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F. B. PARSONS

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MOISTURE SEPARATOR FOR GAS COMPRESSOR

Filed April 28, 1959

2 Sheets-Sheet 1

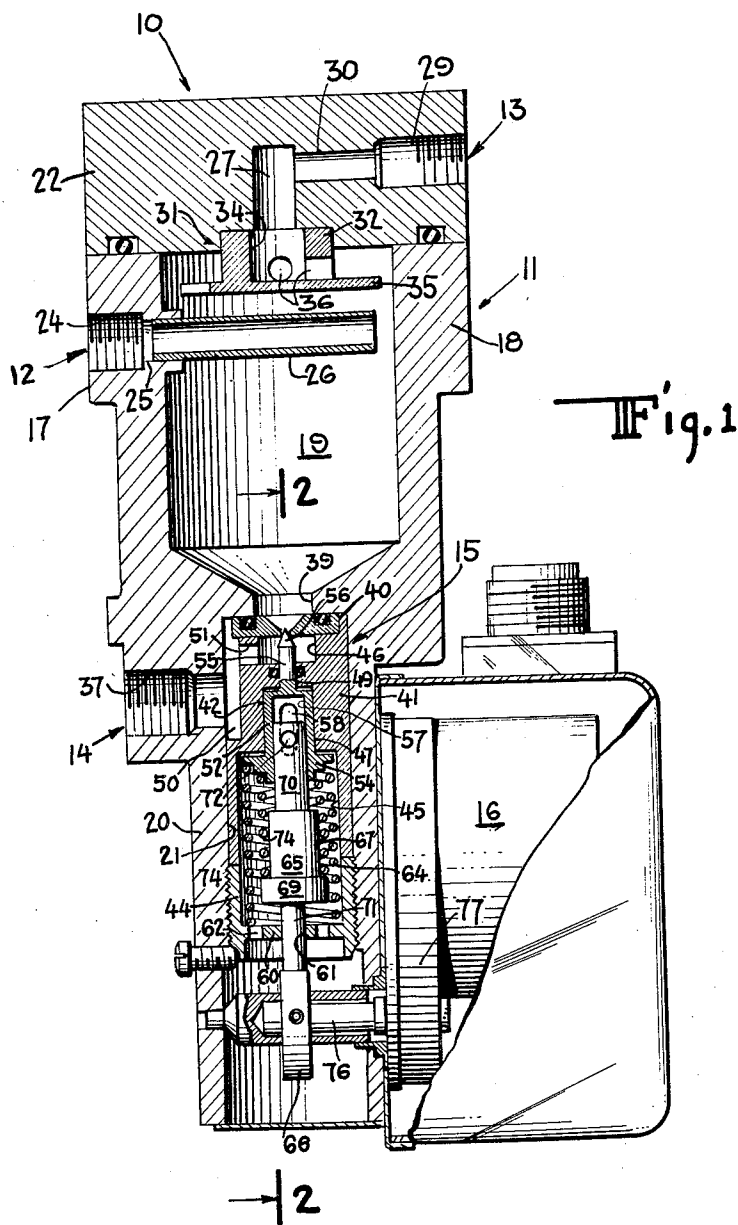


Fig. 1

INVENTOR  
**Floyd B. Parsons**  
BY  
*J. William Carson*  
ATTORNEY

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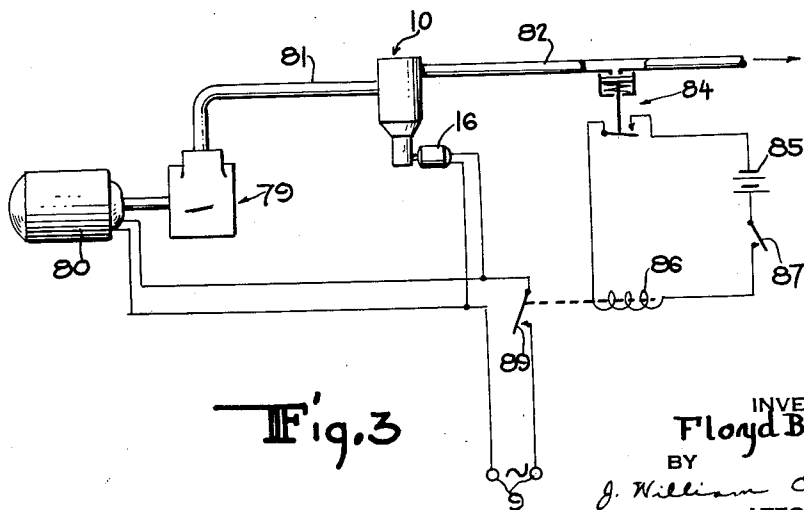
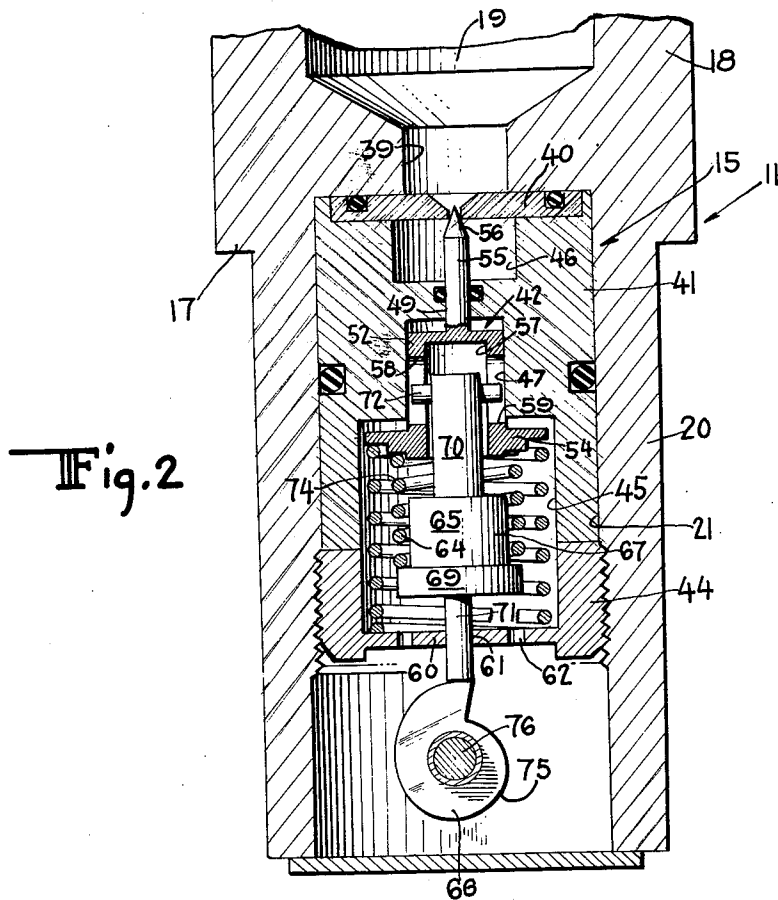
F. B. PARSONS

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INVENTOR  
**Floyd B. Parsons**  
 BY  
*J. William Carson*  
 ATTORNEY

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**MOISTURE SEPARATOR FOR GAS COMPRESSOR**  
Floyd B. Parsons, Ridgewood, N.J., assignor to Specialties Development Corporation, Belleville, N.J., a corporation of New Jersey

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1 Claim. (Cl. 137-203)

This invention relates to moisture separators for separating moisture from pressurized gas such as compressed air, and, more particularly, to a separator which is an improvement over a previously known separator, such as disclosed in United States Patent 2,803,310.

Such a separator generally comprises a casing providing a separating chamber having a gas inlet, a gas outlet and a water drainage outlet, a valve for the drainage outlet, and a turbine positioned within the chamber and adapted to be driven by the inlet gas for operating the drainage valve.

An object of the present invention is to provide a moisture separator having a separating chamber provided with a valved drainage outlet which is automatically and periodically opened by a motor positioned externally of the chamber.

Another object is to provide such a separator wherein the motor controlling the drainage valve is operated continuously whenever the compressor supplying gas to the separator is operating.

Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claim, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

In accordance with the present invention, the foregoing objects are generally accomplished by providing a moisture separator comprising a casing providing a chamber having an inlet for compressed gas from which moisture is to be removed, an outlet for the gas from which moisture has been removed, and a drainage outlet for the removed moisture; a valve seat at the drainage outlet; a valve member positioned externally of the chamber adapted to abut the seat to close the drainage outlet and having an impact receiving surface; an impact producing member including means for engaging the impact receiving surface; spring means biasing the valve member against the seat; second spring means acting against the impact member to bias the surface engaging means toward the impact receiving surface; cam means for alternately moving the impact member against the second spring and releasing the impact member to move under the action of the second spring; and motor means for driving the cam means, the impact member being constructed and arranged so that the surface engaging means contacts the impact receiving surface and moves the valve member away from the seat when the impact member is released by the cam means.

A preferred embodiment of the invention has been chosen for purposes of illustration and description and is shown in the accompanying drawings, forming a part of the specification, wherein:

FIG. 1 is a longitudinal sectional view of a moisture separator in accordance with the present invention.

FIG. 2 is a sectional view taken along line 2-2 on FIG. 1.

FIG. 3 is a schematic diagram of a system containing the moisture separator illustrating an electrical circuit.

Referring to the drawings in detail and more particularly to FIG. 1 thereof, there is shown a moisture separator 10 in accordance with the present invention which generally comprises a casing 11 having an inlet 12 for compressed gas from which moisture is to be removed, an

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outlet 13 for gas from which moisture has been removed, and a drainage outlet 14 for removing accumulated moisture, a valve assembly 15 for the drainage outlet 14, and a valve operating mechanism including an electric motor 16 mounted externally on the casing 10.

The casing 11 includes a body 17 having a cylindrical wall upper portion 18 defining a chamber 19 and a lower portion 20 provided with a longitudinal bore 21, and a cap 22 mounted on the upper end of the wall portion 18 to close the chamber 19.

The inlet 12 is positioned in the wall portion 18 adjacent the upper end thereof and comprises a stepped bore having a screw threaded large diameter outer portion 24 and a small diameter inner portion 25. A tube 26 extends from the inner end of the bore portion 25 diametrically across the chamber 19 toward the opposite surface of the wall.

The outlet 13 is provided in the cap 22, and comprises a vertical passageway 27 extending upwardly from the lower surface of the cap and a horizontal passageway including a screw threaded large diameter outer portion 29 and a small diameter inner portion 30 intersecting the vertical passageway 27. A baffle 31 is secured to the lower surface of the cap 22 at the lower end of the vertical passageway 27, and includes a cylindrical body portion 32 provided with a vertical bore 34 in communication with the passageway 27 and a larger diameter plate portion 35 formed at the lower end of the body portion 32. A plurality of horizontal passageways 36 are provided in the body portion 32 immediately above the plate portion 35 to place the bore 34 in communication with the chamber 19.

The drainage outlet 14 includes a horizontal passageway 37 in the lower casing portion 20 intersecting the bore 21 adjacent the upper end thereof and a vertical passageway 39 extending through the casing from the bore 21 to the chamber 19.

As shown in FIGS. 1 and 2, the valve assembly 15 is positioned in the bore 21 and includes a valve seat 40 at the lower end of the vertical drainage passageway 39, a sleeve 41 below the seat 40, a valve member 42 slidably mounted in the sleeve 41, and a cup-shaped nut 44 threaded into the bore 21 below the sleeve 41 to hold the sleeve and valve seat in position.

The sleeve 41 is formed with a stepped bore comprising a large diameter lower end bore 45, an intermediate size diameter upper end bore 46, a second intermediate size diameter bore 47 at the upper end of the lower bore 45, and a small diameter bore 49 connecting the intermediate size diameter bores 46 and 47. The sleeve 41 is provided with a vertically extending recess 50 in the outer surface thereof in communication with the horizontal passageway 37 of the drainage outlet 14, and a small bore 51 extends through the sleeve from the recess 50 to the upper end bore 46.

The valve member 42 includes a cylindrical section 52 slidably positioned in the lower intermediate size diameter bore 47 and extending downwardly into the lower end bore 45, a stepped flange section 54 formed on the lower end of the section 52 and positioned within the bore 45, and a small diameter section 55 extending from the upper end of the cylindrical section through the small diameter bore 49 and having a conical upper end 56 for engaging the valve seat 40. The cylindrical section 52 is provided with a bore 57 and a pair of diametrically opposite vertical slots 58 each having a lower impact receiving surface 59 (FIG. 2).

The bottom wall 60 of the cup shaped nut 44 is provided with a bore 61 and a plurality of venting ports 62, and a helical spring 64 in the bore 45 bears against the wall 60 and the flange 54 to urge the valve member 42 against the seat 40.

The valve operating mechanism includes a cylindrical impact producing plunger 65 positioned within the lower end bore 45, and a cam member 66 positioned in the bore 21 below the nut 44.

The plunger 65 includes a body portion 67 provided with a flange 69 at the lower end thereof, a small diameter portion 70 extending upwardly into the bore 57 in the valve member, and a cam follower portion 71 extending downwardly through the bore 61 in the nut 44. A pin 72 extends through the plunger portion 70 and has its ends disposed in the slots 58, and a second helical spring 74 bears against the flange 69 and the stepped flange 54 of the valve member to urge the plunger away from the valve member.

The cam member 66 is formed with a generally spiral single stepped cam surface 75 and is mounted on a shaft 76 which is driven by the motor 16 through a speed reducing gear train 77.

As schematically shown in FIG. 3, the moisture separator 10 is incorporated in a system for supplying pressurized air wherein an air compressor 79 driven by an electric motor 80 delivers pressurized air to the separator 10 through a conduit 81, and a conduit 82 provided with a pressure switch 84 conducts the air from the separator to the point of storage or use. The pressure switch 84 is connected in series with a direct current source 85, a relay coil 86, and a master switch 87. A normally open switch 89 under control of the coil 86 is connected in series with the motor 80 and a pair of terminals 90 of an alternating current source. The motor 16 of the moisture separator is connected in parallel with the motor 80 so that it is energized only when the switch 89 is closed to energize the motor 80.

In operation, when the master switch 87 is closed, the relay coil 86 is energized and closes the switch 89 allowing electrical current to flow from the terminals 90 to the motors 80 and 16. The motor 80 drives the compressor 79 and pressurized air is delivered to the moisture separator 10 through the conduit 81.

The moisture laden pressurized air from the compressor enters the compressor through the inlet 12, flows through the tube 26, and impinges on the inner surface of the wall 18. The expansion of the air as it leaves the tube 26 and its forceful contact with the wall 18 causes the moisture in the air to condense and form drops which gravitate toward the passageway 39 while the now moisture free air flows upwardly past the baffle plate 35, through the passageways 36, the vertical bore 34, and the passageways 27 and 30 of the outlet 13.

During the flow of pressurized air to the inlet 12, the motor 16 is energized and continuously rotates the cam 66. As shown in FIG. 2, the rotation of the cam moves the impact plunger 65 upwardly against the action of the spring 74 until the stepped portion of the cam surface 75 passes beneath the follower 71. As this occurs, the spring 74 drives the plunger 70 downwardly and the pin 72 carried by the plunger strikes the lower surface 59 of the slots 57 in the valve member 42. The impact thus imparted to the valve member momentarily moves the valve member downwardly against the action of the spring 64 to unseat the conical valve surface 56 and allow the accumulated moisture to flow from the passageway

39, past the seat 40, to the bore 46, and through the bore 51 and the recess 50 to the passageway 37.

This action is repeated continuously at a rate of once every 6 to 60 seconds until the pressure in the conduit 82 reaches a predetermined value causing the pressure switch 84 to open and deenergize both the compressor motor 80 and the separator motor 16. When the pressure in the conduit 82 again drops below the predetermined value, the switch 84 closes and the motors 80 and 16 are again energized to drive the compressor 79 and the valve assembly 15 of the separator 10.

From the foregoing description, it will be seen that the present invention provides a moisture separator having a valved drainage outlet automatically and periodically opened by a motor which is positioned externally of the separating chamber and is operated continuously whenever the compressor supplying pressurized air to the separator is operating.

As various changes may be made in the form, construction and arrangement of the parts herein, without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in any limiting sense.

#### I claim:

A moisture separator of the class described comprising a casing providing a chamber having an inlet for compressed gas from which moisture is to be removed, an outlet for the gas from which moisture has been removed, and a drainage outlet for the removed moisture; a valve seat at said drainage outlet; a valve member positioned externally of said chamber adapted to abut said seat to close said drainage outlet and having an impact receiving surface; an impact producing member including a formation for striking said impact receiving surface; spring means biasing said valve member against said seat to seal said drainage outlet; second spring means acting between said valve member and said impact member to bias said surface striking formation toward said impact receiving surface; cam means for alternately moving said impact member against said second spring means and releasing said impact member to move under the action of said second spring means; and an electric motor positioned externally of said chamber for driving said cam means, said impact member and said second spring means being constructed and arranged so that when said impact member is released by said cam means said formation strikes said impact receiving surface with sufficient force to move said valve member against said first spring means away from said seat to momentarily open said discharge outlet.

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