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INFLATION DEVICE FOR JET ENGINE CONTAINERS

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1

My present invention relates generally to fluid dispensing apparatus and more particularly to a new and improved apparatus of this character having particular utility for automatically filling large containers, such as are used for the storage and shipping of jet engines or the like, with fluid such as air at a designated pressure.

The apparatus of my present invention is designed and constructed for automatically filling or charging containers from a source of pressurized fluid, for example, compressed air, and includes valve means for isolating my device from the source of pressurized fluid, automatically actuated charging control valve means, additional control valve means automatically actuated to isolate a measuring section wherein the pressure of the fluid charged to a container is to be measured, a cam actuated contact system for automatically and sequentially operating the charging and measuring control valve means, an electrical circuit associated with the cam actuated contact system for operating the same and a pressure responsive switch means capable of energizing the circuit to stop the charging operation of my apparatus under certain conditions.

Although the apparatus disclosed herein has particular adaptability for charging large containers such as are employed for housing and shipping jet engines, it is also capable of being utilized for charging and dispensing pressurized fluid to other styles of containers such as pneumatic tires, balloons, storage cylinders, etc. Be that as it may, it will be appreciated from a description of my apparatus which follows, that the same is distinguished by its simplicity of construction and dependability of operation thereby readily lending itself to a variety of uses and having particular adaptability in production line work of industrial mass production systems.

The main object of my present invention is to provide a new and improved fluid dispensing apparatus capable of automatically charging containers to a predetermined pressure level.

A further object of my present invention is to provide a new and improved fluid dispensing apparatus in which means are provided for automatically charging a container with pressurized fluid and measuring the pressure of the fluid in the container so charged.

The above and further objects, features and advantages of my present invention will be recognized by one familiar with the art from the following detailed description and specification therefor and with reference to the accompanying drawing.

2

In the drawing, the single figure shown sets forth a schematic representation of a device embodying the features of my present invention and showing in diagrammatic set up the functional interrelation between the various mechanical elements and the electrical circuit associated therewith whereby I accomplish the correlated and sequential operation of the various valving means employed to bring about the above set forth objects of my invention.

Referring now to the drawing, it will be recognized that a conventional compressor and storage tank system 10, constructed and arranged to supply pressurized fluid, such as air, at pressures in the neighborhood of 100 lbs. per square inch for example, is connected by suitable piping 11 to a manually operated shut-off control valve 12. Connected to control valve 12 is a charging chamber 13 comprising suitable piping, or the like, fitted with a flexible filling hose 14. Filling hose 14 is fitted with a hose connector valve 15 of conventional design adapted to engage a charging connection on the container being filled. Disposed at one end of the charging chamber 13 and to the intermediate the filling hose 14 and the manually actuated line control shut-off valve 12, is a high pressure charging control valve 16 actuated by a solenoid 17. At the opposite end of the charging chamber 13 is a measuring control valve 18, similar to valve 16, and having associated therewith a second electrical solenoid 19. Both of the solenoids 17 and 19, of course, are electrically responsive to energization and deenergization of the respective circuits associated therewith as will be described herein presently. Leading from the right hand end of the charging chamber 13, as shown, and communicating with chamber 13 via the measuring control valve 18, is a pressure measuring chamber indicated generally by numeral 20. Chamber 20 comprises a substantially straight length of piping, or the like, fitted with a pressure responsive gauge 21 and a pressure release safety valve 22, labeled PR in the drawing. Leading from the right hand end of the measuring chamber 20, as viewed in the drawings, is a pipe section 23 communicating between the measuring chamber and a pressure responsive switch means indicated generally at 25. Switch 25 is fitted with a contact arm 25 and is adapted to interrupt the circuit of my device in the presence of excessive pressure within measuring chamber 20 as will be related presently. Switch 25 is further of a conventional known variety and has means embodied therewith whereby the pressure at which such will actuate the contact
carrying arm 26 to an open circuit position may be regulated as desired.

Turning now to the electrical portion of the device of my present invention, it will be recognized from the circuit in the drawing that I have embodied therein a normally open start switch 30, a normally closed stop switch 31, a solenoid relay 32, cam actuated contact arms 33 and 34, an electrical motor 35 designed to rotate cam members 36 and 37, the pressure responsive switch means 28 and 29, and the valve actuating solenoids 17 and 18. A source of electrical potential for supplying the circuit is harnessed by means of a wall plug 38 or the like. In detail, plug 38 is of a conventional variety adapted to connect the apparatus of my present invention to a source of electrical potential such as a 110 volt, 60 cycle, A.C., conventional power supply. Leading from plug 38 are two line conductors 39 and 43. Conductor 39 is interconnected with one contact 41 of the start switch 30 by means of a branch conductor 42. It will be recognized that the start switch 30 is adapted to bridge contacts 41 and 43 to supply current to a short conductor 44 which is connected to a secondary conductor 45 joined between one contact 46 of the normally closed stop switch 31 and the solenoid coil 47 of the relay 32. Coil 47 further connects to the terminal end of the line conductor 40 to which wall plug 38 is attached. It will thus be recognized that with the wall plug 38 joined to the source of electrical potential, closure of start switch 30 to bridge contacts 41 and 43 permits energization of coil 47 of the solenoid relay 32 thereby to close contact arm 48 with contact 49. Contact arm 48 is also directly connected to line conductor 39. Contact 49 is in circuit with a conductor 50 leading to a secondary contact 51 interposed between contact 52 of stop switch 31 and contact 53 of the pressure responsive switch 25. It will thus be recognized that with the stop switch 31 in its normally closed position across contacts 52 and 46 thereof and the relay arm 48 in circuit closed in relation with the contact 49, opening of the start switch 30 will permit the continued energization of coil 47 of relay 32 via the circuit through closed line conductor 39, relay arm 48, contact 49, conductor 50, conductor 51, stop switch 31 and contacts 52 and 46 thereof, and conductor 45 leading to relay coil 47 connected to line conductor 40. Thus the circuit through the start switch, including conductors 39, 42, 44 and 45 constitutes a temporary holding circuit for the initial electrical energization of my apparatus.

As will be recalled, one side of the pressure responsive switch 25 is in circuit with the stop switch 31 by means of conductor 54. Therefore, closure of the switch arm 25 with contact 55 permits energy to flow across the pressure responsive switch 25 to conductor 55 to energize motor 35 which is joined to the negative side of the line or conductor 40 by conductor 56 at junction 51. Branching off of conductor 55 is a conductor 57 connected by branch conductors 58 and 60 to the solenoid coils 61 and 62 of solenoids 17 and 19, respectively. Coil 61 of the valve actuating solenoid 17 is joined by conductor 64 to the cam actuated contact arm 34 which is adapted to be actuated in the direction of cam member 36 by the resilient contact carrying arm 65 over the cam actuated contact arm 34 for cooperation therewith and is joined to the negative line conductor 40 by a short conductor 66. Solenoid coil 62 likewise is similarly joined to cam actuated contact arm 33 by conductor 67 and contact carrying arm 68 associated therewith is joined to conductor 40 by a short lead conductor 69. An indicating light 70 is jumped across the line by means of conductors 11 connected to conductor 50 and conductor 72 connected to the negative conductor 40.

From an inspection of the cam members 36 and 37, which are rotatably driven by means of motor 35, it will be recognized that cam 35 is provided with a cam portion 76 in its periphery while cam 37 is provided with a projecting ear portion 71 in its periphery. It will further be understood that the showing of the cam members 36 and 37 is schematic herein and designed only to represent any suitable camming arrangement whereby the solenoid coils 61 and 62 of the valve actuating solenoids 17 and 19 may be alternately energized. In this regard it may be pertinent to observe that in the preferred arrangement of the motorized camming system of my instant apparatus, I prefer that circuit closure through contact arm 34, in circuit with the charging valve solenoid 17, be maintained for approximately eight or nine times the length of time that circuit closure to solenoid 19 is effected by closure of contact arm 33. Further it is pertinent to observe that, in effect cam members 36 and 37 are respectively formed to function in direct opposition to one another. That is to say, closing contact between contact arm 34 and the contact carrying arm 65 will take place throughout almost an entire revolution of cam 36 with interruption of circuits to solenoid 17 through these two contact members occurring only when the follower of the cam actuated contact arm 34 falls downwardly into the notch or depression 76 of cam 36. Conversely, circuit closure between contact arms 33 and 68 for energizing solenoid 19 occurs only during that portion of the rotational movement of cam 37 wherein the projecting ear member 71 engages the contact arm 33 to raise the same upwardly into circuit closing engagement with the overlying contact carrying member 68. Obviously, the length of time during which either of the solenoids energized may be regulated by appropriate design of the cam actuators as desired, with the only essential feature necessary to successful operation of my present device residing in the feature of alternately energizing the two valve actuating solenoids 17 and 19 so that the valves associated therewith are alternately opened and closed.

Use and operation

From the above detailed description of the several mechanical features and the electrical circuit employed in my present apparatus, it will be recognized that successful operation of the device takes place somewhat as follows:

To operate my new device, it is first necessary to insert wall plug 38 into a suitable receptacle for connecting the same to the source of electrical potential 30, which is a 110 volt, 60 cycle, A.C. source. Electrical energization of the device and motorizing of cam members 36 and 37 is then accomplished by plunging starter switch 30 to close circuit between contacts 41 and 43 thereof. This permits the flow of energy via conductors 39, 42, 44 and 45 to solenoids 17 and 19, respectively. Branching off of conductor 55 is a conductor 57 connected by branch conductors 58 and 60 to the solenoid coils 61 and 62 of solenoids 17 and 18, respectively. Coil 61 of the valve actuating solenoid 17 is joined by conductor 64 to the cam actuated contact arm 34 which is adapted to be actuated in the direction of cam member 36 by the resilient contact carrying arm 65 over the cam actuated contact arm 34 for cooperation therewith and is joined to the negative line conductor 40 by a short conductor 66. Solenoid coil 62 likewise is similarly joined to cam actuated contact arm 33 by conductor 67 and contact carrying arm 68 associated therewith is joined to conductor 40 by a short lead conductor 69. An indicating light 70 is jumped across the line by means of conductors 11 connected to conductor 50 and conductor 72 connected to the negative conductor 40.

Flow of energy through relay coil 47, of course, actuates the same to attract relay arm 65 into circuit closure with contact 49 thus permitting energy to flow via conductors 39, 50 and 51 to terminal 62.
of the normally closed stop switch 31. Since the stop switch is normally in its closed condition or bridged between contacts 52 and 54 thereof, the second supply circuit to relay coil 47 will be completed through conductor 45. Release of the normally open start switch will then de-energize the starting holding circuit therefrom with the circuit through the relay solenoid 32 being maintained through normally closed stop switch 31, as above explained. Closure of relay contact arm 48 with contact 49 permits energization of motor 35 via conductors 50, 51, switch 25 and conductors 55 and 56. Conductor 55 also supplies energy to the coils of the two valve actuating solenoids 17 and 19 via conductors 58, 59 and 58, 60 respectively. With the motor energized, cams 36 and 37 will be rotated and in the particular situation illustrated in the drawings wherein cam 36 is positioned so that the contact follower of contact arm 34 is engaged with the greater diameter portion of its surface, circuit will be completed through coil 61 of solenoid 17 to line conductor 40, thus permitting energization of the solenoid 17 and the opening of the charging control valve 16. Air or like compressed fluid at a desirable supply pressure, for example, 100 p. s. i. will then flow through open line control valve 12 by means of conduit 11. The charging chamber 13 will then be filled with the pressurized fluid which is transmittable therefrom to the container being charged by means of hose connector 15 and hose 14. As heretofore explained, cam 36 is so designed that energization of solenoid 17 takes place during a time interval approximately nine times the length of the energization period of solenoid 19. Therefore, so long as solenoid 17 remains energized pressurized fluid will continue to flow through charging chamber 13 to a container connected to the charging hose connection 15. When the cam follower on contact arm 34 falls downwardly into recess 16 of cam 36, circuit through solenoid coil 61 will be interrupted and valve 16 will close to interrupt the supply of pressurized fluid to charging chamber 13. Due to the arrangement of the cam members 36 and 37 with the closing of valve 16, the measuring control valve 18 will simultaneously be lifted as projection 71 of cam 37 raises contact arm 33 to close circuit with contact carrying arm 68 and energize solenoid coil 62. Upon this occurrence the pressurized air in chamber 13 and the container being filled will flow into measuring chamber 20 where its pressure will be registered on the scale of pressure gauge 21. If perchance the pressure of the fluid thus measured in chamber 20 is excessively high, the same will be vented off by lifting the pressure responsive safety valve 22. Pressure in chamber 20 will also simultaneously pass to the diaphragm of pressure responsive switch 25 by means of conduit 23. If the pressure of the fluid acting on switch 25 is in excess of the predetermined value set thereon, the same will force contact arm 26 thereof to break circuit connection with contact 25 and thus interrupt energization of motor 25 to interrupt the cyclic operation of valves 16 and 18 by halting the rotational functioning of cams 76 and 77. In the normal operation of a device of this character wherein a jet engine storage or shipping tank is to be charged with air at 8 p. s. l. the cyclic opening and closing of charging valve 16 and the subsequent measuring of the pressure in the container by lifting of the measuring valve 16 to emit fluid from chamber 13 to chamber 20 will take place many times before the desired 5 pound level is reached to cause interruption of the circuit by the actuation of the pressure responsive switch 25. As a further guarantee against overcharging of the container and to permit the manual interruption of the device's operation as desired, opening of the stop switch 31 likewise stops the device by interrupting the circuit to the relay 32. It will be thus recognized that I have provided a new and improved fluid charging apparatus capable of automatic and safe operation of the charging of containers to a desired pressure level. It further will be anticipated that the motorized camming arrangement by which the alternate and time sequential operation of the charging control and pressure measuring control valves of my device takes place, permits a wide range and variation in the charging and pressure measuring periods of an apparatus of this character by merely changing the cam design. Thus a range of utility for specific instances and operations in adapting my device to a wide variety of uses is readily apparent. Further, while I have herein described and illustrated by device as related to particular embodiment thereof, it will be appreciated that numerous changes, modifications and substitutions of equivalents may be made therein without departing from the spirit and scope of my invention. I therefore do not wish to be limited to the specific embodiment of my invention herein illustrated and described except as may appear in the following appended claims.

I claim:

1. A fluid dispensing apparatus of the class described, comprising in combination, a charging chamber, means for supplying pressurized fluid to said charging chamber, charging control valve means for controlling the admission of fluid to said charging chamber, filling connecting means for interconnecting said chamber with a container to be filled with pressurized fluid, a pressure measuring chamber communicating with said charging chamber, means for responding to the fluid pressure in said measuring chamber, pressure measuring means communicated with said measuring chamber, pressure responsive electrical switch means arranged to operatively respond to a preselected fluid pressure in said measuring chamber, and means arranged to cause the alternate opening and closing of said two named control valve means, and a motor in circuit with said switch means and having driving connection with said cam means; charging and measuring of fluid to the container being alternated in response to the sequential opening and closing of said two named control valve means with such functioning being interrupted when the fluid in said container has attained said preselected pressure whereby said switch means will open circuit to said motor.

2. A fluid dispensing apparatus of the class described for filling a container with pressurized fluid, comprising, a charging chamber having connection with a source of pressurized fluid, a first solenoid actuated control valve operable periodically to admit pressurized fluid to said charging chamber, means having connection with said charging chamber for transmitting fluid therefrom to a container to be filled, a pressure measuring chamber communicating with said charging chamber, pressure measuring
means communicating with said pressure measuring chamber, a second solenoid actuated control valve operable to periodically admit pressurized fluid from said charging chamber to said measuring chamber, an electrical motor, cam means driven by said motor and arranged to alternately cause the opening and closing of said two named solenoid actuated valves by alternately closing electrical contact means in circuit with the actuating solenoids thereof, and pressure responsive switch means in circuit with said motor and arranged to open circuit thereto at a preselected pressure in said measuring chamber whereby said container will be charged with fluid until said preselected pressure has been reached therein.

3. Fluid dispensing apparatus of the class described for automatically charging a container with pressurized fluid at a preselected pressure, comprising in combination, a charging chamber having connection with a source of pressurized fluid, first solenoid actuated valve means in said chamber for controlling the admission of pressurized fluid thereto, container filling connective means communicating with said charging chamber and constructed for connection with a container to be filled, a pressure measuring chamber communicating with said charging chamber and having means for measuring the pressure of fluid therein, second solenoid actuated valve means disposed between said two named chambers for controlling the admission of fluid to said measuring chamber, pressure responsive switch means responsive to a preselected pressure within said measuring chamber, and motor driven cam means sequentially controlling actuation of said two named solenoid actuated valve means and having circuit connection with said pressure responsive switch means whereby opening of said first valve means will permit charging of fluid to said container, closing of said first valve means and opening of said second valve means will cause measuring of the fluid pressure within said container, and opening of said switch means will halt the operation of said motor and cam means.

No references cited.