Jan. 30, 1945. A. A. RALSTON 2,368,492

EXPLOSION-PROOF APPARATUS

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Fig. 1.

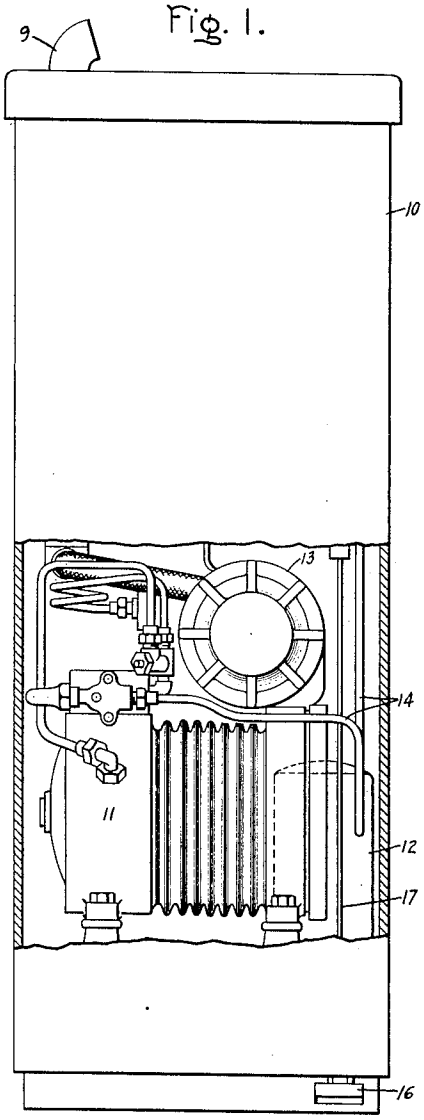
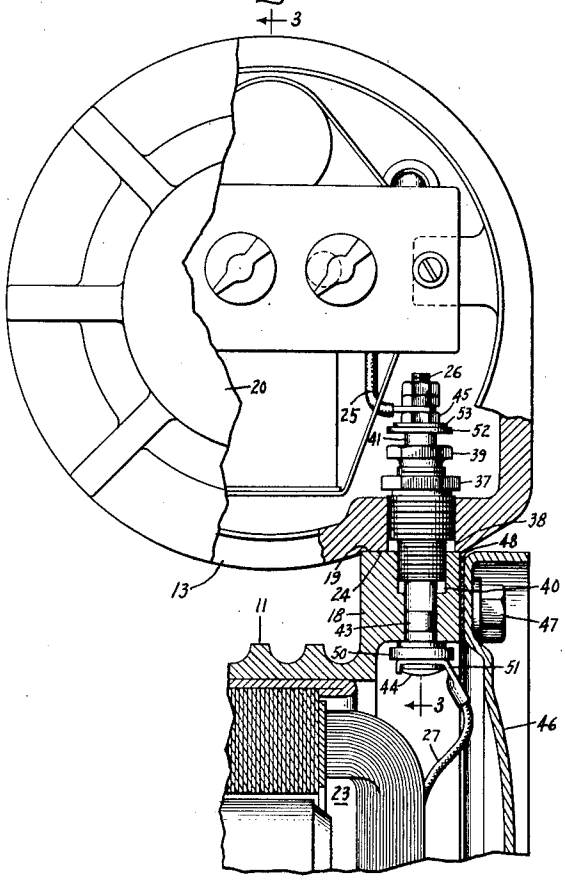


Fig. 2.



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Fig. 3.

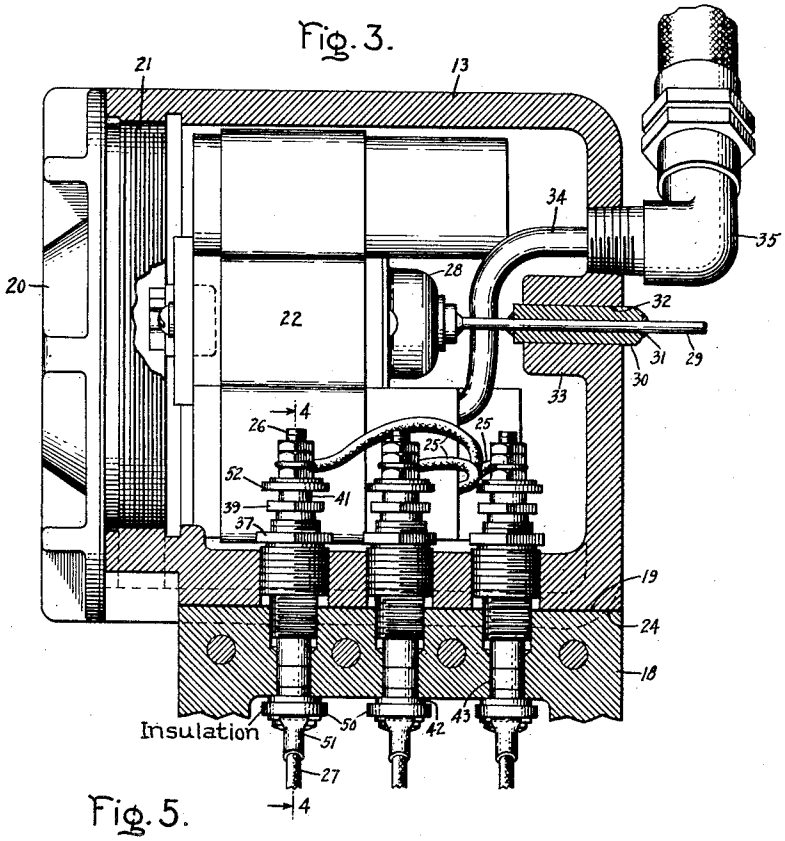


Fig. 5.

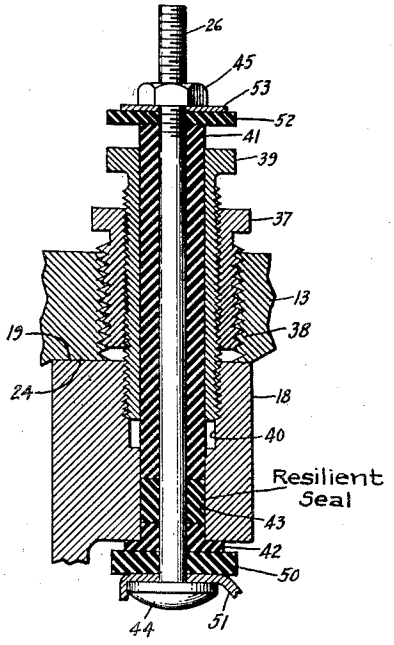
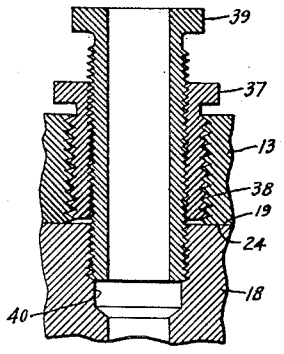


Fig. 4.



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UNITED STATES PATENT OFFICE

2,368,492

EXPLOSION-PROOF APPARATUS

Albert A. Ralston, Fort Wayne, Ind., assignor to General Electric Company, a corporation of New York

Application December 31, 1942, Serial No. 470,815

3 Claims. (Cl. 172—36)

My invention relates to electrically driven apparatus, and particularly to such apparatus which includes an electric motor and a control switch provided with enclosures to render the apparatus explosion-proof.

It is frequently necessary to install apparatus driven by electric motors in locations where there is a possibility of explosion due to the presence in the air of inflammable gases or vapors in quantities sufficient to produce explosive mixtures. For example, it may be desirable to provide a water cooler including an electrically driven refrigerating machine in a factory or other location where there is danger of the presence of an explosive atmosphere in the vicinity of the cooler. The danger of explosion may be avoided by encasing all parts of the mechanism where sparks may be produced so that these sparks do not occur in the atmosphere. However it is also desirable that the control mechanism should be readily accessible for adjustment, repair or replacement. Furthermore, it is desirable for convenience of manufacture that the casing enclosing the control should be separate from the casing enclosing the motor. At the same time, the electric leads connecting the control and motor must be adequately sealed to prevent propagation of flame to the surrounding atmosphere in case of an internal explosion.

It is an object of my invention to provide an improved arrangement for connecting two casings for electric apparatus and which provides a passage for an electrical conductor between the casings.

It is a further object of my invention to provide an explosion-proof unit assembly comprising an electric motor-driven apparatus in a casing; an external control for the electric motor in a separate box; and an improved arrangement for securing the control box on the casing.

Further objects and advantages of my invention will become apparent as the following description proceeds, and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of my invention, reference may be had to the accompanying drawings, in which Fig. 1 is a front elevation view partly in section of a water cooler including a motor-compressor unit embodying my invention; Fig. 2 is an enlarged sectional view of a portion of the motor-compressor unit shown in Fig. 1; Fig. 3 is a sectional side elevation of the unit on the line 3—3 of Fig. 2; Fig. 4 is an enlarged sectional view on the line 4—4 of a connecting means employed in Fig. 3 and shown in its initial position; and Fig. 5 is a view similar to Fig. 4 with the connecting means shown in its final position.

Briefly, the motor-compressor unit illustrated in the drawings comprises a sealed compressor and motor and an enclosed control box mounted on the sealed motor-compressor casing. The control box is provided with an access cover or door which may be screwed tightly in place; and the control box is secured rigidly on the motor-compressor casing by a plurality of motor lead sealing and connecting devices. These devices not only seal the complementary openings in the motor-compressor casing and the control box, but rigidly hold the control box on the unit, and also provide passage for the electrical conductors between the control apparatus and the electric motor within the unit.

Referring now to the drawings, the water cooler illustrated in Fig. 1 comprises an upright casing or cabinet 10, in the lower portion of which is provided a refrigerating machine comprising a motor-compressor unit 11, and a refrigerant condenser 12. The electrical control for operating the motor is included within a closed casing, or control box 13, mounted on the motor-compressor unit 11. During the operation of the cooler, refrigerant is compressed within the casing of motor-compressor unit 11 and is discharged through a conduit (not shown) to the condenser 12, where it is liquefied and is supplied to a cooling unit or evaporator (not shown) located in the upper portion of the cabinet 10. The evaporator absorbs heat from water circulated through a suitable water coil or chamber in accordance with the usual practice, and vaporized refrigerant is returned to the motor-compressor unit 11 through a suction line 14. The water cooler includes a foot pedal 16 connected through a rod 17 to a suitable water controlling valve in the upper portion of the cabinet, and when the pedal 16 is depressed, water is discharged from a drinking fountain bubbler 9 at the top of the cabinet. The casing of motor-compressor unit 11 and the control box 13 are so made and assembled as to provide a so-called explosion-proof structure. By "explosion-proof" is meant that although an enclosure is not necessarily gas-tight, it is such that if an internal explosion should result from the ignition, by a spark, of an explosive gas-air mixture within the enclosure, the flame will be prevented from passing to the surrounding atmosphere.

The control box 13 is rigidly secured on the mo-

tor-compressor 11 in a manner shown in Figs. 2 and 3. The casing of motor-compressor unit 11 includes an upwardly extending boss or flange 18, the top of which is machined to provide a surface 19 for engaging a complementary machined surface 24 of the control box 13. The control box 13 is cylindrical in form and is provided with a cover 20 which is removably secured on the box 13 by threads 21. The cover 20, when removed, provides ready access to the interior of the control box, and when screwed in place provides an explosion-proof closure. Within the control box is located suitable switching apparatus 22 for controlling the motor 23 of the motor-compressor unit 11, the motor being electrically connected to the control through leads 25, conductor rods or leads 26 and leads 27. The control may be made responsive to the temperature of the cooling unit in accordance with common practice, a suitable temperature control bellows 28 being connected through a pressure duct or capillary tube 29 to a control bulb or element (not shown), arranged to be responsive to the temperature of the cooling unit. The control tube 29 is secured and sealed in a metal cylinder 30 by solder 31, and the cylinder is then placed within a cylindrical opening 32 within an internal boss 33 in the casing 13. The fit between the cylinder 30 and the opening 32 is sufficiently close, and the length of the contacting cylindrical surfaces is sufficiently great, that there can be no propagation of flame therethrough. A power supply cable 34 for the motor enters the control box 13 through a suitable connector 35 of an approved explosion-proof construction.

The connecting devices for maintaining the motor lead rods 26 in position, and for holding the control box 13 rigidly on the motor compressor casing 11, each include an external sleeve 37 threaded in an opening 38 in the control box and an internal sleeve 39 threaded in the external sleeve 37 and also in an opening or passage 40 extending through the flange 18 of the casing of motor-compressor unit 11. This construction is clearly indicated in Figs. 4 and 5. The conductor 26 passes through the inner sleeve 39 and is insulated from the sleeve and from the rest of the structure by a sleeve or tube 41 of rigid insulating material which is not provided with threads. The conductor 26 is also provided with a sleeve 42 of rigid insulating material at its lower end adjacent the bottom end of the opening 40 in the casing of motor-compressor 11. The sleeves 41 and 42 do not meet within the passage 40, but are spaced apart to provide room for a resilient sleeve 43 of synthetic rubber or other suitable material. The conductor 26 comprises a bolt having a head 44 at its lower end, and a threaded nut 45 at its upper end. When the connection is in position, the opening 40 is effectively sealed by tightening the nut 45 to compress the sleeve 43 within the opening 40, and provide an effective sealing joint between the lead 26 and the wall of the opening.

The lead 26 is inserted from within the motor-compressor casing 11 after the sleeves 37 and 39 have been secured in place, access to the interior of the casing being had by removing an end closure plate 46 secured to the casing by bolts, one of which is indicated at 47, a suitable gasket 48 being provided between the cover and its seat on the casing.

During the assembly of the motor-compressor unit, the sleeve 37 is threaded into the opening 38 until the lower end of the sleeve is flush with the surface 24. The sleeve 39 is threaded through the sleeve 37 until its lower end is flush with the end of the sleeve 37. This, of course, may be done either before or after threading the sleeve 37 into the opening 38. The sleeves of all three connectors indicated in Fig. 3 are similarly adjusted and the box is then held over the supporting flange 18 with the complementary openings 38 and 40 in coaxial alignment. The sleeves 37 are then rotated away from the flange 18 a slight distance, less than one thread, in order to align the threads of the inner sleeve 39 with the threads of the opening 40, and the sleeves 39 are then threaded into the openings 40 to their lowermost positions as indicated in Fig. 4. The relative positions of the sleeves 37 and 39 as shown in Fig. 4 then depend upon the amount of the slight rotation of the sleeve 37, which was necessary to align the threads of sleeve 39 with those of the opening 40, it being understood, of course, that the sleeve 37 might be flush with the surface 24 if it should happen that the threads were in alignment at this position. The opening in the sleeve 39 and the opening 40 thus provide communication between the interior of the motor compressor casing and the control box 13. The exterior threads on the sleeve 37 have a pitch greater than that of the interior threads which engage the threads on the inner sleeve 39. After the control box has been secured in place with the sleeves in positions such as indicated in Fig. 4, the outer sleeve 37 is rotated in a direction to move it away from the flange 18. The sleeve 39 is held stationary, and there results a differential action whereby the sleeve 37 tends to move out of the opening 38 at a faster rate than it tends to move up the sleeve 39. This rotation of the sleeve 37 forces the control box 13 tightly against the flange 18 and holds the complementary surfaces 19 and 24 rigidly in engagement; furthermore, the differential action of the threads results in a tight locking of the sleeves 37 and 39 with respect to one another. The position of the sleeves after this locking action is indicated in Fig. 5.

After securing the box rigidly on the casing in the manner just described, the assemblies including the conductor rods 26 and their sleeves 41, 42 and 43 together with an insulating washer 50 and clips 51 at the ends of the motor leads are inserted in the opening 40 and the opening in the sleeve 39. Insulating washers 52 and metal washers 53 are then placed over the tops of the rods 26 and the nuts 45 are then tightened in place to compress the resilient sleeves 43 and seal the assemblies against a leakage of refrigerant therethrough. The assemblies thus provide a seal against leakage of refrigerant and also electrical insulation for the motor leads 26. After the assemblies have been secured in place the cover 46 is secured over the end of the motor-compressor casing and the unit is ready to be connected in a refrigerating machine and charged with refrigerant.

The arrangement of the three lead assemblies, including the sleeves 37 and 39, provides a seal between the motor control box and the motor and at the same time provides the connecting means for rigidly holding the control box on the motor-compressor casing. No additional bolts or clamps are required. Access to the lead and connection assemblies is had only through the explosion-proof cover 20, and the entire apparatus, including the control box and the motor-

compressor casing, constitutes an effective explosion proof construction.

From the foregoing, it is readily apparent that I have provided a simple and effective arrangement for securing a motor control box, or similar apparatus, upon an enclosed motor casing, and that the result is an explosion-proof assembly which is effectively sealed and which provides ready access to its several parts for the purpose of adjustment, replacement or repair.

While I have shown and described my invention in connection with a motor-compressor unit for water coolers, other applications will readily be apparent to those skilled in the art. I do not, therefore, desire my invention to be limited to the particular construction shown and described, and I intend in the appended claims to cover all modifications within the spirit and scope of my invention.

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

1. In combination, first and second closed casings, electrical apparatus in said casings, said casings having registering openings providing communication therebetween, said casings having complementary engaging surfaces adjacent their respective openings, and means arranged to force said surfaces into engagement for securing said first casing rigidly on said second casing, said means including a first sleeve threaded in said opening in said first casing and a second sleeve threaded in said first sleeve and in said opening in said second casing, the outer threads on said first sleeve having a greater pitch than the threads on said second sleeve whereby said casings may be secured together by said second sleeve and said complementary surfaces may be forced into effective engagement by rotation of said first sleeve with respect to said first casing to move said first sleeve away from said second casing.

2. In combination, an electric motor having a closed casing and an external closed control box, said casing and said box having registering openings providing communication therebetween, said casing and said box having complementary engaging surfaces adjacent their respective openings, means arranged to force said surfaces into engagement for securing said box rigidly on said casing, said means including a first sleeve threaded in said opening in said box and a second sleeve threaded in said first sleeve and in said opening in said casing, the threads on said first sleeve having a greater pitch than the threads on said second sleeve whereby said box and said casing may be secured together by said second sleeve and said complementary surfaces may be forced into effective engagement by rotation of said first sleeve with respect to said box to move said first sleeve away from said casing, an electric conductor for supplying power to said motor extending from said box to said motor through said second sleeve, means for sealing said conductor within said opening in said casing, and means for electrically insulating said conductor from said box and from said casing.

3. In combination, an electric motor having a closed casing and an external closed control box, said casing and said box having registering openings providing communication therebetween, a close fitting cover on said box for providing access to the interior thereof, said casing and said box having complementary engaging surfaces adjacent their respective openings, means arranged to force said surfaces into engagement for securing said box rigidly on said casing, said means including a first sleeve threaded in said opening in said box and a second sleeve threaded in said first sleeve and in said opening in said casing, the threads on said first sleeve having a greater pitch than the threads on said second sleeve whereby said box and said casing may be secured together by said second sleeve and said complementary surfaces may be forced into effective engagement by rotation of said first sleeve with respect to said box to move said first sleeve away from said casing, said sleeves having portions within said box accessible through said cover and arranged to be engaged by a tool for rotating said sleeves to secure them in position.

ALBERT A. RALSTON.