

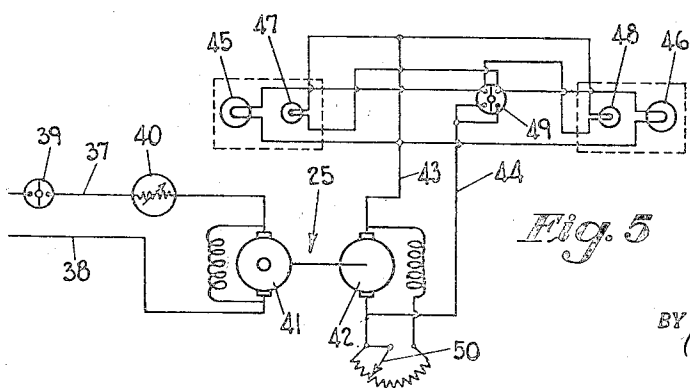
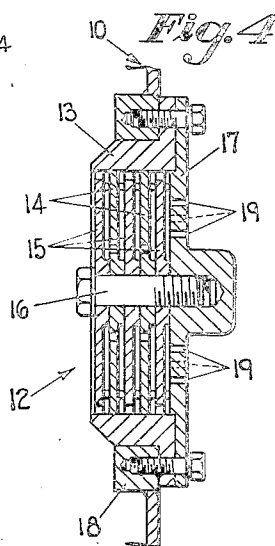
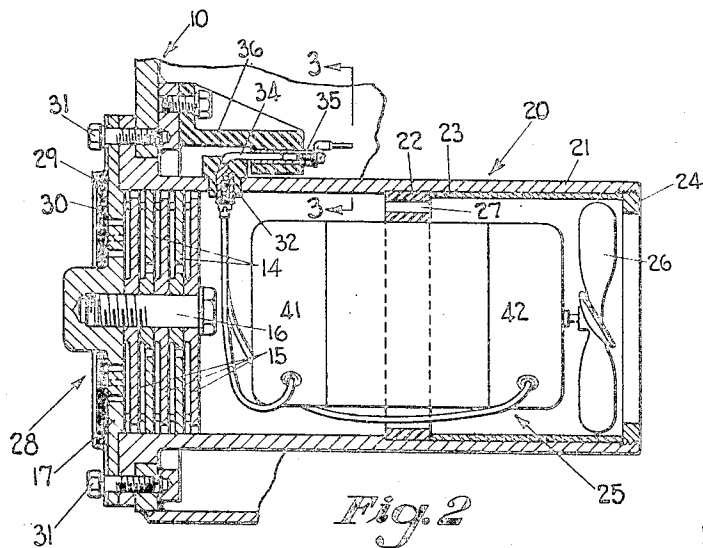
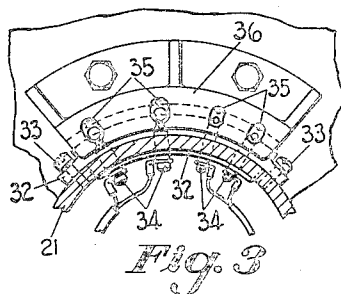
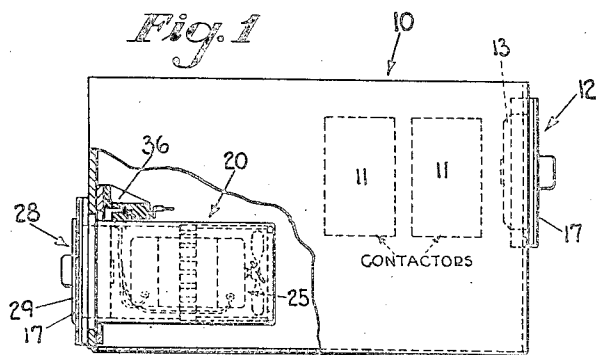
Oct. 26, 1948.

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2,452,248

ELECTRICAL MINE APPARATUS

Filed May 12, 1944



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UNITED STATES PATENT OFFICE

2,452,248

ELECTRICAL MINE APPARATUS

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Application May 12, 1944, Serial No. 535,366

4 Claims. (Cl. 172-36)

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This invention relates to electrical apparatus designed particularly for use in gaseous or other mines.

An object of the invention is to provide electrical apparatus designed to ventilate an explosion proof casing or housing for spark producing electrical apparatus, such as motor contactors, in which the ventilating apparatus can be inserted into and removed from the casing or housing as a unit.

A further object of the invention is to provide an improved unit including a housing or conduit for a fan or motor-generator preferably with a flame proof breather formed as a part of the unit and electrical contacting plugs which automatically make or break the circuit to a fan or motor-generator as the unit is inserted in place or removed from the casing or housing in which it is supported.

Other objects of the invention will appear hereinafter the novel features and combinations being set forth in the appended claims.

In the accompanying drawings,

Fig. 1 is a side elevational view of an explosion proof casing including the features of my invention with parts broken away and in section to illustrate the position of the removable unit;

Fig. 2 is a longitudinal sectional elevational view of the unit and associated apparatus in the casing;

Fig. 3 is a sectional view taken on the line 3-3 of Fig. 2, looking in the direction of the arrows;

Fig. 4 is a sectional view through the flame proof outlet breather of the explosion proof casing; and

Fig. 5 is a wiring diagram of the electrical system.

The device and system of my invention deals with two problems which may be separately considered as different aspects of my invention but which in the preferred embodiment thereof are solved simultaneously. These problems may be stated as follows:

In gaseous mines such as coal mines it is necessary to house all spark producing apparatus within explosion proof casings or housings. However, it is a known fact that the sparking of such electrical devices in a confined atmosphere tends to produce nitrate and/or nitrous acids which tend to eat away metal parts. To overcome this it is necessary to introduce fresh air into the casing or housing and to eject the nitrogen laden air produced by the sparking. This, of course, must be done while preserving the explosion or flame proof character of the housing and there-

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fore the air inlet and exhaust breathers must have flame proof characteristics so that any explosion which takes place within the casing or housing will not produce an external flame. One of the features of my invention is to produce improved apparatus to solve this problem including a unit which may be readily inserted in an explosion proof casing, which unit preferably includes a fan and breather and electrical contacts for the fan which are automatically made and broken when the unit is assembled and disassembled, respectively.

The second problem is as follows: In many mines the voltage of the available electric system may be anywhere from 100 to 600 volts and it is frequently direct current though it is sometimes alternating current. Electric light bulbs designed largely for use in automobiles have reached a high efficiency, particularly in their ruggedness and their ability to stand shock, but these light bulbs are generally designed for relatively low voltages, as for example from 6 to as high as 32 volts. The recently developed "sealed-beam" light bulb is particularly rugged and shock proof. It is desirable to use these low voltage light bulbs in mining apparatus. Heretofore it has been customary either to use high voltage light bulbs on mine apparatus or to employ resistors to obtain the necessary voltage reduction from the high line voltage to the low light bulb voltage. Obviously, however, when this is done there is a great loss of energy since the voltage drop in the resistor must be much greater than the utilized voltage in the light bulb. For example, if the light voltage is 100 volts and a 6 volt bulb is employed, the resistor required to reduce this voltage must cause a voltage drop of approximately 94 volts which is more than ten times as much as the voltage actually utilized. This represents a very great power wastage. To solve this problem I propose to provide a small motor generator set in which the motor is a relatively high voltage unit corresponding to the voltage of the electric system in the mine and in which the generator voltage corresponds to the voltage of the light bulbs.

There is another problem which arises in connection with these lighting systems. It is a known fact that the voltage variation in many electrical systems and mines fluctuates rapidly and over an appreciable range. I have provided apparatus which maintains a fairly uniform voltage on the light bulbs even though the voltage of the electric system may vary appreciably. As previously mentioned, in the preferred embodi-

ment of my invention all of the problems above mentioned are solved. The second and third problems, above described, and apparatus for their solution are described and claimed in my divisional application Serial No. 763,923, filed July 26, 1947, for Electrical lighting apparatus for mining machines.

Referring particularly to Fig. 1 of the drawings there is illustrated a casing or housing 10 which is explosion or flame proof in character and which houses spark producing electrical equipment which is illustrated by a pair of contactors 11 which may be the contactors for the motor of a locomotive or a mining machine or any other electrical equipment. Adjacent one end the casing 10 is provided with an air outlet breather 12. The breather 12 includes a flanged outer ring 13, spaced disc baffles 14 and 15, a central retaining screw 16 and a closure or cap plate 17. The baffles 14 have spaced openings remote from the periphery thereof while the baffles 15 are provided with spaced openings or notches in their peripheries and all of which baffles are provided with spacing lugs near the periphery thereof and a central opening for the screw 16 by which they are clamped to the cap plate 17. The cap 17 and ring 13 are removably clamped to a connecting ring 18 welded to and forming a part of the casing 10. The cap 17 is provided with a plurality of bores 19. It is thus evident that the breather 12 provides a labyrinth type of air outlet requiring any flame to pass over an elongated path and thus be quenched before it reaches the atmosphere outside casing or housing 10.

Referring particularly to Figs. 1 and 2 of the drawings, there is illustrated a unitary combination motor-generator and ventilator structure 20 comprising a cylindrical conduit or housing 21 which is open at both ends. Centrally located within said conduit or housing 21 is a supporting insulating ring 22 which is held on one side against a ledge formed in the conduit 21. On the other or right hand side, as viewed in Fig. 2, it is held by an abutment ring 23 of insulating material which in turn is held in place by a screw threaded ring 24 which is externally threaded to the interior of the right hand end of said housing 21. The ring 24 provides a large opening so that air passing through the conduit or housing 21 will create a pressure in the casing or housing 10 and force the nitrogen laden air out through the breather 12. The insulating ring 22 supports a small fan or motor-generator 25 the shaft of which is provided with a fan blade 26. Said insulating ring 22 insulates the housing of the fan or motor-generator 25 from the conduit 21 and the housing 10. Said ring 22 is provided with a plurality of holes or slots 27 so that air can freely flow through it and through the conduit 21 around the outside of the fan or motor-generator 25. Adjacent the left hand end of the conduit 21 there is an inlet breather 28 which is of essentially the same construction as the breather 12 except that the left hand portion of the housing 21 takes the place of the breather ring 13. In addition, breather 28 is preferably provided with a metal disc or ring 29 which holds a disc or pad of metal wool 30 on the cap of said breather 28 which acts to filter the air passing through said breather 28. Machine screws 31 removably connect the complete unit 20 to the casing or housing 10 and support it therein, as clearly illustrated in Figs. 1 and 2 of the drawings.

To provide electric circuits to the motor and

from the generator of the motor-generator unit 25, which are automatically made when the unit 20 is put in place and automatically broken when it is removed, the conduit or housing 21 is provided near its left hand end with an arcuate slot 5 which receives an insulating strip 32 which is attached thereto as by screws 33 (see Fig. 3). Embedded in the insulating strip 32 are four prongs 34 which extend from said insulating strip 10 32 parallel with the axis of the conduit 21 and toward the right hand end thereof, as viewed in Fig. 2 of the drawings.

As clearly illustrated in Fig. 3 of the drawings, the four prongs 34 are distributed along the arc of a circle concentric with the axis of the conduit 21. Adapted to receive the four prongs 34 are four electrical receptacles 35 which are mounted on an arcuate bracket 36 of insulating material, which in turn is mounted on a wall of the casing or housing 10. It is obvious that the prongs 34 and receptacles 35 cooperate to provide four individual electrical plugs or connectors. Furthermore as the unit 20 is inserted in place in the housing or casing 10, the prongs 34 are guided 20 into the receptacles 35 and automatically make the circuits to the electric motor-generator 25. Conversely, when the unit 20 is disconnected and withdrawn as a unit, these electric plugs or connectors are automatically disconnected. It is evident that the complete unit 20 may be removed 30 as such by removing the screws 31 and pulling it to the left, as viewed in Figs 1 and 2 of the drawings, and thus out of the hole in the casing 10 into which it extends.

Attention is now directed to Fig. 5 of the drawings, illustrating the preferred electrical circuit. 37 and 38 are conductors leading to the high voltage source of current or, in other words, to the electrical system of the mine which, as previously suggested, may have a voltage anywhere from 100 to 600 volts and be either A. C. or D. C. current, though it is generally D. C. Switch 39 may be provided to control the circuit leading to conductor 37 which leads to the motor 41 of 45 motor-generator 25. The conductor or plug receptacle 34—35 is not illustrated in Fig. 5 of the drawings. In the conductor 37 I provide a ballast resistor or ballast resistor tube 40 which is essentially a constant current device and tends to insure a constant current delivery to the motor 41 for wide variations in the voltage of the mine system. For example, in voltage variations up to 25% there is a very small variation without great significance in the current flow to said motor 41. Motor 41 drives generator 42 of the motor-generator set 25 which generator 42 supplies current over conductors 43 and 44 to head- 50 lights 45, 46 and tail-lights 47 and 48 as controlled by double-acting switch 49. The circuits to said lights 45—48 are obvious and when switch 49 is in one position they are all off; when in the second position headlight 46 and tail-light 47 are on; and when in the third position headlight 45 and tail-light 48 are on. The voltage of the generator 42 may be adjusted by a variable rheostat 50 connected in series with its shunt field. Since the load on the generator 42 will be the same when either pair of lights 45—48 or 46—47 is connected, the ballast resistor 40 will 70 operate to maintain a substantially constant current to them and such constant illumination for fluctuations in the voltage in the mine system up to approximately 25%.

In the operation of the system and apparatus the motor-generator set 25 will operate at a

substantially constant velocity even though the line voltage of the mine system varies appreciably and will supply a substantially constant current flow to the connected head and tail lights. Furthermore, even for sudden large fluctuations of line voltages which persist for only a short time it is evident that the inertia of the motor-generator set 25 will act to maintain the connected lights illuminated at approximately normal intensity. This is another feature of importance since it is well known that frequently there is a sudden and drastic change in line voltage in a mine system which persists only for a very short time, for example, as when a very long train of loaded mine cars is starting. Furthermore, the motor-generator 25 is insulated from the conduit 21 and consequently from the casing 10 and any unit such as a locomotive or mining machine to which it is attached, thus preventing any electrical stresses between the windings thereof and the casing.

The motor-generator 25 in operating, not only produces the desired low voltage which makes possible the utilization of very rugged low voltage lamps or bulbs such as designed for automobiles, including the extremely desirable "sealed-beam" type, but in addition when the fan blades 26 are employed, as in the preferred embodiment of my invention, it acts to ventilate the casing or housing 10. This prevents the forming of nitrous and/or nitric acid which if allowed to form will destroy conductors, contactor points, solder joints, as well as any other metal parts. The flame proof breathers 12 and 13 allow the entrance of fresh cleaned air and the exhaust of the air which may be nitrogen laden while preserving the permissible or explosion proof character of the equipment. The filter pad 30 aids in the filtering of the incoming air. The electrical plug and receptacle arrangement 34-35 provides for the automatic making of the circuits to and from the motor 41 and generator 42 of the motor-generator set 25 whenever the unit 20 is inserted in place and the automatic breaking thereof whenever it is removed.

It is to be particularly understood that the arrangement shown is one which embodies my invention in its most complete aspect and various broader aspects thereof may be employed not utilizing all of the apparatus disclosed. For example, fan blade 26 may be eliminated if the ventilating feature is not desired or is otherwise provided. Again instead of the motor-generator 25 I may employ merely a fan with a driving motor preferably of low voltage which may be derived from any desired source such as a storage battery or taps on a resistor. While the unit 25 is shown inside the housing 10, in other arrangements it may be located entirely outside the housing and communication therewith may be provided as from the outlet of conduit 21 to a housing inlet. This might be done, for example, where there was insufficient room within the housing 10 to receive the unit 20. Again, other types of fan mechanism may be employed instead of the blade 26, such as a centrifugal type fan. Still further, in another broad aspect of my invention the ventilating features may be eliminated entirely and the motor-generator 25 merely be utilized for the lighting circuits, as above described.

Obviously those skilled in the art may make various changes in the details and arrangement of parts without departing from the spirit and scope of the invention as defined by the claims

hereto appended and I wish therefore not to be restricted to the precise construction herein disclosed.

Having thus described and shown an embodiment of my invention, what I desire to secure by Letters Patent of the United States is:

1. In explosion-proof electrical apparatus, the combination with a casing adapted to house spark producing apparatus, of a unit insertable and removable as such relative to said casing, said unit including a fan housing, a fan mounted in said housing and providing an air passageway between it and the housing interior, electrical plug contactors on said housing, cooperating plug receptacles mounted on said casing adapted to receive said contactors when said unit is inserted in said casing to make electrical contact therewith and to break said electrical contact when said unit is removed, and a flame proof breather carried in one end of said housing and forming a part of said unit.

2. In explosion-proof electrical apparatus, the combination with a casing adapted to house spark producing apparatus, of a unit insertable and removable as such relative to said casing, said unit including a housing for an electrical device, an electrical device mounted in said housing and providing an air passageway between it and the housing interior, electrical plug contactors on said housing, cooperating plug receptacles mounted on said casing adapted to receive said contactors when said unit is inserted in said casing to make electrical contact therewith and to break said electrical contact when said unit is removed, and a flame proof breather carried in one end of said housing and forming a part of said unit.

3. In electrical mining apparatus, the combination with an explosion-proof casing adapted to house spark producing apparatus, of a combination motor-generator and ventilator unit insertable and removable as such relative to said casing, said unit including an open-ended tubular housing, a motor-generator including a fan mounted in said housing and providing an air passageway between it and the interior of said housing through which said fan moves ventilating air, electrical plug contactors connected with said motor-generator carried by said housing, cooperating plug receptacles mounted on said casing adapted to receive said contactors when said unit is inserted in said casing to make electrical contact therewith and to break said electrical contact when said unit is removed, a flame-proof breather covering that end of said tubular housing which is the outer end thereof when said motor-generator and ventilator unit is associated with said casing, and an air filter associated with said flame-proof breather for filtering all air passing therethrough.

4. In electrical mining apparatus, the combination with an explosion-proof casing adapted to house spark producing apparatus, of a combination motor-generator and ventilator unit insertable and removable as such relative to said casing, said unit including an open-ended tubular housing, a motor-generator including a fan mounted in said housing and providing an air passageway between it and the interior of said housing through which said fan moves ventilating air, electrical plug contactors connected with said motor-generator carried by said housing, cooperating plug receptacles mounted on said casing adapted to receive said contactors when said unit is inserted in said casing to make electrical contact therewith and to break said electrical con-

tact when said unit is removed, and a flame-proof breather covering that end of said tubular housing which is the outer end thereof when said motor-generator and ventilator unit is associated with said casing.

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