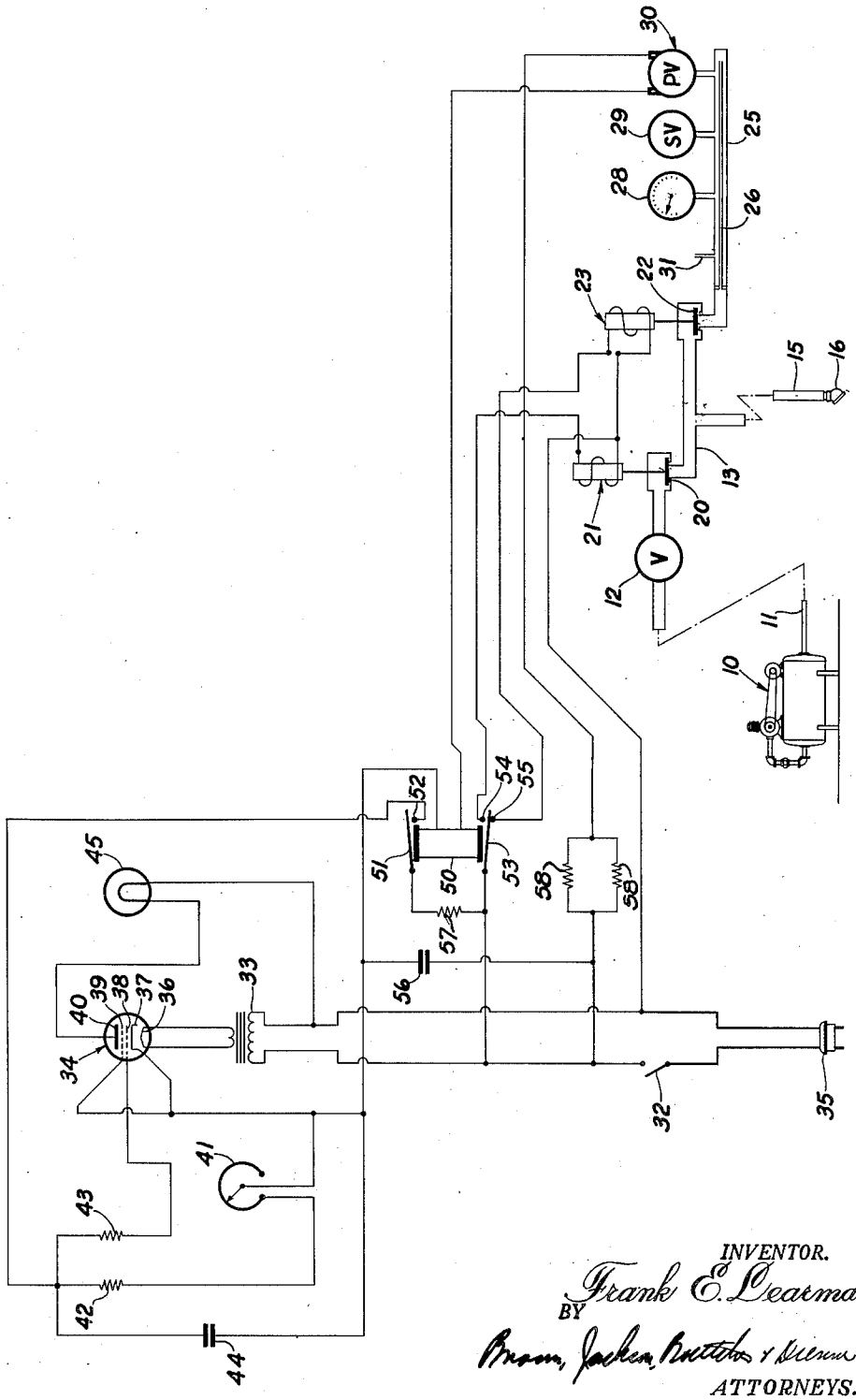
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FLUID DISPENSING APPARATUS

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FLUID DISPENSING APPARATUS

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My present invention concerns fluid dispensing apparatus having particular utility for filling cylinders with fluid under pressure.

The apparatus of my present invention is designed and constructed for connection to any suitable source of fluid under pressure, for example compressed air, and includes shut-off valve means operable to close connection between the supply source and a container being charged with such fluid. Additionally, filling control and pressure regulating control valve means respectively separate the container from the supply source and pressure measuring and regulating means in such a manner that at the completion of charging of the container, the fluid therein will be at a desired pressure. Further, associated with the valving system of my present apparatus I have embodied an electronic timing device capable of automatically opening and closing the control valves of the filling and control sections of my apparatus.

The apparatus as disclosed herein, finds particular utility in charging air cylinders used in storing airplane jet engines, but may be used with like facility for the charging of pneumatic tires, balloons or other similar containers. In any event, the utilization of an apparatus of the character herein disclosed readily adapts itself to production line setups wherein continuous manufacturing processes are carried forth and provides a convenient medium for automatically charging a container to a designated pressure level.

The main object of my present invention is to provide a new and improved automatic fluid dispensing apparatus useful for the charging of containers to predetermined pressure levels.

A further object of my present invention is to provide a new and improved fluid dispensing apparatus having associated therewith electronic timing means capable of automatically actuating suitable valving arrangements whereby containers to be charged with fluid may be filled to a predetermined and desired pressure.

A still further object of my present invention is to include means, associated with the fluid dispensing apparatus of my invention, which will overcome the automatic electronic timing means utilized to control and effect the filling operation of a container from a designated source of pressurized fluid so that my apparatus may be operated without respect to the electronic timing means associated therewith.

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

In the drawings:

The single figure is a schematic representation of a device embodying the features of my present invention and showing in diagrammatic setup the functional interrelation between the electronic timing means, the valving means controlling the connection of a container to be filled with a suitable supply source of pressurized fluid and the control means associated therewith for insuring the filling of such a container to a designated pressure.

Referring now to the drawing, it will be recognized that a conventional compressor and storage tank system **10** is arranged to supply pressurized fluid, such as air, at pressures, for example, in the neighborhood of 100 pounds per square inch. A supply line **11** leads from the storage tank system **10** and is fitted with a line control shut-off valve indicated schematically at **12**. Connected to control valve **12** is a filling chamber **13** consisting of a suitable piping arrangement fitted with a flexible filling hose **15** having a filling connection valve **16** of conventional variety at its outer end for connection with a container to be charged. Disposed at one end of chamber **13** intermediate the filling hose **15** and the shut-off valve **12**, is a first solenoid controlled filling valve **20**, electrically operable in response to energization and deenergization of a solenoid, indicated generally at **21**. At the opposite end of chamber **13** is positioned a second solenoid actuated pressure control valve **22** responsive to the electrical control of solenoid **23** associated therewith. Opening and closing movement of valve **22** controls communication of chamber **13** with a delayed pressure chamber **25** comprising an elongated pipe section closed at its outer end. When the second solenoid valve **22** is positioned in an open condition as illustrated, air from chamber **13** flows into the delayed pressure chamber **25** via a small diametered elongated tubular member **26** having a reduced internal cross section. The sole function of the second solenoid actuated valve **22** is to control the admission of air from the filling chamber **13** to the delayed pressure chamber **25**. Chamber **25** is fitted with a pressure gauge **28**, safety valve **29**, and a normally closed pressure responsive electrical switch of a known or preferred variety indicated generally at **30**. Also leading from the delayed pressure chamber **25** is a small vent tube **31**. The sole function of the first named solenoid actuated shut-off valve **20** is to control the admission of pressurized fluid from the compressor and storage tank **10** to the filling hose **15** and the filling connection valve **16**.

In order to control the automatic and time sequential operation of the two solenoid actuated valves **20** and **22** and thus the admission and control of the pressurized fluid to the container being filled, I have found it desirable to employ a pulse timing electronic circuit, as shown, of known design which is disclosed and described in "Handbook of Industrial Electronic Circuits" by Markus and Veluff, published by McGraw-Hill Publishers, First Edition—1948, page 241, and also in "Industrial Chemistry and Engineering (Analytical Edition)" for January 1946, volume 18, page 79. In general the timer circuit as illustrated in the drawings and described in the above named references is designed to control the electrical energization of the two solenoids **21** and **23** so that the valves **20** and **22** associated respectively therewith will be alternately opened and shut in response to the timing impulses generated by the electronic circuit.

Briefly, the timer circuit is to be fed off of a 110 to 115 volt, 60 cycle A. C. supply, such as a normal household supply source, by means of wall plug **35**. A line control switch **32** is used to selectively control the supply of the energy to a transformer **33**. The energization of the electronic circuit is controlled generally by the operation of a 2050 gas tetrode electronic tube indicated generally at **34**. The tetrode tube **34** includes five elements, namely, a filament **36**, cathode **37**, control grid **38**, shield grid **39** and plate **40**. Since the shield grid **39** requires no voltage in relation to the cathode, such is interconnected with the cathode. The cathode grid circuit includes a potentiometer **41**, a resistance **42**, a second resistance **43** and a condenser **44**. In circuit with the plate is resistance **45**, shown herein as a light bulb which serves additionally to indicate to the operator that the timing circuit is energized. Operation of the two solenoids **21** and **23** by the timer circuit is not effected directly but through a normally open electro-magnetic relay **50** having a first movable contact arm **51** associated with a single contact **52** of the timer circuit which cooperates to connect and disconnect one side of the supply line with the grid supply circuit for tube **34** over a resistance **57**. A second movable contact arm **53** operates between contacts **54** and **55** respectively teamed with the valve actuating solenoids **21** and **23**. A plate circuit capacitor **56** is also in circuit with the relay **50** which serves to maintain the relay energized after deenergization of the 2050 tube **34**, as will be explained hereinafter. Additionally a pair of resistances **58**, **58**, coupled in parallel relation, are connected in circuit between the relay **50**, and one side of the supply line.

Operation

In operating a device of the character described hereinabove, closure of line switch **32** serves to energize transformer **33** of the electronic timer circuit from the 110 to 115 volt, 60 cycle, A. C. supply source tapped by means of wall plug **35**. Filament **36** of tube **34** will then be warmed in approximately 15 seconds at voltages of substantially 6.3 volts and currents of .6 ampere. Plate current is supplied over resistance **45** which limits the plate current and the charging current of capacitor **44** to less than the tube's rated maximum of 1 ampere.

Resistance **43** of one megohm is coupled with the grid **38** of the tube and this resistance serves to limit the grid current while the setting of rheostat **41** in circuit with the cathode and control grid determines the pulse rate of the tube. The range of the tube's pulse rate is determined by the values of rheostat **41**, resistance **42** and capacitor **44**. Rheostat **41** also acts to reduce arcing between relay contact arm **51**, and contact **52** and between relay contact arm **53**, and contacts **54** and **55** on inductive loading of the relay. In operation negative bias on the tube grid leaks off as determined by the RC combination in the grid circuit so that when sufficient bias voltage is lost from the grid, the 2050 tube **34** conducts, closing relay contact arm **51** with contact **52** and contact arm **53** with contact **54**; the circuit being completed to the other side of the supply line through the relay **50** and the normally closed pressure responsive switch **30**.

Closure of relay contact arm **51** with contact **52** and arm **53** with contact **54** when relay **50** is energized is also accompanied by charging of capacitor **44** and capacitor **56** until the plate voltage of the tube becomes too low for conduction to continue. At that point the tube stops conducting and the period of non-conduction is determined or controlled through the setting of the potentiometer **41** and the value of resistance **42** in ratio to the ability of the condenser **44** to absorb charge and retain it. While condenser **44** is being degenerated through resistance **42** and potentiometer **41**, the plate circuit capacitor **56**, which was also charged during the conduction period of the tube, continues to discharge to relay **50** thereby energizing the same for an additional period of time after tube **34** has stopped conducting.

As relay **50** is energized, closure of contacts **52** by relay contact arm **51** serves to replace the negative charge on the grid of the gas tetrode rectifier tube **34**.

Closure of contact **54** with arm **53** as relay **50** is energized, serves to energize solenoid **21** associated with the filling control valve **20**. Such action permits valve **20** to open allowing high pressure air (100 p. s. i.) to enter chamber **13** for charging a container attached to the filling hose **15** by means of connector **16**.

When relay **50** is deenergized, the circuit to solenoid **21** is interrupted and contact arm **53** falls to make closed circuit connection with contact **55** associated with the second solenoid **23**. This action places solenoid **23** across the line to open valve **22**. Opening of valve **22** allows the air or fluid in chamber **13** to seep gradually into the delay pressure chamber **25** via the small inlet tube **26**. The pressure in chamber **13**, the container being filled, and the chamber **25** is thus registered on pressure gauge **28**.

When tube **34** again conducts, relay **50** is energized to break the circuit to solenoid **23**, thus closing valve **22** and energizing solenoid **21** to open valve **20**. This cyclic operation of the two valves **20** and **22** is continued according to the pulse rating of the electronic timer circuit until the container being charged has been filled to a desired level.

During the time that valve **22** is open and when the same is closed the air in chamber **25** is permitted to gradually escape to atmosphere via the small diametered vent tube **31**.

It should also be noted that if pressure in chamber **25** at any time exceeds a designated limit, the safety valve **29** therein will lift to rapidly vent off the air in both chambers **13** and **25** as well as the container being filled. At the same time the pressure responsive switch **30**, which is likewise set to open at a designated pressure level, will open to cut out the electronic timing circuit and place solenoid **23** directly across the line thereby maintaining valve **22** open until the pressure in chamber **13** and the container being filled is vented off to the desired pressure level.

In the particular use for which my present device is designed, I desire to charge huge air flasks, such as jet engine housings, to a designated pressure level of approximately 5 p. s. i. I, therefore, set the pressure responsive switch **30** to lift at 5 p. s. i. and the safety valve **29** to lift at a somewhat higher pressure. Thus, charging of the container takes place automatically according to the pulsating cyclic operation of the timer circuit, the filling valve **20** and the delayed pressure control valve **22**, until the desired 5 p. s. i. pressure is arrived at in the flask being charged. Normally the operator watches gauge **28** near the last part of the charging operation so that as the desired pressure is approached he may open line switch **32** or disconnect the filling hose **15** from the flask being charged to stop the operation. However, if the operator does not happen to be on hand to shut off the charging, no great damage will be done to the container since at pressures greater than the 5 pound level, switch **30** will open to lift valve **22** and vent off the excess pressure to atmosphere via vent tube **31**. If the charging operation is not stopped after such an occurrence the pressure responsive switch will close again when the 5 pound level is reached thereby to cut in the charging operation effected by the electronic timing circuit. Valve **20** will subsequently open according to the energization of relay **50**, charging the container in excess of the 5 p. s. i. desired. When valve **22** is again opened at deenergization of relay **50**, the excessive pressure in the container will again open switch **30** until the pressure in excess of 5 p. s. i. is vented off via tube **31**, etc.

Thus it will be recognized that I have provided a new and improved fluid dispensing device or apparatus particularly adapted for the automatic charging of containers, flasks, etc., to designated pressure levels with the charging time being automatically controlled by an electronic circuit means as described.

The advantages of such an apparatus will be readily apparent to those familiar with the art and although various changes, modifications and substitutions of equivalents may be made in my device as disclosed and described, it is not contemplated that such will depart 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. In a fluid dispensing apparatus of the class described for filling a container from a source of pressurized fluid, a filling chamber, filling valve means controlling the admission of pressurized fluid to said chamber, filling connection means in said chamber arranged for attachment with the container to be filled, a delayed pressure chamber communicating with said filling chamber, pressure control valve means between the two chambers, timing means adapted to open and close said filling and pressure control valves alternately according to a preselected time sequence, pressure measuring means in said delayed pressure chamber for measuring the pressure in the container when said pressure control valve means is open, vent means in said pressure chamber for venting the pressure therein to atmosphere, and switch means arranged to open said pressure valve at a predetermined pressure irrespective of the operation of the timing means thereby to vent pressure off of the container being filled.

2. A fluid dispensing apparatus of the class described comprising, a filling chamber having means for connection with a container to be filled with pressurized fluid, means connecting said filling chamber with a source of pressurized fluid, a filling control valve means operable to selectively isolate said filling chamber from said source of fluid, a delayed pressure chamber communicating with said filling chamber, a pressure control valve means operable to isolate said filling chamber from said pressure chamber, pressure measuring means communicating with said pressure chamber, a vent means opening to atmosphere from said pressure chamber, electronic timing means arranged to alternately open and close said filling and pressure control valve means, and a pressure responsive switch means in said pressure chamber constructed and arranged to deenergize said electronic timing means and open said pressure control valve means at pressures in excess of a predetermined value.

3. In a fluid dispensing apparatus of the class described for filling a container from a source of pressurized fluid, a filling chamber, a first solenoid, a filling valve means controlling the admission of fluid to said filling chamber from the source of pressurized fluid and operable in response to actuation of said first solenoid, a delayed pressure chamber adjacent said filling chamber and interconnected therewith, a second solenoid, a pressure control valve means disposed intermediate said two chambers for controlling the flow of fluid therebetween in response to operation of said second solenoid, timing means arranged to control the alternate energization and deenergization of said two solenoids thereby to effect alternate opening and closing of said filling and pressure control valve means, pressure measuring means in said delayed pressure chamber for measuring the pressure in said two chambers and the container to be filled, vent means communicating with said pressure chamber for venting the same to atmosphere, and pressure responsive switch means arranged to disconnect said timer means at a preselected pressure and energize said second solenoid thereby to open the said pressure control valve means and vent off pressures in the container in excess of the preselected pressure at which said switch means is set to respond.

4. A fluid dispensing apparatus of the class described for filling a container with pressurized fluid, comprising,

a filling chamber having connection with a source of pressurized fluid, a solenoid actuated filling control valve operable to selectively emit pressurized fluid into the filling chamber, means associated with said filling chamber for connecting the same with the container to be filled, a delayed pressure chamber communicating with said filling chamber, solenoid actuated pressure control valve means operable to selectively control the emission of fluid from the filling chamber to said pressure chamber, pressure measuring means in said pressure chamber, vent means in said pressure chamber for venting the same to atmosphere, timing means for automatically and alternately operating the said two named solenoid actuated valve means, and pressure responsive switch means in said pressure chamber for disrupting the sequential energization of the solenoid operated valve means by the said timer means at a predetermined pressure; said switch means additionally opening said pressure control valve means until the pressure in the container is vented off to the said predetermined pressure via said vent means.

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