapes from the usual automobile generator; the invention is therefore to be limited only to the extent set forth in the appended claims.

I claim:

1. An article of manufacture comprising a casing defining a closed space and adapted to be bolted onto an electrical machine having a window therein, said casing having an inlet valve and an outlet valve so positioned as to lie in juxtaposed relation to said window when said device is secured to said machine.

2. In combination, an electrical device subject to sparking, comprising a casing having ventilating openings therein, said openings being screened to prevent the transfer of flames therethrough, and an expansion chamber defining a closed space distinct from the space within the said electrical device, and means for communicating said expansion chamber with said electrical device, comprising an inlet valve which opens in response to pressure within the electrical device exceeding the pressure within said expansion chamber and an outlet valve adapted to communicate said expansion chamber with said electrical device in response to pressures within said expansion chamber exceeding the pressure within said electrical device.

3. An attachment for an electric machine having a cylindrical casing with windows therein, said attachment comprising an annular expansion chamber having a curved inner wall conforming with the curvature of the said casing and adapted to lie closely thereagainst in sealing engagement about the window therein, and a pair of valves in said curved wall juxtaposed to said window, one of said valves opening inwardly in response to excess pressure in said machine and the other of said valves opening outwardly in response to excess pressure in said expansion chamber.

4. In combination, an electric device subject to sparking and an expansion chamber for absorbing pressure of an explosion within said device, said explosion chamber comprising a closed casing, and valve means communicating said closed casing with said electric device, said valve means remaining closed in response to equal pressures in said device and said expansion chamber and opening in response to differential pressure therebetween.

ORVILLE B. FREEMAN.