

[54] **DOUBLE PRESSURE COMPRESSED AIR ELECTRIC APPARATUS HAVING AN AIR DRYING DEVICE**

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[58] Field of Search.....200/148 E, 148 G, 148 R

[56] **References Cited**

UNITED STATES PATENTS

2,550,886 5/1951 Thompson.....200/148 E X
3,566,062 2/1971 Meier.....200/148 E

FOREIGN PATENTS OR APPLICATIONS

696,066 10/1964 Canada.....200/148 E
1,178,925 5/1961 Germany.....200/148 R

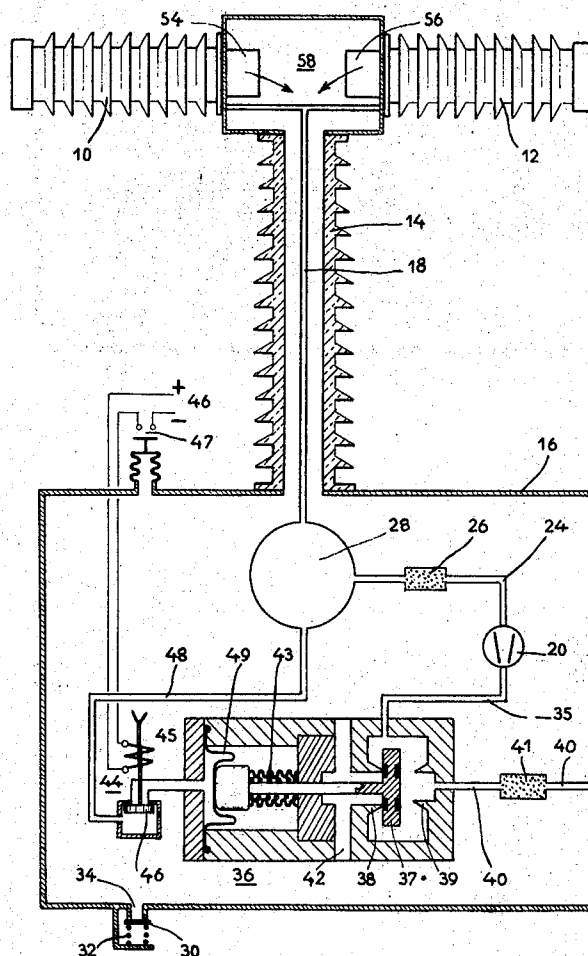
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[57] **ABSTRACT**

Double pressure compressed air electric apparatus such as an air-blast circuit interrupter having a high-pressure tank and a low-pressure (exhaust) tank whereby the low-pressure is greater than the atmospheric pressure under normal operating conditions. A compressor taking air from the low-pressure tank supplies high-pressure air to the high-pressure tank. A three-way valve cooperating with an air-drying device causes said compressor to take air from the atmosphere in case the low-pressure drops to a dangerous value under the influence of a leakage in the system. The additional quantity of air taken from the atmosphere is dried by the air-drying device.

3 Claims, 2 Drawing Figures



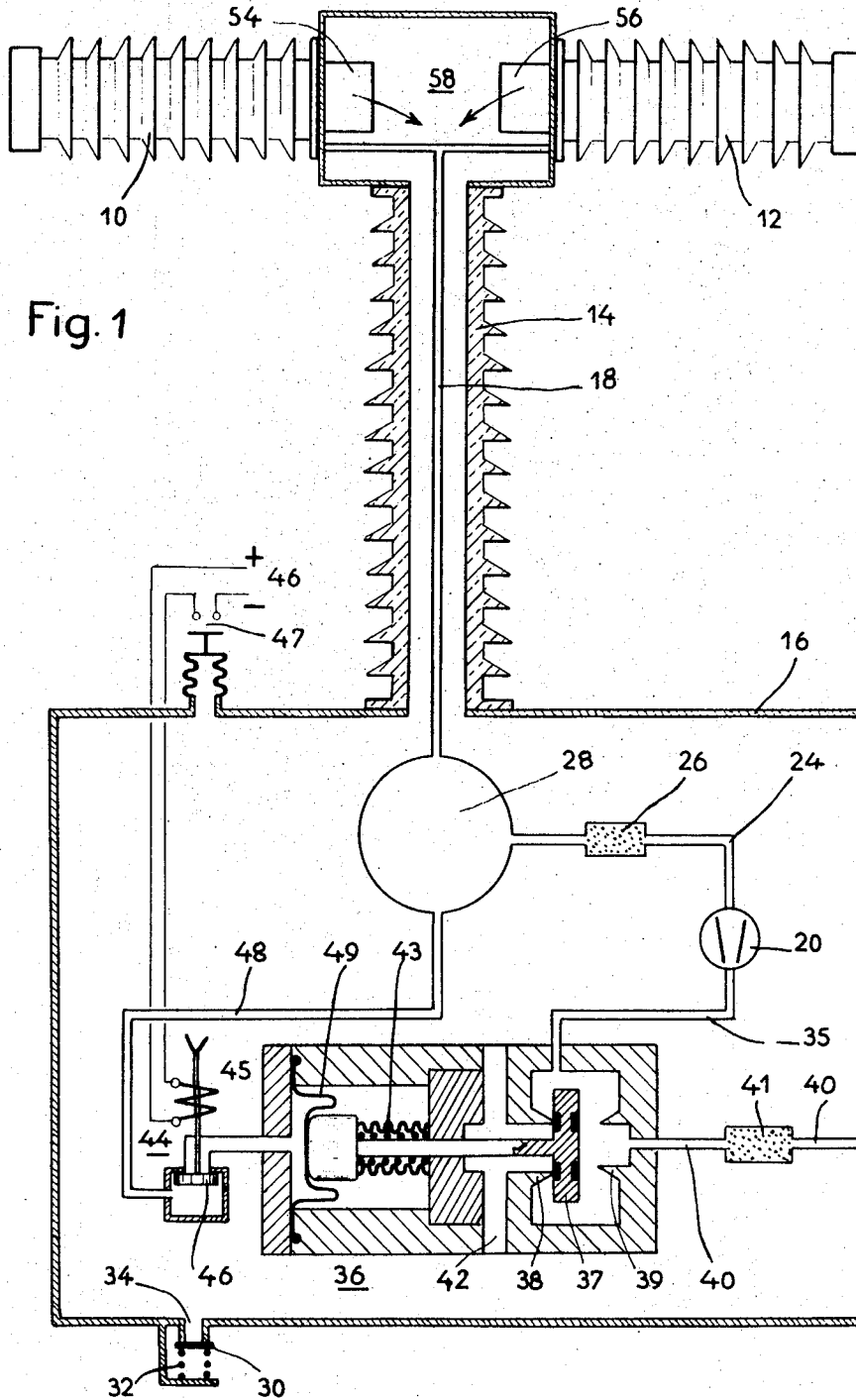
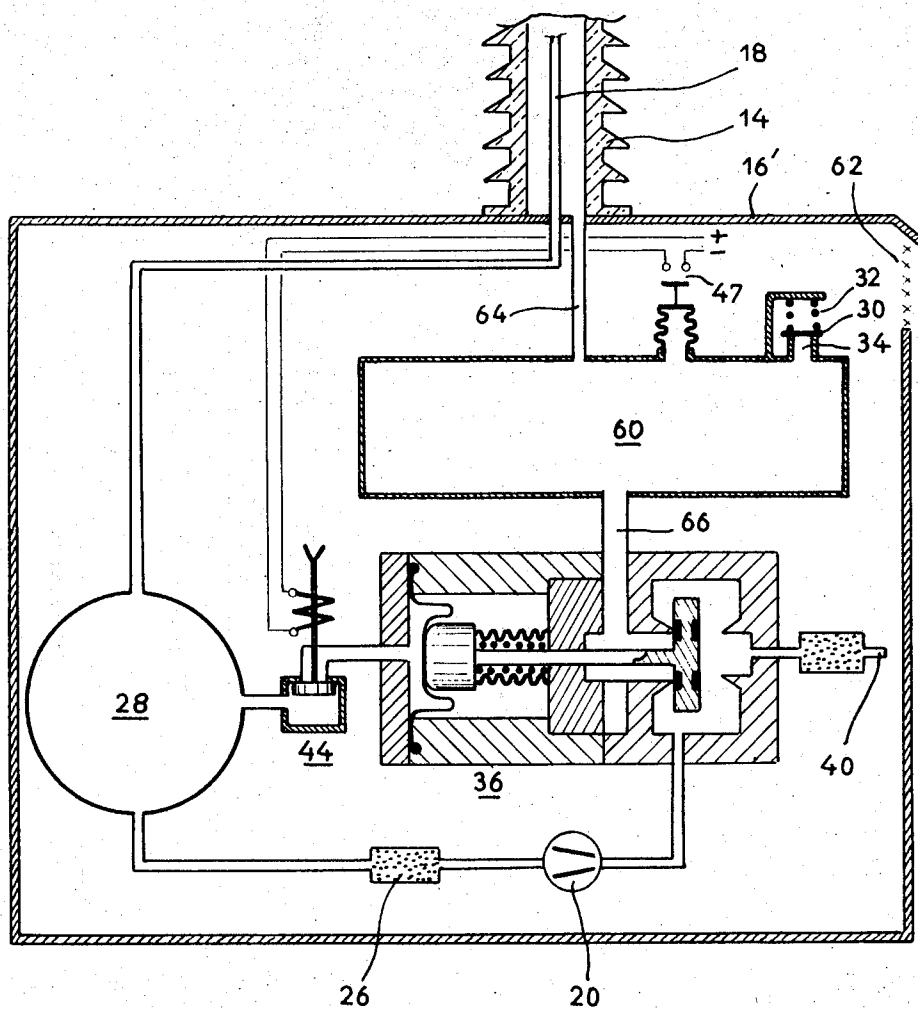


Fig. 2



DOUBLE PRESSURE COMPRESSED AIR ELECTRIC APPARATUS HAVING AN AIR DRYING DEVICE

The present invention relates to a double pressure compressed air electric apparatus arranged in atmospheric air and comprising an enclosure containing compressed air under high pressure, an enclosure containing air under low pressure and a compressor for taking air normally from said low-pressure enclosure and supplying it to the high-pressure enclosure, whereby an air drying device is provided to dry the air so that only dry air is supplied to the apparatus.

The harmful influence of the moisture of the feed air on air-blast circuit interrupters is well known, and particularly the danger of condensation on the insulating walls, which causes flash-over. Consequently, the conventional compressor groups for compressed air circuit interrupters must be equipped with water separators and/or air drying devices which constitute large and bulky systems which must treat large quantities of air to be evacuated into the atmosphere after only a single use.

It is well known that the drying of the air is readily effected by contacting it with absorbent products, but these devices can be designed only for the treatment of small quantities of air since the absorption capacity of these products is limited. The frequent replacement or regeneration of the absorbent products are incompatible with the normal maintenance of electrical apparatus under economical conditions.

The applicant, in its copending patent application filed on Oct. 16, 1969, under Ser. No. 867.012, has disclosed a device of the type mentioned in which the normal pressure prevailing in the low-pressure enclosure is close to atmospheric pressure, an inlet valve causing atmospheric air to enter said enclosure when the pressure therein drops below a predetermined value as the result of a leakage of compressed air towards the outside. This system permits the circuit interrupter to operate normally in closed cycle with a quantity of air which has been dried once and for all, an additional quantity of air being introduced from the atmosphere in a limited way only in the event of a leakage from the system towards the outside. This device for the recovery of dry air and circulation in a substantially closed cycle which comprises a drier provides a satisfactory solution by decreasing the use of the absorbent material. As a matter of fact, the feed air continuously passes through the drying device of absorbent filter inserted in the circulation system, but once dry it deposits therein merely traces of moisture resulting from possible slight leaks which are compensated for by an addition of ambient air. The filter retains its absorbent properties longer the more limited are the quantities of ambient air introduced into the circulation system.

This system has given full satisfaction in practice but cannot be used in case the low pressure value is substantially higher than atmospheric pressure, such as of the order of 4 bars.

An object of the invention is to provide an economical system of the said type having an air drying device drying only limited quantities of air and which makes it possible to use a low pressure which is substantially higher than atmospheric pressure.

According to the invention, means are provided to cause the compressor to take air from the atmosphere in case of hazardous drop of pressure in the low-pressure tank whereby an air-drying device dries the air thus introduced in the substantially closed cycle system.

Other advantages and features will become evident from the following description of two embodiments of the invention which are shown schematically, partially in axial section, in the accompanying drawings by way of illustration and not of limitation.

The example selected consists of a compressed-air circuit interrupter which operates in closed cycle, but the invention may naturally find other applications in any electric apparatus utilizing two compressed air pressures and subject to leaks which make an intermittent addition of moist outer air necessary.

In FIG. 1, a compressed-air circuit interrupter has two arc-extinguishing chambers 10, 12 borne by a hollow support insulator 14 secured at its lower end to a low-pressure enclosure or tank 16 which is located in a zone of ground potential in such a manner that the inside of the insulator 14 communicates normally hermetically with the tank 16. An insulating conduit 18 extending within the insulator 14 connects the high- and low-potential zones and feeds the chambers 10, 12 with high pressurized air. Depending on the type of circuit interrupter used, the air forwarded by the conduit 18 can feed auxiliary high-pressure tanks located in the region of high potential or directly feed arc blast devices or pneumatic control devices for the contacts (not shown) located in the chambers.

Within the low-pressure housing or tank 16 there is arranged a compressor 20 which, via a conduit 24, in which an air-drying filter 26 is also inserted, feeds a high-pressure tank 28, which is also housed within the low-pressure tank 16. The conduit 18 is connected to the tank 28.

A discharge or excess-pressure valve 30, urged towards its closed position by a compression spring 32, closes a discharge orifice 34 of the tank 16 in such a manner that it opens automatically upon a predetermined excess pressure within the tank 16 and allows the air to escape towards the atmosphere while preventing any admission of air towards the tank 16.

The suction or intake conduit 35 of the compressor 20 is connected to a three-way valve or pneumatic relay 36 comprising a valve member 37 which cooperates with two stationary valve seats 38 and 39 in order to establish a selective communication on the one hand between the conduit 35 and the inside of the low-pressure enclosure 16, by means of a passage 42 when it is applied against the seat 39 and on the other hand between the conduit 35 and the atmosphere, via tube 40 provided with an air-drying filter 41, when it is applied against the seat 38. A compression spring 43 biases the valve towards said second position (lefthand position) and an electrically operated pilot valve 44, the coil 45 of which may be excited by a source of current 46 by means of a pressure contact 47 sensitive to the pressure in the enclosure 16, makes it possible to admit compressed air of high pressure coming from the tank 28 through a conduit 48 behind a diaphragm 49 in order to bring the valve 37 to its first (righthand) position, which is its position of normal operation.

Exhaust valves 54, 56, shown schematically and associated with the arc-extinguishing chambers 10, 12, respectively, discharge into a space 58 which communicates hermetically with the inside of the hollow insulator 14. The space 58, the hollow insulator 14 and the housing 16 constitute a low-pressure enclosure for the recovery of the air escaping from the chambers 10, 12 through the valves 54 and 56. The recovery enclosure is adapted to communicate with the ambient atmosphere only through the discharge valve 30.

The compressed-air circuit interrupter in accordance with the invention operates in the following manner:

At the start, the valve 37, under the action of the spring 43, is in its second position of rest shown in the drawing. The starting of the compressor 20 (which is driven in a conventional manner which does not form part of the present invention) causes the tank 28 and chambers 10 and 12 to be placed under high pressure (for instance 15 bars) via the tube 18, the compressor taking air in through the tubes 35 and 40 from the outside atmosphere, the air drawn in being dried by the filter 41. When the desired high pressure is reached, the compressor stops. The low-pressure enclosure 58, 14 and 16 is also placed under pressure either independently or after an operation of the exhaust valves 54 and 56. As soon as the pressure in said enclosure 58, 14, 16 reaches a predetermined value which may be of the order of 4 bars, the manostat 47, which is set at this value, closes and excites the coil 45 of the pilot valve 44 which opens, admitting the pressure from the tank 28 through the conduit 48 behind the diaphragm 49. The valve 37 then immediately moves towards its first position of rest, coming against the seat 39, separating the enclosure 16 from the open air and establishing communication between the intake conduit 35 and the inside of the enclosure 16. Upon the subsequent operation of the compressor, in particular after an opening operation of the circuit interrupter resulting in a drop of pressure in the tank 28, the compressor re-establishes the high pressure in said tank 28, taking air only from the enclosure 16. The pressure normally prevailing in the enclosure 16, that is to say, during the normal operation of the circuit interrupter, is not sufficiently high to open the valve 30 nor sufficiently low to open the contacts 47 so that the valve 44 remains normally open and the valve 36 remains in its righthand position (not shown in the figure).

During an operation of the circuit interrupter, the high-pressure air admitted into the arc-extinguishing chambers 10, 12 and serving, inter alia, for the blowing of the arcs escapes through the valves 54, 56 and is collected in the low-pressure enclosure 58, 16, causing therein a normal increase in the pressure which is insufficient to open the discharge valve 30. The high-pressure air supplied to the chambers 10, 12 is taken by the conduit 18 from the high-pressure tank 28 and causes therein a drop in pressure which is sufficient to cause the operation of the compressor 20 which may, for instance, be governed by a manostat (not shown). The compressor 20 takes air in from the enclosure 16 and again feeds the high-pressure tank 28 through the air-drying filter 26 so as to re-establish therein the nominal high pressure which causes the stopping of the compressor. It is easy to see that the air circulates in closed cycle, the expanded air which escapes from the arc-

extinguishing chambers 10, 12 being taken up again by the compressor 20 and returned via the conduit 18 into the chambers 10, 12. The air upon each cycle passes through the drying device 26 which eliminates the moisture from it, if there subsists any.

In normal operation, the drying products of the filter 26 are no longer called upon to act as soon as the volume of air included in the closed circuit has been dried.

In the case of a leakage from the closed circuit towards the outside environment, the quantity of gas included in this system decreases and the drop of pressure in the enclosure 16 resulting therefrom causes the opening of the contacts 47 as soon as the pressure drops below the set value of this manostat and thus the closing of the pilot valve 44 which causes the valve 36 to move towards the position shown in the drawing. Upon the subsequent operation of the compressor 20, an amount of air necessary for the proper operation of the device is drawn in by the compressor via the conduits 35, 40 and dried by passage through the filter 41 and through the filter 26. The quantity of air to be dried is equivalent to the leaks and therefore has nothing in common with those used in the conventional circuit interrupters which evacuate all the expanded exhaust air to the atmosphere. After restoring of the pressure in tank 16 to the normal operating pressure, the contacts of the manostat 47 close and re-open pilot valve 44.

A substantial leak of the high-pressure region towards the low-pressure region can cause a relative excess pressure in the enclosure 16 and the opening of the safety valve 30. This discharge of dry air has the same consequences as the said accidental leaks, specifically a decrease in the quantity of air in the closed circuit which is compensated for upon the operation of the compressor 20 by an admission of air through the conduit 40. A slight internal leak will have no effect on the air drying devices, the dry air which escapes from the high pressure being automatically recovered in the enclosure 16 and therefore kept in the normal circulation circuit. The only effect is a more frequent operation of the compressor.

FIG. 2 shows another embodiment in which parts identical or similar to those in FIG. 1 have been designated by the same reference numbers.

In this embodiment, the housing 16' freely communicates with the atmospheric air, for instance through grids 62, the low-pressure tank 60 being now separate from said housing and spaced from the high-pressure tank 28. The inside of the support insulator 14 communicates with the tank 60 via a conduit 64 and the manometric switch 47 and the discharge valve 30 are now, of course, associated with this tank 60 which communicates with the valve 36 via a conduit 66 (corresponding to the passage 42 of FIG. 1). The conduit 40 discharges within the housing 16' and the operation of this device is identical to that of the device of FIG. 1, except for the different arrangement in space of the different parts.

What is claimed is:

1. A closed cycle double pressure compressed-air electric apparatus disposed in atmospheric air, comprising a high-pressure compressed-air enclosure, a low-pressure compressed-air enclosure carrying compressed air having a pressure greater than the at-

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mospheric pressure, conduit means connecting said high-pressure compressed-air enclosure to the atmosphere, air-drying means inserted in said conduit means, compressor means in said conduit means, and pressure responsive three-way valve means inserted in said conduit means between said compressor means and the atmosphere and also connected to said low-pressure compressed air enclosure, said three-way valve means being responsive to the pressure of said low-pressure compressed air enclosure and adapted to connect said compressor means selectively to said low-pressure compressed air enclosure and to the atmosphere in a manner such that said compressor means is normally connected to said low-pressure compressed air enclosure whereby an abnormal pressure drop in said low-pressure enclosure causes said valve means to connect said compressor means to the atmosphere.

2. A closed cycle double pressure compressed air electric apparatus disposed in atmospheric air, comprising a high-pressure compressed air enclosure, a low-pressure compressed air enclosure, a compressor having a high pressure outlet connected to said high-pressure enclosure and an inlet, valve means connected to said inlet and adapted to connect said inlet selectively to said low-pressure enclosure and to the atmosphere, said valve means comprising pressure sensitive control means responsive to the pressure in said low-pressure enclosure to control the position of said valve means in a manner such that said valve means connect said inlet to said low-pressure enclosure under normal pressurized condition of said low-pressure en-

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closure and to the atmosphere upon an abnormal drop of pressure therein below a predetermined pressure greater than the atmospheric pressure, and air-drying means to dry the air taken by said compressor from the atmosphere.

3. A substantially closed-cycle air blast circuit interrupted comprising arc-extinguishing means, a high-pressure tank supplying high-pressurized compressed air to said arc-extinguishing means, a low-pressure tank collecting exhaust air from said arc-extinguishing means, a compressor adapted to supply high-pressurized air to said high-pressure tank and to maintain the pressure therein at a predetermined value, said compressor having an inlet, valve means connected to said inlet and also to said low-pressure tank and to the atmosphere to cause said inlet to communicate selectively with said low pressure tank and with the atmosphere, said valve means comprising pressure-sensitive control means for controlling the position of said valve means responsive to the value of the pressure in said low-pressure tank so that said inlet is connected to said low-pressure tank under normal pressurized condition thereof and to atmosphere upon a drop of said value of the pressure in said low pressure tank below a predetermined pressure value greater than the atmospheric pressure to cause said compressor to take air from the atmosphere until said normal pressurized condition is restored, and air-drying means to dry the air taken by said compressor from the atmosphere.

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