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WATER SEPARATOR FOR COMPRESSED AIR LINES

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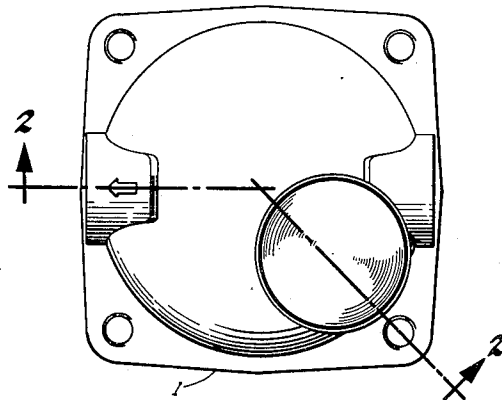


FIG. 1.

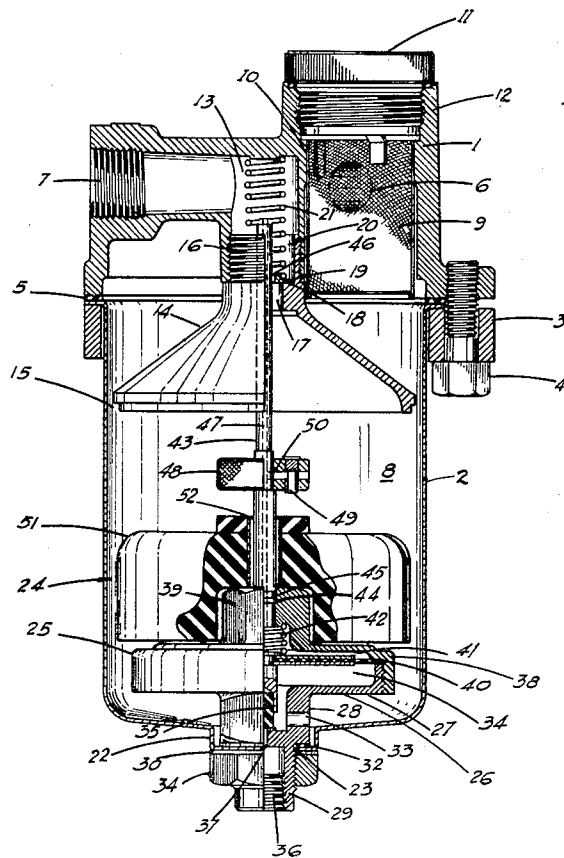


FIG. 2.

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## WATER SEPARATOR FOR COMPRESSED AIR LINES

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4 Claims. (Cl. 137—195)

The present invention relates to improvements in devices for separating water from compressed air in which the water is entrained.

Such devices are commonly referred to as water separators and for ease of explanation will be so identified in the present application. The improved water separator disclosed herein is generally of the type shown in U.S. Patent #2,629,458, issued February 24, 1953, to Allen et al. However, the applicant has provided an unusually low cost, improved design which readily lends itself to mass production manufacturing techniques. At the same time, the applicant's device is characterized by improved performance and extended life.

Accordingly, it is an object of the present invention to provide an improved, low cost water separator readily adaptable to mass production techniques.

A feature of the present invention is the provision of a water dump valve, a diaphragm for actuating the valve, an air pressure reducing valve, an elongated diaphragm-controlling hollow tube extending into the area of reduced air pressure, and a valve for controlling the application of inlet or reduced pressure to the diaphragm by way of the tube, all in axial alignment with each other.

Another feature is the use of a submerged diaphragm assembly.

Another feature is the use of a truncated-conical baffle with a somewhat restricted flow passage there around to provide more efficient water precipitation.

Another feature is the air flow structure which permits effective precipitation over unusually wide rates of air flow.

Other objects and features will be evident upon a perusal of the following disclosure in which:

Fig. 1 is a plan view of the water separator; and

Fig. 2 is a sectional elevation view along line 2—2 of Fig. 1.

With particular reference to Fig. 2, it may be seen that the water separator comprises a generally annular head 1 and a generally cup shaped bowl 2 secured to the lower edge of the head 1 by means of a flange retainer ring 3 and screws 4. A gasket 5 is secured between the head 1 and the bowl 2 to prevent leakage therebetween. The irregularly shaped head 1 may be conveniently formed by casting. The bowl 2 is preferable stamped or drawn from sheet metal.

The head 1 has an air inlet 6 and an air outlet 7. The inlet 6 is connected during use to a source of high pressure air. The outlet 7 may be connected to any one of a number of air operated devices such as air motors or oil-mist generators for lubrication systems. The inlet 6 is connected to a chamber 8 defined by the inner periphery of the bowl 2 by way of a strainer 9 which removes foreign particles from the air passing there-through. The strainer 9 is held in a cylindrical bore 10 in the head 1 by a plug 11 which is threaded into an annular boss 12 immediately above the bore 10.

A central vertical passageway 13 in the head 1 connects the chamber 8 with the outlet 7. A baffle 14 of a

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generally truncated-conical form is supported by the head 1 in the upper portion of the chamber 8 with a narrow annular passageway 15 being provided between the outer periphery of the baffle 14 and the adjacent inner periphery of the bowl 2. It has been found that the truncated-conical impact surface of the baffle 14 with the enlarged chamber therearound and the restricted annulus around the bottom thereof provides unusually efficient precipitation at present believed to result from increased rate of air flow. The upper central portion of the baffle 14 is provided with an upwardly extending annular projection 16 which is threaded into the head surface defining the passageway 13.

Thus incoming air will pass through the inlet 6, the strainer 9, the passageway 15, the chamber 8, an axial bore 17 in the baffle 14, and the passageway 13 to the outlet 7. As the air leaves the strainer 9, it is directed against the upper surface of the baffle 14 to precipitate water entrained therein. The entrained water is collected at the bottom of the chamber 8.

A pressure reducing valve 18 rests on the seat 19 defined by the lower surface of an axial counterbore 20 in the baffle 14. A spring 21 urges the valve 18 toward its seat 19 with a predetermined force, which force determines the reduction in air pressure between the chamber 8 and the outlet 7.

The central portion of the base of the bowl 2 is recessed at 22 and includes a central aperture 23. A diaphragm housing assembly 24, having an upper section 25 and a lower section 26, is disposed at the bottom of the chamber 8. The upper and lower sections of the assembly 24 are preferably castings.

The lower section 26 includes a generally cup-shaped upper end 27 and a downwardly extending cylindrical boss 28 at the central portion thereof. The boss 28 is carried by the recess 22, and a reduced lower portion 29 of the boss 28 is received through the aperture 23. The section 26 is held securely to the bowl 2 by a washer 30 and a jam nut 31 threaded on the reduced boss portion 29. A suitable gasket 32 is inserted between the boss 28 and the recess 22 to prevent leakage therebetween. A plurality of cross bores 33 are provided at the upper end of the boss 28 to apply the fluid pressure in chamber 8 to the chamber 34 defined in part by the section 26. The cross bores 33 also provide for the passage of precipitated water from the lower portion of the chamber 8 into the chamber 34. A valve 35 to be described in detail later controls the flow of water from the chamber 34 to atmosphere by way of an exhaust passageway 36 and a more restricted passageway 37 in the boss 28.

The upper housing section 25 includes an inverted, generally cup-shaped portion 38 which is suitably secured to the section 26, and an upwardly extending boss 39 at the central portion thereof. A conventional diaphragm structure 40 is held between the upper and lower housing sections. The diaphragm 40 and the lower housing section 26 defined the chamber 34 which, as described above, is subjected at all times to the pressure in chamber 8. The diaphragm 40, and the upper housing section 25 define a control chamber 41. The lower central portion of the diaphragm assembly 40 carries the valve 35 which, as described below, controls the exhausting of precipitated water to atmosphere. A spring 42 normally urges the diaphragm assembly 40 downwardly to seat the valve 35.

An elongated hollow tube 43 is press fit into an axial counterbore 44 at the upper end of the housing boss 39. An O-ring 45 prevents leakage between the boss 39 and the outer periphery of the tube 43. The tube 43 extends through the passageway 17 in the baffle 14, through an axial aperture 46 in the valve 18, and through the passageway 13 to the outlet 7. Thus, a passageway 47 in

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the tube 43 connects the chamber 41 to the outlet 7. The upper end of the passageway 47 is restricted. A small amount of leakage between the tube 43 and the valve 18 can be tolerated.

A valve assembly 48 is press fit on the upper reduced portion of the tube 43 at a desired distance above the bottom of the bowl 2. The valve assembly 48 includes a passageway 49 open to the chamber 8 and connecting with a cross bore 50 in the tube 43. The upper end of passageway 47 is appreciably restricted in relation to the restriction of passageway 49. Thus, with the valve assembly 48 open as shown in Fig. 2, the fluid pressure in the chamber 8 is applied to the central portion of the passageway 47 by way of the passageway 49 and the cross bore 50. This pressure of chamber 8 is transmitted to the chamber 41 so that chambers 41 and 34 are at the same pressure. Air also flows through the upper portion of the passageway 47 and into the outlet 7.

A generally cylindrical float 51 loosely encircles the tube 43 and the hub 39. The float 51 includes an annular upper portion 52 which, when the water in chamber 8 reaches a predetermined level, engages the valve assembly 48 to close the passageway 49 from the chamber 8. With the valve assembly 48 closed, the reduced pressure in the outlet 7 will be gradually applied to the chamber 41. The higher pressure in the chamber 34 will now urge the diaphragm assembly 40 upwardly against the force of the spring 42 to lift the valve 35 from its seat to expel water through the outlet 36. After the water level has fallen sufficiently to cause the valve assembly 48 to again open and after the fluid pressure of chamber 8 is re-established in the chamber 41, the valve 35 will again be seated.

While there has been described what is at the present believed to be the preferred embodiment of the invention, it will be understood that various changes and modifications may be made therein; and it is contemplated to cover in the appended claims all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A device for removing water from compressed air having water entrained therein comprising a casing defining an air inlet and an air outlet and defining a precipitation chamber between the inlet and the outlet, an apertured baffle defining a truncated-conical impact surface carried by the casing near the upper end of the chamber against which air flowing from the inlet impinges to precipitate water entrained therein, the lower periphery of the baffle defining a somewhat restricted annular passageway with the adjacent inner periphery of the casing for increasing the rate of air flow, the lower portion of the chamber collecting precipitated water, a yieldable element disposed in the lower portion of the chamber, an immovable housing enclosing the yieldable element and defining upper and lower chambers above and below the element, structure defining a fluid connection between the lower housing chamber and the precipitation chamber, structure defining an outlet for the water at the lower portion of the lower housing chamber, a dump valve immediately below, coaxial with, and connected to the element for controlling the flow of water through its outlet, a hollow tube restricted at its upper end and extending upwardly from the top of the housing, and through the baffle to the air outlet to connect the upper housing chamber to the air outlet, structure carried by the tube defining a control passageway between the tube interior and the precipitation chamber, a float surrounding the tube and engaging the last-mentioned structure to close the control passageway incident to a rise in the water to a predetermined level, a pressure reducing valve interposed between the precipitation chamber and the air outlet, the yieldable element operated by the pressure differential above and below the element incident to the closure of the control passageway by the float for opening

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the dump valve to expel water from the precipitation and lower diaphragm chambers.

2. A device for removing water from compressed air having water entrained therein comprising a casing defining an air inlet and an air outlet and defining a precipitation chamber between the inlet and outlet, a baffle defining an impact surface carried by the casing near the upper end of the chamber against which air flowing from the inlet impinges to precipitate water entrained therein, the lower portion of the chamber collecting precipitated water, a yieldable element disposed in the lower portion of the chamber, a housing enclosing the yieldable element and defining upper and lower chambers above and below the element, structure defining a fluid connection between the lower housing chamber and the precipitation chamber, structure defining an outlet for the water at the lower portion of the precipitation chamber, a dump valve connected to the element for controlling the flow of water through its outlet, a hollow tube connecting the upper housing chamber to the air outlet, structure carried by the tube defining a control passageway between the tube interior and the precipitation chamber, the tube being more restricted at its end adjacent the air outlet than the control passageway restriction, a float assembly engaging the last-mentioned structure to close the control passageway incident to a rise in the water to a predetermined level, a pressure reducing valve interposed between the precipitation chamber and the air outlet, the yieldable element operated by the pressure differential above and below the element incident to the closure of the control passageway by the float for opening the dump valve to expel water from the precipitation chamber.

3. A device for removing water from compressed air having water entrained therein comprising a casing defining an air inlet and an air outlet and defining a precipitation chamber between the inlet and outlet, a generally annular baffle defining an impact surface carried by the casing near the upper end of the chamber against which air flowing from the inlet impinges to precipitate water entrained therein, the lower portion of the chamber collecting precipitated water, a yieldable element disposed in the lower portion of the chamber, a housing enclosing the yieldable element and defining upper and lower chambers above and below the element, structure defining a fluid connection between the lower housing chamber and the precipitation chamber, structure defining an outlet for the water at the lower portion of the precipitation chamber, a dump valve connected to the element for controlling the flow of water through its outlet, a hollow tube restricted at its upper end and extending upwardly from the top of the housing to the air outlet to connect the upper housing chamber to the air outlet, structure carried by the tube defining a control passageway between the tube interior and the precipitation chamber, a float surrounding the tube and engaging the last-mentioned structure to close the control passageway incident to a rise in the water to a predetermined level, a pressure reducing valve interposed between the precipitation chamber and the air outlet, the yieldable element operated by the pressure differential above and below the element incident to the closure of the control passageway by the float for opening the dump valve to expel water from the precipitation chamber.

4. A device for removing water from compressed air having water entrained therein comprising a casing defining an air inlet and an air outlet and defining a precipitation chamber between the inlet and outlet, a baffle defining an impact surface carried by the casing near the upper end of the chamber against which air flowing from the inlet impinges to precipitate water entrained therein, the lower portion of the chamber collecting precipitated water, a yieldable element disposed in the lower portion of the chamber, a housing enclosing the yieldable element and defining upper and lower chambers above and

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below the element, structure defining a fluid connection between the lower housing chamber and the precipitation chamber, structure defining an outlet for the water at the lower portion of the lower housing chamber, a dump valve immediately below, coaxial with, and connected to the element for controlling the flow of water through its outlet, an elongated, hollow tube restricted at its upper end and extending upwardly from the top of the housing, and through the baffle to the air outlet to connect the upper housing chamber to the air outlet, structure carried by the tube defining a control passageway between the tube interior and the precipitation chamber, a float surrounding the tube and engaging the last-mentioned structure to close the control passageway incident to a rise in the water to a predetermined level,

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a pressure reducing valve interposed between the precipitation chamber and the air outlet, the yieldable element operated by the pressure differential above and below the element incident to the closure of the control passageway by the float for opening the dump valve to expel water from the precipitation and lower diaphragm chambers.

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