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MECHANISM FOR DRAINING ACCUMULATED
MOISTURE FROM STORAGE TANKS

2,552,518

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2 Sheets-Sheet 1

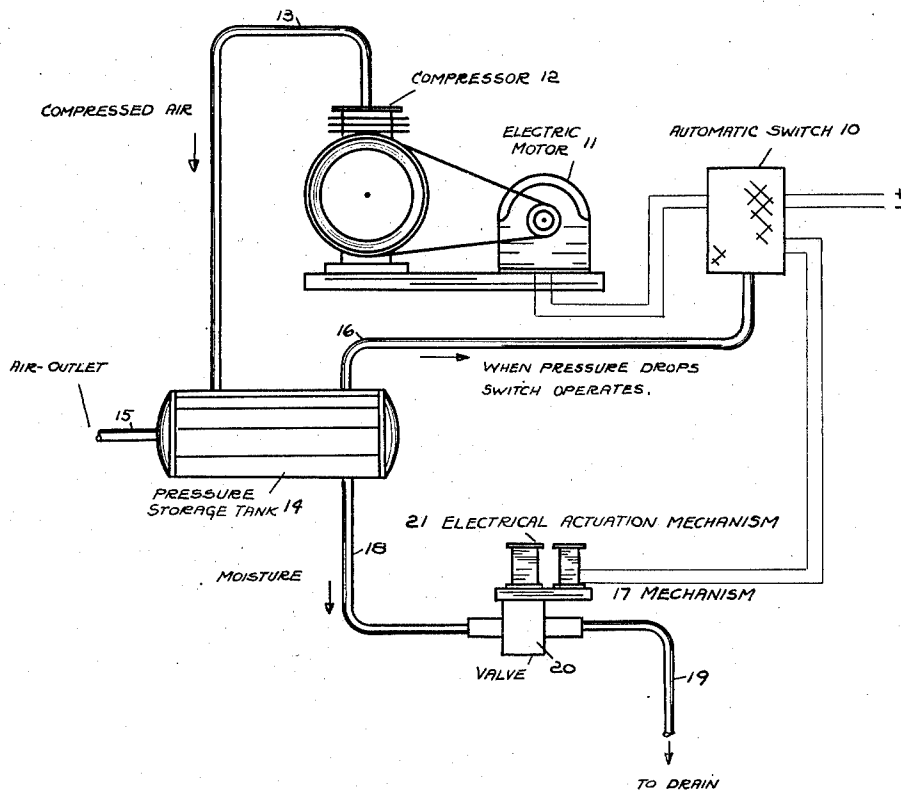


Fig. 1

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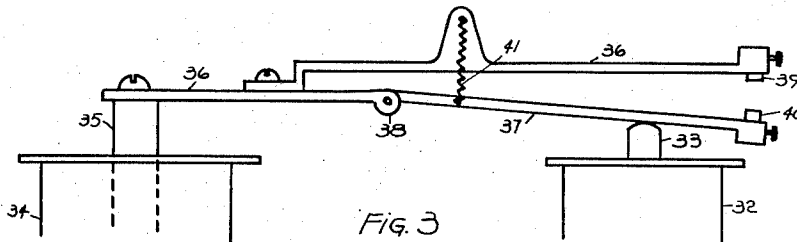


Fig. 3

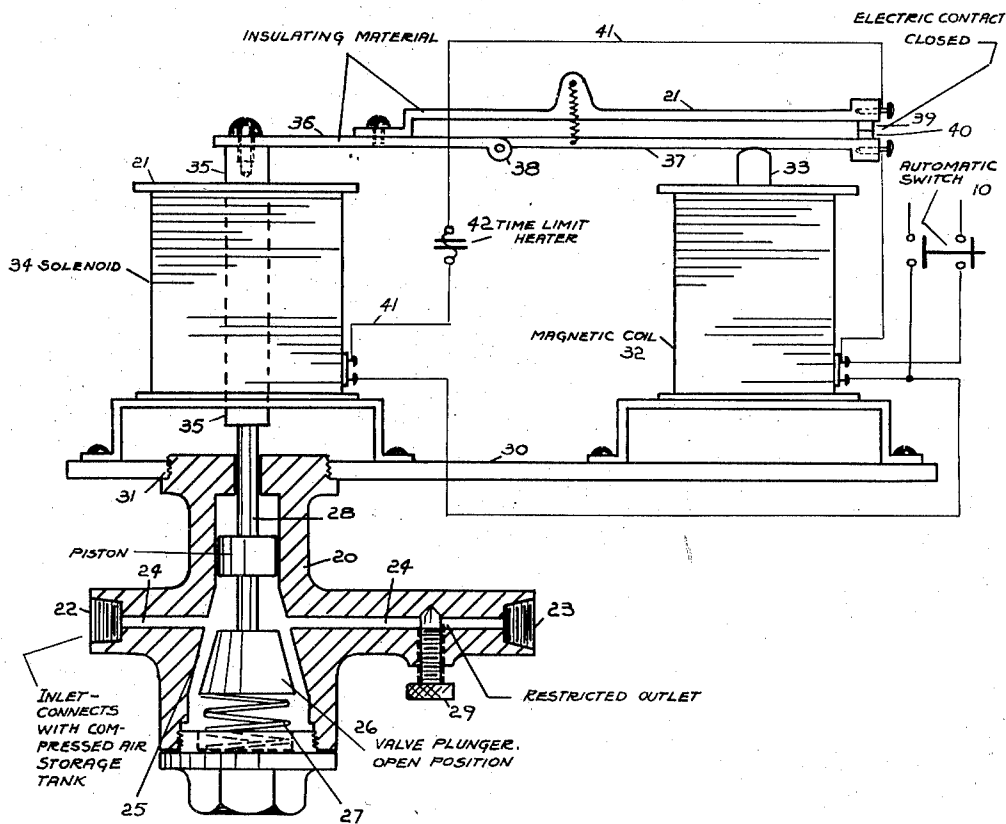


Fig. 2

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MECHANISM FOR DRAINING ACCUMULATED
MOISTURE FROM STORAGE TANKS

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3 Claims. (Cl. 230—1)

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This invention relates to a mechanism and means for actuating the mechanism in combination with a compressor unit and a storage tank to drain any accumulated moisture from the storage tank through the mechanism to a disposal point and more particularly is an improvement over Patent 2,330,027 issued September 21, 1943 of which applicant is a co-inventor.

Compressed air finds many uses in industry chief among which are: inflating automobile tires, a means of forcing grease through and from grease guns, spraying paint, operating air brakes and in the operation of numerous types of machinery. The air that is compressed is at atmospheric pressure and temperature; and always contains some water vapor. The air and water vapor are at equilibrium at atmospheric pressure and temperature but as the air is compressed and the pressure raised, equilibrium is disturbed and the water vapor drops out as a liquid in the pressure storage tank. If the water is not drained from the pressure storage tank, it passes out with the compressed air to create numerous disadvantages; for example it has a corrosive effect on metal parts contacted and dilutes any material sprayed, such as paint.

It has been the practice in the past to equip storage tanks with a petcock or hand operated valve means to manually drain off accumulated moisture from the storage tanks. Neglect on the part of attendants or operators makes this procedure ineffective with resultant damage to the equipment.

It is an object of the invention among others to provide a mechanism and actuation means in combination with any type compressor unit and storage tank to drain accumulated moisture from the storage tank.

It is still another object of the invention to provide a mechanism and actuation means in combination with a storage tank and compressor unit which mechanism is opened when the compressor unit starts into operation and is held open for a predetermined time interval each time the compressor unit starts into operation to drain accumulated moisture from the storage tank.

It is a still further object of the invention to provide a valve having means to actuate the valve to open the same and a control means to hold the valve open for a predetermined time interval.

It is a still further object of the invention to provide an electrical actuation means having a movable member which actuates any desired device with a time control means associated therewith.

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It is a still further object of the invention to provide a mechanism and actuation means automatic in operation which is economical to manufacture, durable and efficient in use, easy to install and maintain and easy of adjustment. Other objects will become apparent from a detailed description to follow in conjunction with the drawing.

In carrying out the objects of the invention there is provided a compressor unit connected to a storage tank with the compressor unit maintaining pressure in the storage tank at a predetermined pressure and a mechanism connected with the storage tank which mechanism is opened when the compressor unit starts into operation to drain any accumulated moisture from the storage tank through the mechanism to a disposal point. The mechanism may be a valve with a plunger member seated within the valve closing off the valve and said plunger unseated by an electrical actuation means to open the valve when the compressor unit starts into operation with the valve being open for a predetermined time interval each time the compressor unit starts into operation. There is included a thermostatically controlled member which closes off electric current to the electrical actuation means after the predetermined time interval has elapsed and a means for breaking the electric circuit to the thermostatically controlled member after the valve has once been actuated to insure that the valve will open only once each time the compressor unit operates.

There is also provided a means for controlling the compressor unit which may be a starting and stopping means such as an electric switch means and the valve is connected with both the electric switch and storage tank. When the electric switch allows electric current to pass to the compressor unit, electric current from the switch also passes to the electrical actuation means.

As a sub-combination there is disclosed a valve with a body member having a plunger seated therein and means to actuate the plunger to open the valve. The means to actuate the plunger may be electrical and includes an electrically influenced member such as a solenoid to unseat the plunger and control means such as a thermostatically controlled switch member to close off electric current to the electrically influenced member after a predetermined time interval has elapsed. A means for breaking the electrical circuit to the solenoid after the thermostatically controlled switch has closed off electric current to the solenoid is included which may be hinged arm mem-

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bers, carrying contact members through which electric current flows to the solenoid when the contact members are in engagement; with a magnetic coil along with the solenoid pulling the hinged arms apart to thus separate the contact members and a spring means pulls the hinged arms together and the contact members into engagement when current to the magnetic coil is closed off.

As a further sub-combination there is provided an electrical actuation means with an electrically influenced member such as a solenoid having a movable member or core therein; the movable member or core is pulled to one position when electric current is supplied to the electrically influenced member or solenoid and returned to its original position when electric current is no longer supplied to the electrically influenced member or solenoid. There is included a time control means, one form of which is a thermostatically controlled switch member to close off electric current to the electrically influenced member or solenoid after a predetermined time interval has elapsed, and a means for breaking the electric current to the solenoid which may take the form of hinged arm members carrying contact members through which the electric current flows to the solenoid when the contact members are in engagement and breaking the electric circuit to the solenoid when separated.

With the foregoing and other objects in view, the invention will be more fully described hereinafter and will be particularly pointed out in the claims appended hereto.

In the drawings, wherein like symbols refer to like or corresponding parts throughout the several views:

Figure 1 is a diagrammatic view showing a compressor unit, storage tank and valve in combination.

Figure 2 is a view of the valve showing the valve body in section and the electrical actuation means partly in elevation and partly diagrammatically.

Figure 3 is an elevational view of the hinged arms showing the hinged arms in their fully separated position.

Referring to Figure 1, there is shown an automatic switch 10, electrically connected to electric motor 11 which furnishes the motive power for air compressor 12. The electric motor 11 and the air compressor 12 form a compressor unit which may be in any compact arrangement. Compressed air leaves the compressor 12 by conduit 13 and enters pressure storage tank 14 from where it is distributed for use by pipe 15. A conduit 16 connects pressure storage tank 14 with automatic switch 10 and automatic switch 10 is so constructed as to be influenced by the air pressure in pressure storage tank 14. It is the usual practice to maintain air pressure in storage tank 14 at a maximum of 125 pounds per square inch. When the pressure of air in storage tank 14 reaches this point, the pressure is exerted through conduit 16 against automatic switch 10 to close off the automatic switch 10 from supplying electric current to electric motor 11 thus stopping the compressing operation. As air is withdrawn from storage tank 14 for use, the pressure in storage tank 14 is reduced and is likewise reduced in conduit 16. When pressure in storage tank 14 and conduit 16 reaches 90 pounds per square inch, automatic switch 10 will make contact, allowing electric current to flow to electric motor 11 and thus set the compressing

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operation in operation until pressure in storage tank 14 again reaches 125 pounds per square inch. This operation is standard practice in most every commercial compressor unit offered for sale today and applicant lays no claim of novelty to this feature.

The surrounding atmosphere always contains a certain amount of moisture, which is measured as the relative humidity of the atmosphere. The relative humidity of the atmosphere varies from time to time, depending upon temperature and pressure conditions existing at the time. When air is drawn from the surrounding atmosphere and compressed, equilibrium conditions of the air and the moisture contained therein are disturbed. At the increased pressure, water vapor can no longer exist in the air as a vapor, hence it drops out as a liquid and is collected in pressure storage tank 14. If provisions are not provided to drain accumulated water from storage tank 14, after a certain length of time tank 14 will contain a large quantity of water and this water will pass out with the compressed air being withdrawn from storage tank 14. Water in the compressed air is undesirable where air pressure is being used to operate machinery since the water has a corrosive effect on the metal parts of the machinery. Where the compressed air is being used in a spray, the water in the compressed air dilutes the material being sprayed and in the case of paint the paint tends to lose its adhesive quality to adhere to a surface. It is very desirable that the accumulated moisture in storage tank 14 be removed positively and automatically without the human element entering into this operation.

In Figure 1 is shown a mechanism 17, which in the present instance for purposes of illustration is shown as an electrically actuated valve mechanism. The mechanism 17 is connected with storage tank 14 by conduit 18 which conduit passes through the mechanism 17 and drains any accumulated moisture from storage tank 14 to a disposal point through conduit 19 when the mechanism 17 is open to connect conduits 18 and 19. The mechanism 17 is electrically connected with the automatic switch 10 so that electric current passes to the mechanism 17 at the same time electric current passes to electric motor 11. The mechanism 17 is then opened to connect conduits 18 and 19 and drain any accumulated moisture from storage tank 14. The mechanism 17 remains open for a pre-determined time interval each time the compressor unit starts into operation.

Turning now to Figure 2, the operation of mechanism 17 can be more clearly understood. The mechanism as shown comprises a valve having a body member 20 which valve is actuated by an electrical actuation means represented generally at 21. Valve body 20 has an inlet 22 into which conduit 18 connects which joins storage tank 14 with the valve body 20. An outlet 23 is provided to receive the conduit 19 which conduit leads to a point of disposal for any accumulated water drained from storage tank 14. A passage 24 runs through the valve body 20 from inlet 22 to outlet 23 to establish a conduit through the valve body 20. Within the valve body 20 is a tapered seat 25 to receive tapered plunger 26 in sealing arrangement to close off passage 24 through the valve body 20. Spring 27 urges the plunger 26 into sealing engagement with seat 25. The plunger 26 has an extension rod 28 extending upwardly through the valve body 20 and out-

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side thereof to contact an actuation means for unseating the valve plunger 26 from the seat portion 25. Spring 27 always tends to urge the plunger into closed position or into engagement with seat 25 to close off passage 24. A screw member 29 fits across passage 24 in the outlet side of the valve body 20 and may be screwed in or out of the valve body 20 to restrict or enlarge the size of passage 24.

The valve is actuated by electrical actuation means 21 by unseating plunger 26 from seat 25. Extension rod 28 contacts and forces the whole plunger downwardly against the resistance of spring 27. The electrical actuation means 21 may be mounted on a supporting member 30 which in turn is supported on any member where an actuation action is desired and in the present instance is shown mounted on the valve body 20 as by screw threads 31. As previously pointed out, the electrical actuation means connects electrically with the automatic switch 10 and electric current flows to the electrical actuation means 21 at the same time electric current flows to electric motor 11. Mounted on supporting member 30 is an electrically influenced member which in the present instance is a magnetic coil 32 connected electrically with the automatic switch 10. Electric current flowing into magnetic coil 32 magnetizes projecting core 33 which is rounded on top as more clearly shown in Figure 3. Mounted on the other side of supporting member 30, opposite magnetic coil 32 is another electrically influenced member 34, which in the present instance is a solenoid. The solenoid has a core member 35 therein, which core member 35 is moved downwardly by the solenoid 34 when energized to unseat plunger 26 from seat 25 in the valve. Connected rigidly to the top of core member 35 and supported thereby is an arm member 36 having a second arm member 37 hingedly connected to arm 36 at 38. Arm 36 has an electrical contact member 39 connected to the end thereof while arm 37 has contact member 40 rigidly connected thereto and a spring 41 between arms 36 and 37 keeps contact members 39 and 40 in engagement. The contact member 40 is connected electrically with the automatic switch 10 and is supplied electric current at the same time electric current is supplied electric motor 11.

In operation, when electric current is supplied electric motor 11, electric current also flows to magnetic coil 32, thus magnetizing projecting core 33 and electric current also flows to electric contact member 40. With the parts in the position shown in Figure 2, contact member 39 is in engagement with contact member 40 hence electric current is conducted from contact member 40 to contact member 39, through conductor 41 to a time limit controlled switch member 42. The switch member 42 has connected therewith a thermostatic member that is heated by electric current passing therethrough and expands to actuate the switch means 42 to close off flow of electric current to the solenoid member 34. The thermostatic member can be made to allow any time interval desired, and in the present instance applicant has found a time interval of five seconds to be sufficient time to hold valve 20 open to drain accumulated moisture from the storage tank 14. Conductor 41 after connecting to the time limit control switch 42 connects into solenoid 34 to furnish electric current to the solenoid 34 when time limit control switch 42 is in contact.

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When electric current does not flow to the solenoid 34, it is no longer energized hence core member 35 moves upward to the position shown in Figure 3. When the solenoid is energized, core member 35 is pulled downward, contacting extension rod 28 to unseat plunger 26 from seat 25 to thus open passage 24 through the valve and allow accumulated water in storage tank 14 to drain to a disposal point through conduit 19. The plunger 26 is held unseated for five seconds while air under pressure in storage tank 14 forces accumulated moisture through conduit 18, the valve and conduit 19. The screw 29 may be regulated in passage 24 to enlarge or restrict passage 24 to be sure all moisture is removed from storage tank 14 during the five second period the valve is open. When solenoid 34 is no longer energized, core member 35 is moved upwardly and spring 27 forces plunger 26 into closed position across passage 24.

When time controlled switch 42 closes off electric current to solenoid 34, after the five second time interval has elapsed, electric current is still being supplied to the magnetic coil 32. The core member 35 moves upwardly about one-quarter inch and the arm member 36 being rigidly attached thereto moves upwardly also. Since the projecting core 33 is still magnetized, it holds arm 37 and will not let arm 37 move upwardly, hence in order for arm 36 to move upwardly arm 37 must hinge about point 38. As seen in Figure 3, the upward movement of arm member 36 separates contact members 39 and 40 hence no electric current can pass to the solenoid until the contact members 39 and 40 are back in engagement again.

The arm members 36 and 37 remain in the position shown in Figure 3 for the time electric current is supplied to electric motor 11 or until automatic switch 10 closes off. When this occurs no more electric current is furnished magnetic coil 32 and in turn projecting core 33 is no longer magnetized. Spring 41 then pulls arm 37 upwardly until contact members 39 and 40 are in engagement and the mechanism 17 is all set to operate again when automatic switch 10 is again actuated by a pressure drop in storage tank 14. Electric current again passes to magnetic coil 32 and magnetizes projecting core 33; solenoid 34 is energized thus pulling core member 35 downwardly and also bringing arm 37 into engagement with the projecting core 33. This completes the cycle of operation as the device is back to the position shown in Figure 2.

The valve and electrical actuation means will be assembled in a compact unit and be suitably enclosed. The valve has been suitably cast from Kirksite, a zinc alloy metal and the plunger member can also be of Kirksite and an effective seal can be made with the seat by covering the plunger with a synthetic rubber covering which can be removable so as to be replaced when worn. The solenoid presents nothing new and novel, since it is the ordinary wound member with a core therein. The solenoid member must be small and several different type units are now being offered commercially which applicant has used successfully. The same applies to the magnetic coil as to the solenoid, namely it must be small and several different magnetic coils are available on the market at the present time which have been successfully employed in the present organization. The time control switch is a regular switch member having contact members.

When electric current passes through the contact

members, it must first pass through a control member which is a resistance member made of a metal that has relatively large thermal expansion upon heating, which expansion separates the switch contact members and breaks off passage of electric current through the switch. Here too, applicant has not presented anything new or novel since a switch of this type, suitable in the present organization, is available on the commercial market and has been used by applicant. Applicant's claim to novelty resides in the specific assembly or organization of the respective elements rather than the individual elements themselves.

While the invention has been described in connection with several specific embodiments, it is to be understood that the words which have been used are words of description rather than of limitation, and that practice of the invention with the scope of the appended claims may be resorted to without departing from the true scope of the invention in all its aspects.

I claim:

1. In combination, a compressor unit connected to a storage tank, said compressor unit maintaining pressure in the storage tank at a predetermined pressure, a valve connected with the storage tank having a plunger member seated within the valve closing off the valve, an electrical actuation means to unseat the plunger to open the valve when the compressor unit starts into operation, and a thermostatically controlled member operable to close off electric current to the electrical actuation means after a predetermined time interval has elapsed to allow the plunger to seat within the valve.

2. In combination, a compressor unit connected to a storage tank, said compressor unit maintaining pressure in the storage tank at a predetermined pressure, a valve connected with the storage tank having a plunger member seated within the valve closing off the valve, and electrical actuation means to unseat the plunger to

open the valve when the compressor unit starts into operation, a thermostatically controlled switch member operable to close off electric current to the electrical actuation means after a predetermined time interval has elapsed to allow the plunger to seat within the valve and means for breaking the electric circuit to the thermostatically controlled switch member after the valve has once been actuated to insure that the valve will open only once each time the compressor unit operates.

3. In combination, a compressor unit connected to a storage tank, said compressor unit maintaining pressure in the storage tank at a predetermined pressure and a valve in a conduit connected to the bottom of the storage tank to drain any accumulated moisture from the storage tank through the valve to a disposal point, said valve having a plunger member seated within the valve normally closing off flow through the conduit, an actuation means to unseat the plunger in the valve connected to the compressor unit, said actuation means operated each time the compressor unit starts into operation to hold the valve open and means included in the actuation means operable to make the actuation means ineffective to hold the valve open after a predetermined time interval has elapsed.

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