Aug. 11, 1964 J. M. JACKSON 3,144,314

MEANS FOR SUPPLYING PRESSURIZED DRY AIR TO AN ENCLOSURE AND CABLE SYSTEMS EMBODYING SUCH MEANS

Filed June 22, 1960 3 Sheets-Sheet 1

FIG. 1A

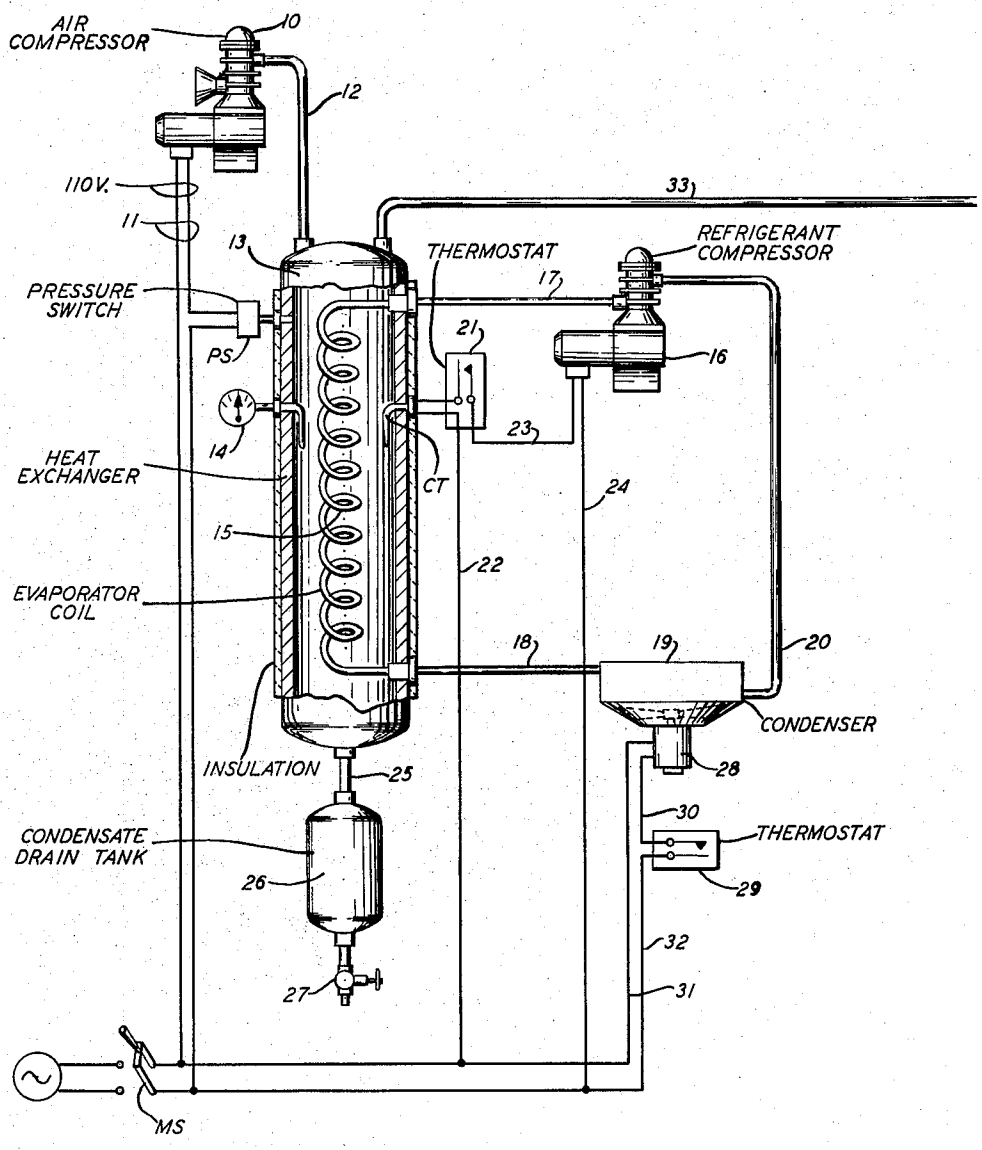

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FIG. 1B

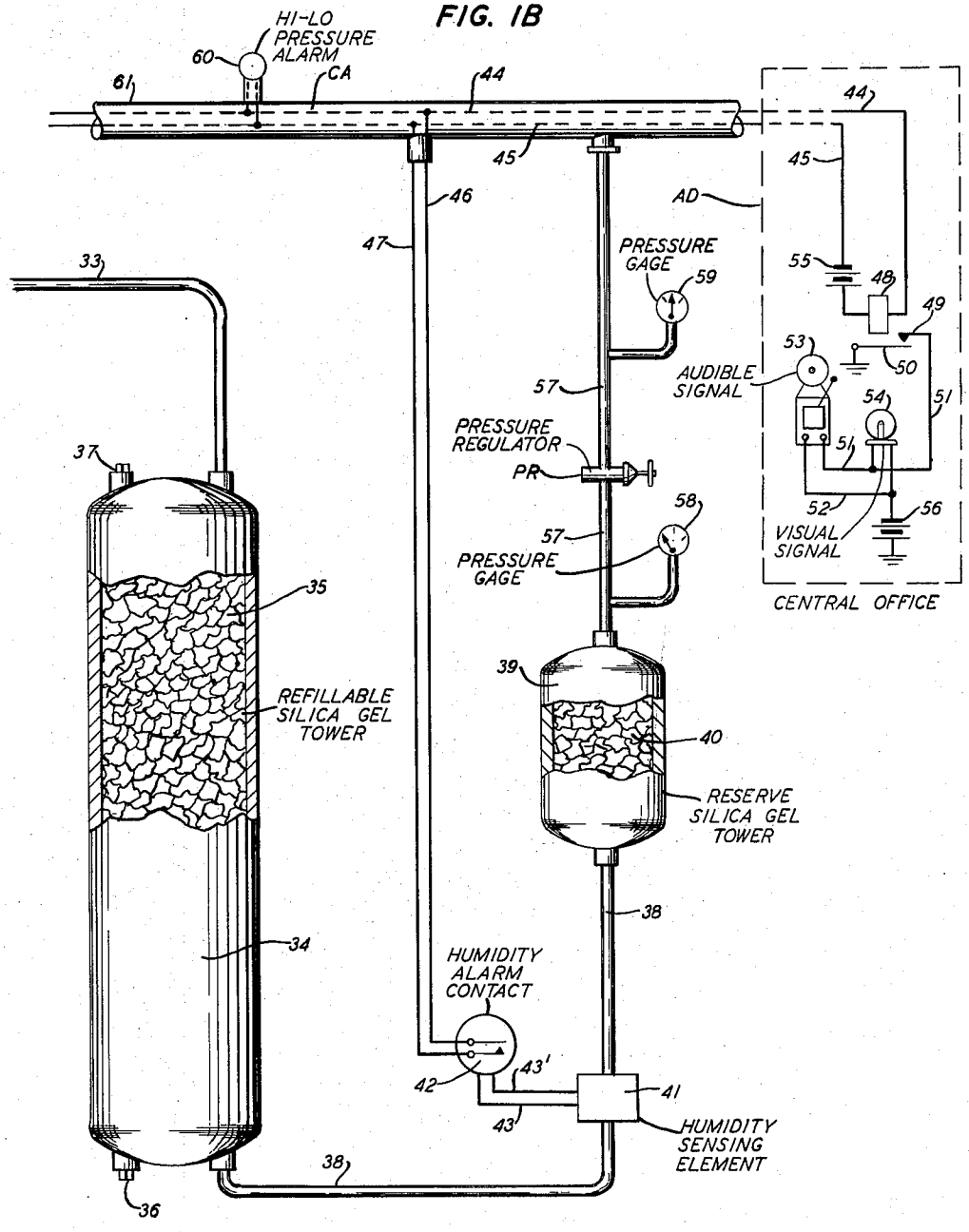

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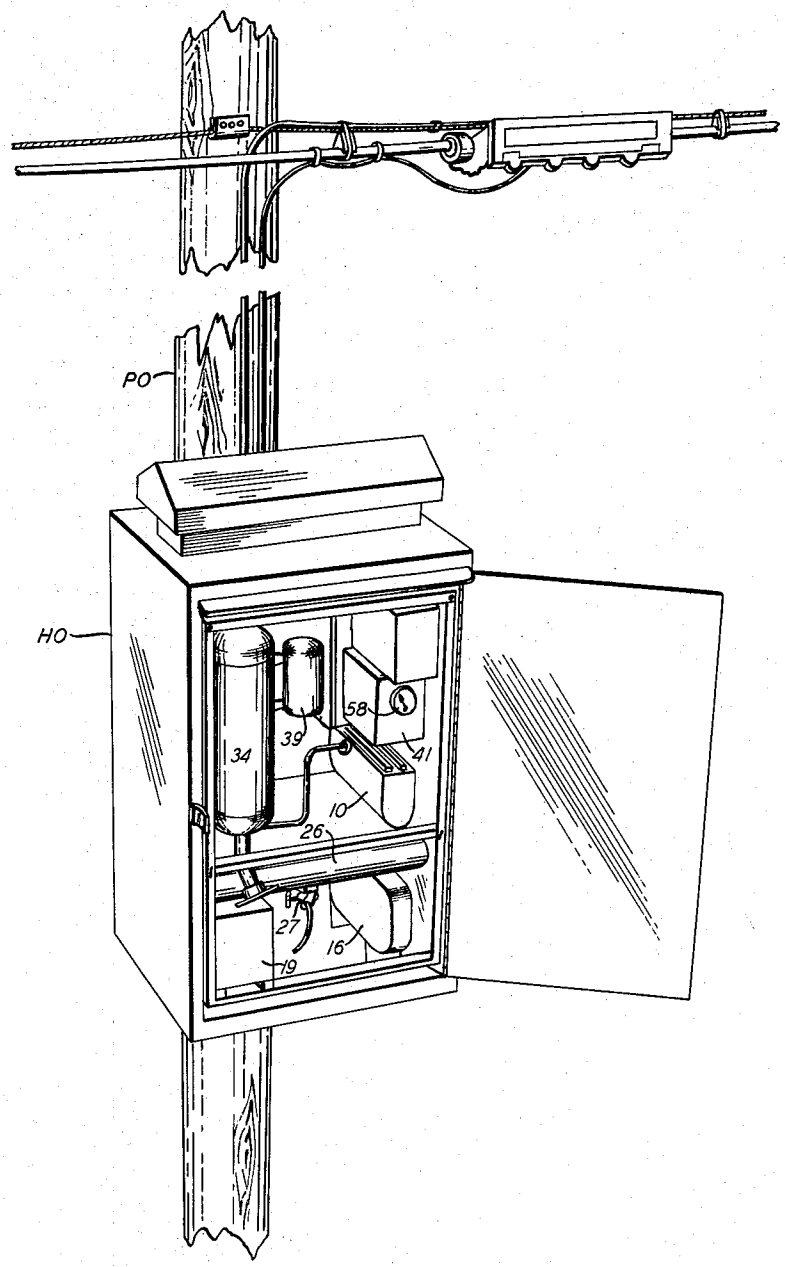
FIG. 2



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MEANS FOR SUPPLYING PRESSURIZED DRY AIR TO AN ENCLOSURE AND CABLE SYSTEMS EMBODYING SUCH MEANS

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This invention relates to means for supplying dry air to sheathed telephone cables and similar enclosures in which it is desirable, for the maintenance thereof, to keep dry air under pressure and it also relates to pressurized cable systems embodying said means. More particularly, it relates to a combined refrigeration and moisture removing unit enclosed in a weatherproof housing or casing intended for installation on existing telephone poles adjacent the cable supported thereby.

An object of my invention is to provide a unit for supplying substantially moisture free air, under pressure, to an enclosure containing electrical apparatus or conductors, which can be combined in a single self-contained unit and which is capable of reliable and continuous operation at a point remote from direct human supervision.

A further object of my invention is the provision of automatic means for controlling the various components which work in combinaiton to produce air, under pressure, which is substantially free from moisture and introduce it into an enclosing structure.

My invention contemplates means for supplying substantially moisture free air, under pressure, to enclosures and in particular to electrical cable, which comprise a plurality of insulated conductors enclosed in a common sheath or jacket.

My invention comprises a combination of components so oriented that they function in a unique and novel manner which results in a trouble-free system which requires a minimum amount of maintenance and service.

A feature of my invention is the provision of refrigeration means for removing the greater portion of the moisture from the air supply in a first stage and additional drying means for removing the remaining portion of the moisture from the air in a second stage before it is introduced into the enclosure and the provision of reserve means associated with the second stage moisture removing means which goes into action when the second stage moisture removing means becomes inoperative.

A further feature of my invention is the provision of alarm means at a remote point for indicating that the second stage moisture removing means is not functioning and that the reserve moisture removing means has gone into action.

Other objects and features will be apparent from the detailed description below.

In the preferred embodiment of my invention which has been found to meet the exacting conditions required for a pole-mounted device for maintaining dry gas pressure in a sheathed aerial electrical cable, I have provided means for supplying air, under pressure, to a heat exchanger. Enclosed in the heat exchanging chamber is a suitable evaporator coil which is in closed circuit with refrigerating components for cooling the interior of the chamber, and the air therein, to a temperature between 30° and 40° Fahrenheit and consequently removing a large portion of the moisture from the air passing therethrough. This chamber is insulated and comprises the first moisture removing stage. The air, under pressure, and having a large percentage of moisture removed therefrom now passes to a second stage moisture removing medium which comprises a chamber or tank containing a suitable moisture removing desiccant, for example, silica gel.

The air upon leaving the second stage of moisture removal now passes through a means for sensing the moisture content of the air which in turn is connected to a suitable alarm at a remote location over a pair of conductors in the cable.

The air after passing through the humidity sensing device is introduced into a second chamber or tank of moisture removing desiccant. This chamber is a reserve and goes into action only when the first chamber of desiccant is no longer functioning.

Under normal circumstances this chamber of desiccant performs no function since the air ordinarily passing therethrough is substantially moisture free due to its previous treatment. The moisture free air is now introduced into the cable through suitable pressure controlling devices.

In order that the unattended device of this invention may be properly supervised and controlled from a remote location suitable signals are provided for indicating the condition of the apparatus and when the second stage of moisture removing desiccant must be renewed.

The invention will be more clearly understood from the following detailed description when read in connection with the following drawings, in which:

FIG. 1 (consisting of 1A and 1B) is a diagrammatic layout illustrating the components which make up the present invention connected to a fragment of multiconductor cable; and

FIG. 2 is a view in perspective illustrating the form the components shown in FIG. 1 assume when assembled in a housing and mounted on a suitable pole.

In FIG. 1 the reference character 10 represents an electrically powered air compressor of the usual type which is manually controlled by the master switch MS and the pressure-operated automatic switch PS in the 110 volt A.C. power supply line 11. Connected to the compressor 10 by means of the piping 12, is the heat exchanging chamber 13 which has associated therewith the pressure switch PS referred to above, and a temperature indicating gauge 14. Enclosed in the chamber 13 is an evaporator coil 15 one end of which is connected to the refrigerant compressor 16 by means of the piping 17. The other end of the coil 15 is connected over piping 18 to the condenser 19 which in turn is connected to the refrigerant compressor 16 by means of piping 20. The action of the compressor 16 is controlled by the temperature within the chamber 13 by means of the capillary tube CT of the thermostat 21 over the conductors 22, 23 and 24 and the 110 volt A.-C. line 11.

Attached to the bottom of the heat exchanging chamber 13, by means of the piping 25, is the condensation drain tank 26 which is equipped with a suitable drain cock 27. Associated with the condenser 19 is the fan 28 which functions as part of the refrigerant unit and also exhausts warm air from the housing (shown in FIG. 2), under the control of the thermostat 29 over the conductors 31 and 32 connected to the 110 volt A.-C. line 11. Thus we have a refrigeration unit cooling the chamber to maintain a temperature therein of between 30° and 40° Fahrenheit and removing from the air passing therethrough the major portion of the moisture which passes into the tank 26.

As the air under pressure leaves the heat exchanger 13, it passes through piping 33 to the tank or chamber 34 which is the second stage of moisture removal. This tank 34 contains a substantial amount of moisture removing desiccant 35, for example, silica gel, which removes the remaining moisture from the air passing therethrough. The tank 34 is provided with a drain plug 36 at its bottom and a refill plug 37 at its top.

The air after passing through the silica gel 35, travels through the pipe 38 to a reserve tank 39 containing an additional supply of moisture removing desiccant 40. Interposed in the piping 38—38 is the humidity sensing

device 41 which is connected to the alarm contact mechanism 42 over the conductors 43 and 43' which in turn are connected to the conductor pair 44 and 45 in the cable CA over the conductors 46 and 47.

The conductor pair 44 and 45 is connected to the distant alarm device AD at the central office. The alarm device comprises the relay 48, the contacts 49 and 50, the conductors 51 and 52 and the audible signal 53 and the visual signal 54 together with a suitable power supply 55 and 56.

In normal operation the air passing into the reserve tank 39 will be substantially moisture free and will pass through the pressure regulator PR, over the piping 57 into the sheathed cable CA. However, in the event that the desiccant in the tank 34 has become saturated the humidity alarm 42 will operate and indicate at the central office that the tank 34 needs recharging and that the system is in operation on the reserve supply of desiccant in the tank 39. The recharging of the tank 39 is not required since upon the recharge of the tank 34, the dry air passing therethrough will automatically reactivate the desiccant 40.

As shown, the outlet piping 57 is also equipped with a first pressure gauge 58, between the tank 39 and the pressure regulator PR, and a second pressure gauge 59 between the pressure regulator PR and the cable CA.

The cable CA is made up of a plurality of insulated conductors encased in an essentially gas-tight sheath 61. In order to maintain the gas pressure within the sheath, the sheath is ordinarily equipped with hermetic seals (not shown) at all terminations and openings or at the ends of the pressurized zone within the cable.

Located in the cable CA is a Hi-Lo pressure alarm detector 60 which indicates when the pressure in the cable CA drops below a certain prescribed minimum. This alarm detector is connected to the alarm system AD at the central office over the conductors 44 and 45 in the cable CA.

With reference to the pictorial showing in FIG. 2, the component parts are assembled in a suitable housing HO which is supported on the pole PO and the component parts in the housing have been marked for ready identification when reference is made to FIG. 1.

While I have shown and described the preferred embodiment of my invention, I am not to be limited to the precise details shown or to any particular type of desiccant for the removal of moisture.

What is claimed is:

1. A pressurized sheathed electrical cable system comprising an electrical cable made up of a plurality of insulated electrical conductors enclosed in a gas-tight sheath, an air compressor, a refrigerant compressor, a heat exchanger unit receiving air under pressure from said air compressor and being cooled by said refrigerant compressor, a drying apparatus through which said air passes into said cable, said drying apparatus including in succession a first desiccant dryer and a second desiccant dryer, a humidity-sensitive switch responsive to the humidity of the air between said first desiccant dryer and said second desiccant dryer, and electrically operated alarm means, remote from said switch, connected operatively to said switch by means of electrical conductors enclosed in said sheath, said switch responsive to a predetermined critical degree of humidity of the air emitted from said first dryer and upon sensing said degree operating said alarm before the desiccant in said second dryer begins to saturate.

2. An apparatus for supplying dry air under pressure to an enclosure, comprising in combination an enclosure, an air compressor, a heat exchanging chamber connected to said compressor, a refrigerant compressor, an evaporator coil in said chamber connected to said refrigeration compressor for cooling the interior thereof, an air outlet on said chamber connected to a first tank containing a moisture removing desiccant, a second tank of moisture removing desiccant connected to said first tank, a humidity alarm device interposed between said first and second tanks responsive to a predetermined degree of humidity of the air emitted from said first tank and upon sensing said degree operating said alarm before the desiccant in said second tank begins to saturate, and an outlet on said second tank connected to said enclosure for the introduction of air into said enclosure.

3. An apparatus for supplying dry air, under pressure to an enclosure, comprising in combination an enclosure, an air compressor, a heat exchanging chamber connected to said compressor, a refrigerant compressor, an evaporator coil in said chamber connected to said refrigeration compressor for cooling the interior thereof, an air outlet on said chamber connected to a first tank containing a moisture removing desiccant, a second tank of moisture removing desiccant connected to said first tank, a humidity sensing and alarm contactor interposed between said first and second tanks, and an outlet on said second tank connected to said enclosure for the introduction of air into said enclosure.

4. An apparatus for supplying dry air under pressure to an enclosure, comprising in combination an enclosure, an air compressor, a heat exchanging chamber connected to said compressor, a refrigerant compressor, temperature and pressure controlling means connected to said chamber, an evaporator coil therein connected to said refrigerant compressor for cooling the interior thereof, an air outlet on said chamber connected to a first tank containing a moisture removing desiccant, a second tank of moisture removing desiccant connected to said first tank, a humidity sensing and alarm contactor interposed therebetween, and an outlet on said second tank connected to said enclosure for the introduction of air into said enclosure.

5. An apparatus for supplying dry air under pressure to the interior of a sheathed electrical cable, comprising in combination a sheathed cable, an air compressor, a refrigerant compressor, a heat exchanging chamber connected to said air compressor, an evaporator coil in said chamber connected to said refrigerant compressor, for cooling the interior thereof, an air outlet on said chamber connected to a first tank containing a moisture removing desiccant, a second tank of moisture removing desiccant connected to said first tank, a humidity-sensing and alarm contactor interposed between said first and second tanks, an outlet on said second tank connected to the sheath of said cable for the introduction of air thereto, a pressure alarm contacting device on said cable, and alarm means at a remote point connected over a pair of conductors in said cable to said device and to said contactor.

6. An apparatus for supplying dry air under pressure to the interior of a sheathed electrical cable, comprising in combination a sheathed cable, an air compressor, and a refrigerant compressor, a heat exchanging chamber connected to said air compressor, an evaporator coil in said chamber connected to said refrigerant compressor for cooling the interior thereof, an air outlet on said chamber connected to a first tank containing a moisture removing desiccant, a second tank of moisture removing desiccant connected to said first tank, an outlet on said second tank connected to the sheath of said cable for the introduction of air thereto, and alarm means at a remote point connected over a pair of conductors in said cable to a humidity sensing and alarm contactor located between said first and said second desiccant containing tanks said contactor responsive to a predetermined critical degree of humidity of the air emitted from said first tank and upon sensing said degree operating said alarm before the desiccant in said second tank begins to saturate.

7. A pole mounted device for supplying dry air under pressure to a telephone cable remotely located from a central office, said cable having a plurality of electrically conducting wires contained within an airtight sheath, comprising in combination: an air compressor, a heat

exchanging chamber connected to said compressor, a refrigerant compressor, an evaporator coil in said chamber connected to said refrigerant compressor for cooling the interior thereof, an air outlet on said chamber connected to a tank containing a moisture removing desiccant, an auxiliary reservoir of moisture removing desiccant connected to said tank, an outlet on said reservoir connected to said cable for introducing air into the sheath thereof, a humidity-sensing and alarm contactor interposed between said tank and said reservoir, and alarm means located in said central office, said means connected to said contactor over a pair of conductors in said cable, said contactor responsive to a predetermined critical degree of humidity of the air emitted from said tank indicating the saturation of the desiccant contained therein, and to operate said alarm before the desiccant in said reservoir begins to saturate.

8. The device described in claim 7 wherein temperature and pressure controlling means are connected to said chamber.

9. The device according to claim 8 wherein a pressure regulator is located between said reservoir and said cable for regulating the pressure emitted from said device to said cable.

10. The device described in claim 9 wherein a pressure sensing mechanism is located on said cable and connected over a pair of conductors to said alarm means in said central office, said mechanism responsive to a predetermined amount of pressure within said sheath and set to operate said means if the pressure in said sheath drops below said amount.

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