

April 12, 1949.

C. H. BARNARD ET AL
EXPLOSION PROTECTIVE APPARATUS

2,467,181

Filed Nov. 8, 1946

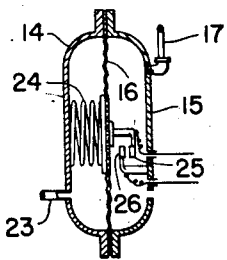


FIG. 2

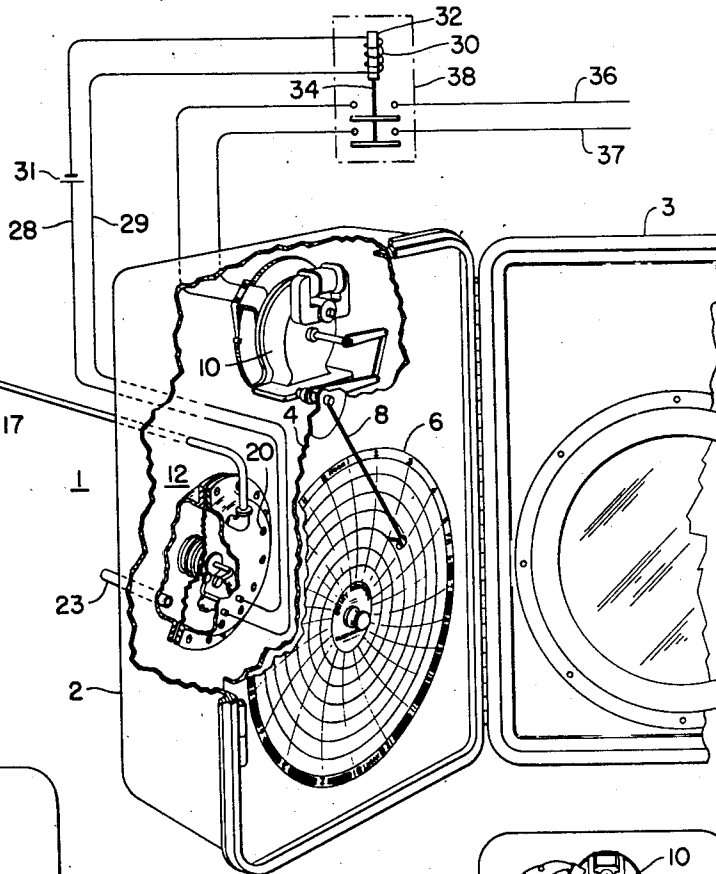
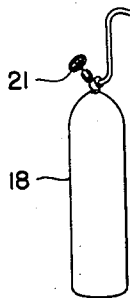


FIG. 1

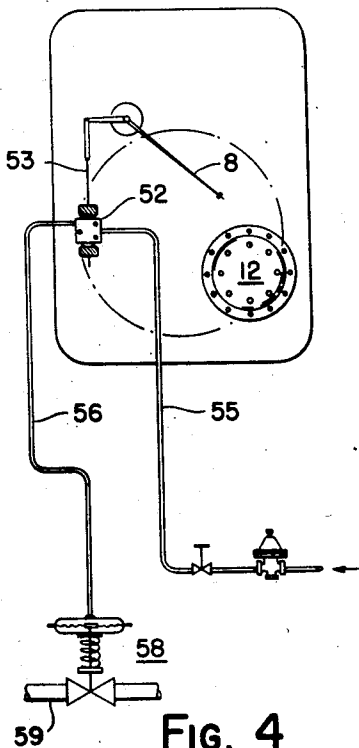


FIG. 4

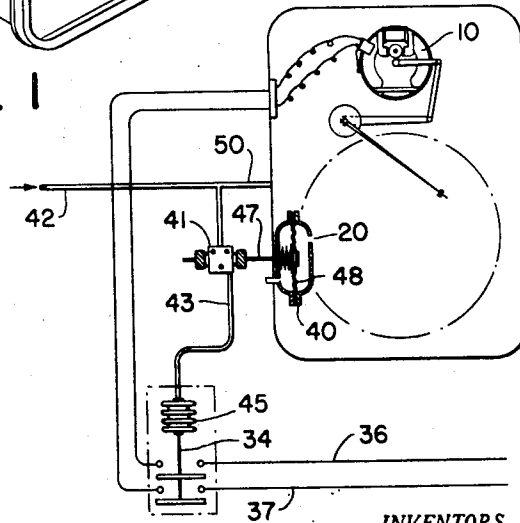


FIG. 3

INVENTORS
CLAYTON H. BARNARD
AND
PAUL S. DICKEY
BY
Raymond W. Jenkins
THEIR ATTORNEY

UNITED STATES PATENT OFFICE

2,467,181

EXPLOSION PROTECTIVE APPARATUS

Clayton H. Barnard, Cleveland, and Paul S. Dickey, East Cleveland, Ohio, assignors to Bailey Meter Company, a corporation of Delaware

Application November 8, 1946, Serial No. 708,560

11 Claims. (Cl. 171—252)

1

This invention relates to apparatus for protecting against the ignition of explosive gases. It relates more particularly to means for purging a casing of explosive gases and controlling the operation of apparatus contained within the casing.

It is frequently necessary that apparatus having a tendency to ignite explosive gases, be used in places where such gases are present. For instance, it may be necessary that an electrically actuated meter be used in such a place for measuring some condition. The meter may be enclosed within a casing, but it is difficult to seal the latter against the passage of gases to its interior. It may be necessary that the casing be opened at times to make adjustments or to change recording charts, and then, if explosive gases are present, the casing will become filled with the gases and an explosion may take place unless some means are provided for purging the gases from the casing before the circuits for the meter are completed.

A preferred form of our invention may include a pressure responsive mechanism which is operative to complete electrical circuits in the casing only when the pressure in the latter exceeds the pressure at its exterior by a predetermined amount. By providing a restricted escape for fluid within the casing and supplying to the latter a gaseous fluid which is free of explosives, there may be obtained a purging of the casing and a gradual increase of the pressure therein to the desired value. The pressure responsive mechanism may be made operative to complete the electrical circuits only when the pressure in the casing has been increased to a value sufficient to force gases therefrom and has been maintained at such value for a period of time sufficient to assure a complete purging of the gases. The pressurizing of the casing may be effected by supplying thereto an inert gas, such as nitrogen, or air from the atmosphere at a point where it is free of explosive gases.

An object of our invention is to provide means for purging a casing of gases and controlling the operation of apparatus contained within the casing. Another object is to provide means for pressurizing a casing which has restricted communication with its exterior and effecting the operation of apparatus in the casing after the latter has been pressurized. Yet another object is to provide for a casing having restricted communication with its exterior, means for supplying a gaseous fluid to the casing, and means responsive to the pressures in the casing for controlling

2

ing electrical circuits to apparatus contained within the casing. Other objects will appear in the course of the following description.

There are shown in the accompanying drawing several forms which our invention may assume in practice.

In this drawing:

Fig. 1 is a perspective view of a meter with a portion of its casing broken away to disclose a device operating in response to pressures within the casing and controlling the circuit for an electric motor contained therein.

Fig. 2 is an enlarged vertical sectional view of the pressure responsive device shown in Fig. 1.

Fig. 3 is a schematic diagram of another form of control system for a meter casing and motor circuit.

Fig. 4 is a schematic diagram showing still another form of the invention.

Referring to Fig. 1, it will be noted that there is shown a meter, generally designated 1, having a casing portion 2 which is adapted to be closed by a hinged door 3. Arranged within the casing portion 2 is a backing plate 4 for supporting a chart 6, which is adapted to be rotated by any suitable means, not shown. A pen arm 8 moves over the chart 6 and is operatively connected to an electric motor 10 for actuation by the latter in accordance with changes in the value of a condition being measured. The spaces of opposite sides of the backing plate are in communication with each other through spaces surrounding the drive connections for the chart and the pen arm, and may be in communication by reason of a loose fitting of the back plate within the casing. The hinged door 3 does not fit the casing portion 2 so tightly when closed but what some leakage takes place between the interior and exterior of the casing. There may also be some leakage between the interior and exterior of the casing along the connections leading to the operating parts of the meter. It will be seen that by reason of such leakages, any gases in the space surrounding the casing may gain admission thereto even when the door is closed. When the door is opened to change the chart, the gases will readily gain admission to all parts of the casing. If the meter is being used in a place where explosive gases are present, such gases will get into the casing and may be ignited by sparks from the electric motor or other portions of the electric circuit.

In order to purge the casing of explosive gases, it is proposed to supply a pressure fluid to the interior of the casing until a sufficient pressure

is built up therein to cause any gases to leak to its exterior. Means responsive to the casing pressures are provided for controlling the motor circuit so that an operation of the motor is obtained only when the desired pressure exists in the casing.

As shown in Fig. 1, a pressure responsive device 12 is arranged within the casing portion 2 and comprises casing members 14 and 15 clamped to opposite sides of a diaphragm 16. A conduit 17 leads from a source of pressure fluid supply, such as a tank 18, through a wall of the meter casing to communicate with the space between the diaphragm and the casing member 15. Ports 20 formed in the casing member 15 connect the space at its inner surface in free communication with the interior of the meter casing so that the pressure fluid, which may be pure air or an inert gas, such as a nitrogen, flows into the meter casing and builds up a pressure therein equal to the pressure acting on the diaphragm 16. A manually controlled valve 21 is provided for regulating the flow of pressure fluid so that the pressure in the meter casing will reach in time the desired value. The space between the diaphragm and the casing member 14 is subjected to atmospheric pressure by a conduit 23 leading from the space to the exterior of the meter casing. A spring 24 acts between the casing member 14 and the diaphragm for opposing movement of the latter by pressures acting upon its opposite side. Fixed to the casing member 15 and the diaphragm 16 at their sides adjacent each other are electrical contact elements 25 and 26 which are normally in an open position, but which are adapted to be closed when the diaphragm is moved against the action of the spring 24. Conductors 28 and 29 connect the contact elements 25 and 26 in series with a solenoid winding 30 and to a source of power, such as a battery 31. A plunger 32 actuated by the winding 30 is connected to a switch 34 which controls the flow of current from lines 36, 37 to the motor 10. The switch may be located at a point which is remote from the meter and free of explosive gases, or, if desired, it may be located close to the meter and be enclosed in a fluid tight casing 38.

When the meter is placed in operation its door is closed so that there is only a restricted communication between its interior and exterior. The valve 21 is then opened to supply pure air or an inert gas from the tank 18 to the space between the diaphragm 16 and the casing member 15. The air or inert gas then flows through the ports 20 to the meter casing and carries with it away from the contact elements 25, 26 any explosive gas which may be present. The flow of fluid to the meter casing causes the pressure therein to increase until the fluid escapes from the casing at a rate equal to the supply. The spring 24 is designed so that the diaphragm is moved to close the contact elements 25, 26 when the pressure in the casing reaches approximately the maximum desired value. Closing of the contact elements results in an energization of the solenoid winding 30 to close the switch 34 and supply current to the motor 10. As the pressure builds up in the meter casing, there will be some fluid escaping therefrom and carrying with it explosive gases. If a sufficient purging of the casing is not obtained before the pressure builds up to the value at which it closes the contacts 25, 26, a further delay may be obtained by providing any suitable means which effects closure of the line switch 34 after a predetermined period of time.

It will be seen that a loss of pressure in the meter casing resulting from a failure of the pressure fluid supply or an excessive escape of fluid from the casing, causes the contact elements 25, 26 to open and deenergize the solenoid winding 30 so that the switch 34 opens and cuts off the supply of current to the motor.

In Fig. 3 there is shown a meter like that of Fig. 1 but containing within its casing a pressure responsive device 40 which operates to control a pilot valve 41 instead of contact elements for an electrical circuit. The pilot valve is like that disclosed in the patent to Johnson 2,054,464 and operates to control the flow of pressure fluid from a source of supply through conduits 42 and 43 to a bellows 45 which actuates the switch 34 in the lines 36, 37. The pilot valve has a valve element 47 which is connected to a diaphragm 48 of the device 40, and is movable by the diaphragm to a position connecting the conduit 42 in communication with the conduit 43 leading to the bellows. In the normal position of the diaphragm 48, the valve element is positioned to vent fluid from the bellows to atmosphere.

The fluid supply conduit 42 is also connected by a conduit 50 in communication with the interior of the meter casing so that a pressure is built up therein for purging the casing and forcing the diaphragm against the action of the spring 24 to position the valve element. By effecting an operation of the line switch through fluid actuated means rather than through an electrical circuit, there is avoided the possibility of an explosion which might be caused by an inadequate purging of the casing before the circuit was closed. The supply of fluid to the bellows may be made such that the line switch is not closed until a predetermined lapse of time after the pilot valve is positioned by the diaphragm, the time lapse being made sufficient to assure a complete purging of the casing before the motor is started.

In Fig. 4 there is shown an arrangement in which a pilot valve 52 like the valve 41, has a valve element 53 connected for operation by the motor 10 of a meter like that of Fig. 1. As described in the patent to Johnson 2,054,464 the valve element 53 is continuously vertically (in the drawing) positioned by the motor 10 relative to the casing 52 to establish in the pipe 56 a pneumatic loading pressure representative of the value of the variable whose value is recorded by the pen 8 upon the chart 6. The pilot valve in this case is arranged within the meter casing and controls the flow of pressure fluid from a source of supply through conduits 55 and 56 to a fluid actuated valve mechanism 58 in a conduit 59. The valve 58 is shown as located in a pipe 59 for controlling the rate of flow of fluid therethrough. The fluid flow through pipe 59 may contribute to the value of the variable recorded by pen 8 or may be unrelated thereto. This pilot valve, as described in the above mentioned patent of Johnson, permits a continuous restricted escape of pressure fluid past its ends. The escaping pressure fluid causes a pressure to be built up in the meter casing and in the casing of a pressure responsive device 12 for effecting completion of a circuit or the operation of a pilot valve, as in Figs. 1 and 2, to close the line switch 34.

As a result of our invention there is provided improved means for effecting the removal of gases from a casing and preventing the operation of apparatus until a purging of the casing has been obtained. While the invention is described as

applied to a meter, it will be understood that it may be applied to any chamber device and the control of other apparatus.

While there are described in this application several forms which our invention may assume in practice, it will be understood that these forms of the same are intended merely as illustrations and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What we claim as new, and desire to secure by Letters Patent of the United States, is:

1. The combination with a chamber device having restricted communication between its interior and exterior and containing a power actuated mechanism, of means for supplying power to said power actuated mechanism, means for supplying pressure fluid continuously to the interior of said chamber device, a pressure responsive device subjected to the pressures in said chamber device, and means including an element controlled by said pressure responsive device for controlling said power supply means.

2. The combination with a chamber device having restricted communication between its interior and exterior and containing a power actuated mechanism, of means for supplying power to said power actuated mechanism, means for supplying pressure fluid continuously to the interior of said chamber device, and means for controlling said power supply means, said last mentioned means including a device responsive to the pressures in said chamber device and operative at a predetermined maximum pressure for initiating the supply of power by said power supply means.

3. The combination with a casing having restricted communication between its interior and exterior and containing electrical apparatus, of means for supplying pressure fluid continuously to said casing, a switch for controlling a circuit to said electrical apparatus, a pressure responsive device subjected to the pressures in said casing, and means controlled by said pressure responsive device and operating to effect a control of said switch.

4. The combination with a casing having restricted communication between its interior and exterior and containing electrical apparatus, of means for supplying pressure fluid to said casing, a switch for controlling a circuit to said electrical apparatus, and means for controlling said switch, said last mentioned means including a device responsive to the pressures in said casing and operating at a predetermined maximum pressure for effecting a closure of said switch.

5. The combination with a casing having restricted communication between its interior and exterior and containing electrical apparatus, of means for supplying pressure fluid to said casing, a switch for controlling a circuit to said electrical apparatus, a pressure responsive device subjected to the pressures in said casing, and an electrical circuit for controlling said switch, said electrical circuit including contact elements controlled by said pressure responsive device and a solenoid operatively connected to said switch.

6. The combination with a casing having restricted communication between its interior and exterior and containing electrical apparatus, of a pressure responsive device including a diaphragm arranged within said casing, means for subjecting one side of said diaphragm to casing pressure and the other side to exterior pressure,

means for supplying pressure fluid at a controlled rate to said casing, a circuit including a switch for supplying power to said electrical apparatus, a solenoid for controlling said switch, contact elements adapted to be closed by said diaphragm when the pressure in said casing reaches a predetermined maximum value, and a circuit connecting said solenoid and said contact elements in series with a source of electric power.

7. The combination with a casing having restricted communication between its interior and exterior and containing electric apparatus, of a pressure responsive device including a diaphragm arranged within said casing, means for subjecting one side of said diaphragm to casing pressure and the other side to exterior pressure, means for supplying pressure fluid at a controlled rate to said casing, a circuit including a switch for supplying power to said electric apparatus, a pressure responsive device for controlling said switch, means for supplying pressure fluid to said last mentioned pressure responsive device, and valve means operatively connected to said diaphragm for controlling the flow of pressure fluid in said last mentioned pressure fluid supply means.

8. The combination with a casing having restricted communication between its interior and exterior and containing an electric motor, of means for supplying pressure fluid to said casing, a pressure responsive device responsive to the pressures in said casing, a circuit including a switch for supplying current to said motor, pressure responsive means for controlling said switch, means for conducting pressure fluid relative to said pressure responsive means, and valve means operatively connected to said pressure responsive device for connecting said fluid conducting means selectively to a pressure fluid supply and to exhaust.

9. The combination with a casing having restricted communication between its interior and exterior and containing an electric motor, valve means arranged within said casing and operatively connected to said motor, said valve means controlling the flow of pressure fluid from a source of supply to a fluid actuated device and passing a continuous restricted flow of pressure fluid to said casing, a circuit including a switch for supplying current to said motor, and means including a device responsive to the pressures in said casing for controlling said switch.

10. The combination with a casing having restricted communication between its interior and exterior and containing an electric motor, of a pressure responsive device including a diaphragm connected at one side in free communication with said casing and at its other side in free communication with the exterior of said casing, means for supplying pressure fluid to said diaphragm at the side communicating with said casing, a circuit including a switch for supplying power to said motor, a solenoid for controlling said switch, and a circuit including a contact element connected to said diaphragm for controlling said solenoid.

11. The combination with a casing having restricted communication between its interior and exterior and containing electrical apparatus, of means for supplying pressure fluid to said casing, a switch for controlling a circuit to said electrical apparatus, a pressure responsive device having opposed surfaces, one surface exposed to the pressure within the casing and the other surface exposed to the pressure at the exterior of the casing, yieldable means acting upon said device for op-

posing its operation by the pressure within the casing, and means operatively connected to said device for controlling said switch, said last mentioned means operating at a predetermined maximum pressure within the casing for effecting a closure of said switch.

CLAYTON H. BARNARD.
PAUL S. DICKEY.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,021,454	Levin	Nov. 19, 1935