May 9, 1967 K. W. PEARSON 3,318,323

AUTOMATIC DRAIN VALVES

Filed April 22, 1964 2 Sheets-Sheet 1

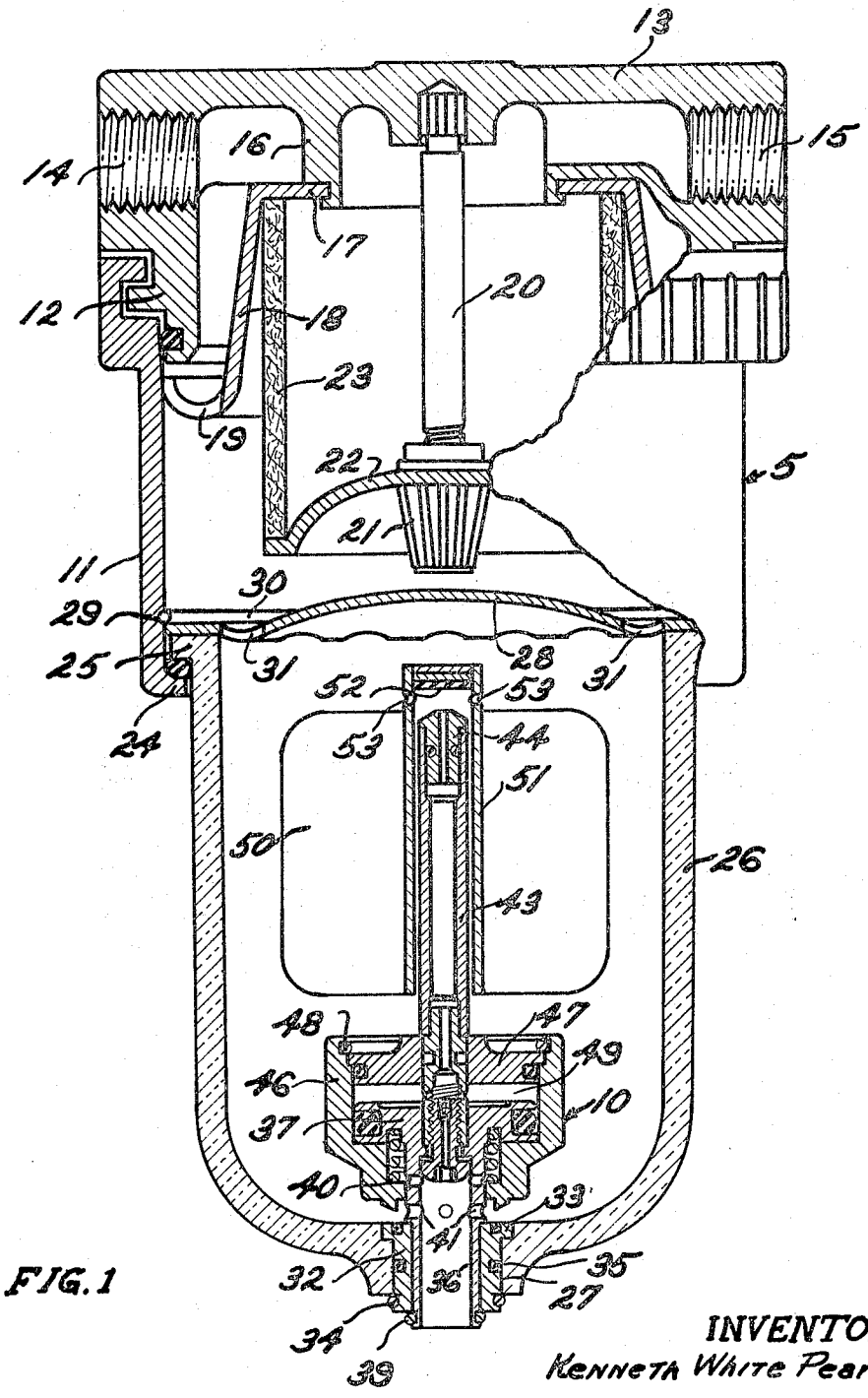


FIG. 1

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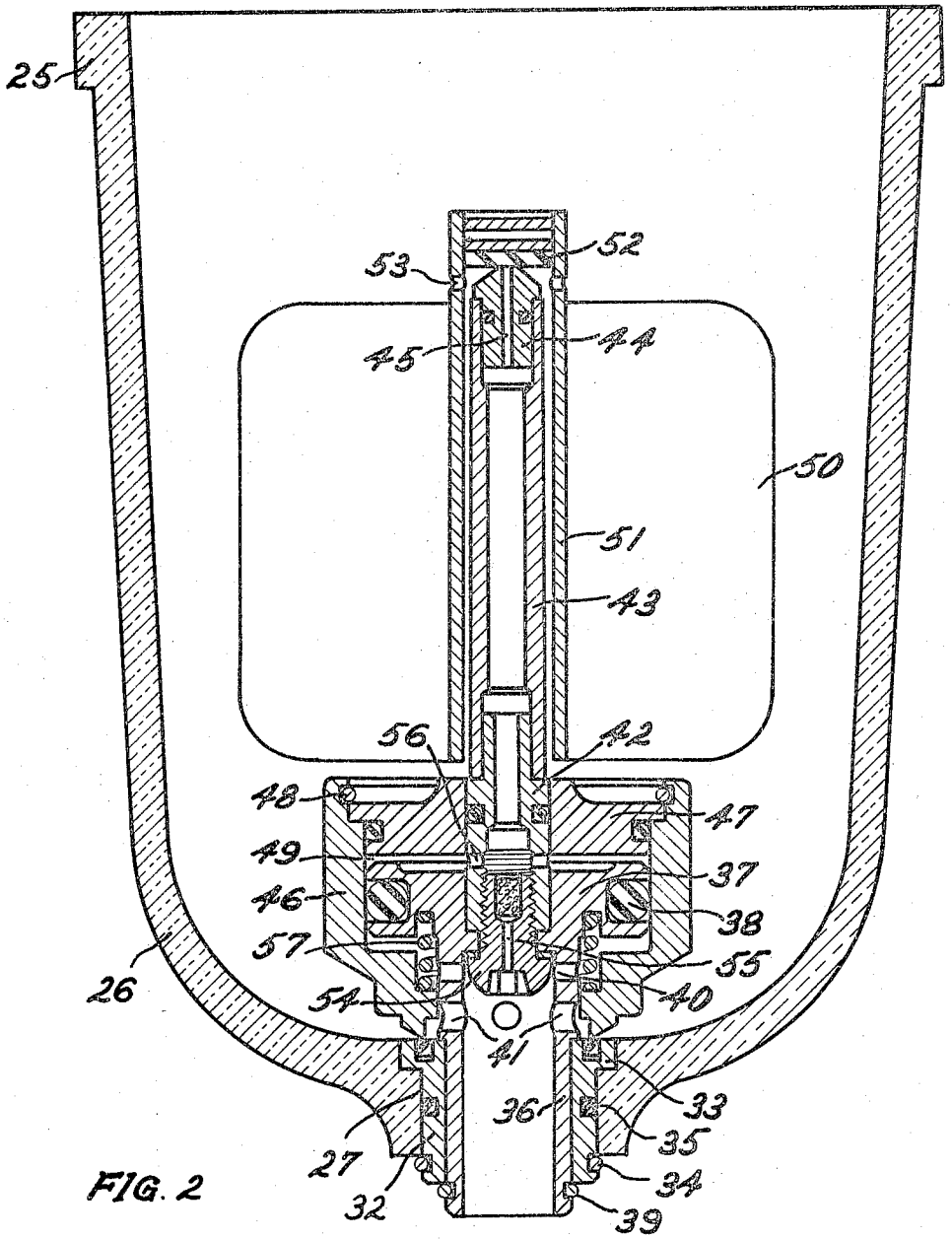


FIG. 2

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3,318,323

AUTOMATIC DRAIN VALVES

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The present invention relates to automatic means for removing objectionable liquids and solids from fluid flowing through a compressed fluid conveying line.

The invention contemplates the provision of a storage trap adapted to receive the objectionable matter usually carried with the compressed fluid, in association with automatic means for controlling the accumulation and discharge from the storage trap.

The object of the invention is to provide automatic means for discharging periodically, the accumulated matter when it reaches a predetermined height within the unit.

The invention further relates to a unit designed for placement within a pipe line conveying compressed fluid from a source to its point of consumption, and functioning to separate, filter and accumulate within itself objectionable liquids and solids usually contained within the fluid flowing therethrough.

Another object of the invention is to provide a unit having automatic means for discharging accumulated matter when the fluid within the line is not in use, but still under pressure. That is, when pressure fluid within the line is idle, moisture contained therein will condense and accumulate within the unit, when that accumulation has reached a predetermined height, the automatic means opens the outlet, when the accumulation has discharged, the automatic means closes the outlet.

A further object of the invention is to provide a unit having a new and improved control means for discharging the accumulated matter consisting merely of a tubular element fixed within the outlet of the unit, and having movable thereof, a float and a valve, the latter controlling the discharge of the accumulated matter through the tubular element to atmosphere.

Still another object of the invention is to provide a unit of the character described which is simple in design and construction, composed of relatively few parts, yet highly efficient and economical in operation, and manufacture, and easy to assemble.

Further objects and advantages of the present invention will hereafter be apparent, and to all of these ends, the invention consists of the features of construction, arrangement of parts, and combination of elements, substantially as described and claimed in the following specification, and illustrated in the accompanying drawings, in which:

FIGURE 1 is a vertical sectional view taken along the center line of a unit embodying the features disclosed, and showing the discharge valve in an open position, and

FIGURE 2 is a similar view, somewhat enlarged, of the automatic means with the discharge valve in a closed position.

Briefly, the invention about to be described is directed to a unit adapted to be positioned within a line conveying compressed fluid from a source to its point of consumption, and functioning to separate and filter from the fluid, objectionable solid particles and liquids usually carried thereby. It further includes a receptacle which stores and retains the separated matter until it is periodically discharged to atmosphere by automatic means positioned within the receptacle. This automatic means

constitutes the most important and essential feature of the invention. Operation of the automatic means is accomplished by the control of pressurized fluid, from within the receptacle, by a float, the movement of which depends upon the rise and fall of the separated matter within the receptacle.

To be specific, the discharge valve is normally held in a closed position by pressurized fluid active thereupon, in combination with an expansion spring,, and these forces are constant and effective with the exception of those intervals when pressurized fluid engages the valve in the reverse direction and overcomes the forces holding the valve closed, the result being that the valve opens and discharge of the accumulated matter follows.

With the structure briefly mentioned, and assuming that pressure fluid is passing through the unit, and that the discharge valve is held closed by the pressure fluid within the receptacle and the expansion of the spring, when foreign matter has collected within the receptacle to a predetermined height, the float moves upwardly of a tubular element, and the valve carried thereby moves out of contact with the upper end of the tubular element, permitting pressure fluid to enter the tubular element and an expansion chamber, where it becomes active upon a movable wall of the chamber, which is a part of the valve, moving the valve upwardly of the tubular element and opening radial passages therein forming communication between the receptacle and atmosphere. It will be observed that the lower end portion of the valve is subjected to pressure from the accumulated matter within the receptacle, and this, together with the pressure fluid engaging the under face of the top wall of the valve, moves the same to its open position. When the accumulated matter within the receptacle has passed to atmosphere, the float drops, cutting off the passage of pressurized fluid to the expansible chamber, whereupon pressure of the fluid within the receptacle, in combination with the force exerted by the expansion element, moves the valve to its closed position, upon the gradual escape to atmosphere of pressure fluid within the expansion chamber.

The drawing submitted shows a unit having incorporated therein, one specific combination of elements serving to separate, filter, and store, within itself, objectionable solids and liquids generally present within a compressed fluid line. The automatic means to which this application is specifically directed, which permits this accumulation within the unit, and the discharge therefrom, may be used in combination with any desired structure serving the purpose of that illustrated, in which, the numeral **5** indicates in general, a complete separator and filter unit consisting of a tapered cylindrical body **11** opened at both ends and provided at its larger and upper end with some desirable means for quickly connecting the same to a depending flange **12** of a head **13**, the latter having a horizontally disposed inlet **14** and outlet **15**, both of which are internally threaded at their outer ends, permitting the unit to be connected within a compressed fluid conveying line.

The head **13**, has formed centrally of its top wall, and depending therefrom, a circular wall **16**, forming an abutment against which the incoming fluid impinges, separating therefrom to some degree, the objectionable foreign matter. The diametrically opposite part of the wall **16** has a passage which becomes a part of the outlet **15**, permitting the uninterrupted flow of fluid from the inlet back to the conveying line.

The under face of the circular wall **16** is provided with a recess which receives, and retains, the edge portion of an inturned flange **17** formed integral with an inverted cone-shaped metallic element **18**, the lower edge of which is curved outwardly and upwardly bearing firmly against

the inner face of the body wall. This lower portion of the member **18** is provided with a series of spaced cuts extending inwardly, at an angle to the axis of the member, with that portion of the member lying between the cuts bent down to form right angle deflectors adjacent openings **19**, causing the inrushing fluid to engage the circular body wall and move centrifugally therein, further removing from the fluid both solids and objectionable liquids.

Fixed to the inner top wall of the casing **13**, and centrally within the circular wall **16**, is a depending rod **20**, the lower end of which is threaded and receives thereon, a thumb piece or nut **21**, molded of some suitable material, and having an outwardly flared skirt **22**, the peripheral edge portion of which supports upon its upper face, a tubular filtering element **23**, of any suitable material, its upper end being held firmly against the inturned flange **17**, by adjustment of the nut **21**. It will be noted, from the drawing, that the flared skirt **22**, closes completely, the open lower end of the filtering element, thus insuring the full flow of fluid through its body.

The lower portion of the body **11** has formed integral therewith, an inwardly projecting flange **24** upon which rests an outwardly extending flange **25** formed at the upper end of a transparent bowl or receptacle **26**, serving both as a chamber for pressurized fluid, and as a storage trap for the objectionable matter removed from the fluid. The bowl **26** has at its extreme lower end, a discharge opening or outlet **27**, within which the automatic means indicated at **10** is positioned. To hold the bowl firmly in its relation to the body **11**, is a plate **28**, the central portion of which is convexed while its outer edge rests upon the flange **25**, both the plate and body are immovable with respect to the body, and to maintain this relation, the inner face of the body wall is provided with an annular groove **29** within which fits a snap ring **30**. The plate **28** has near its retaining flange, a groove within which are a number of openings **31** affording free passage for pressurized fluid and separated matter from the body to the bowl.

From the drawing, it will be observed that when assembling the unit, the bowl **26**, is inserted through the open top of the body **11**, and dropped down until its flange **25** rests upon a suitable packing ring positioned upon the flange of the body, the plate **28** is then placed over the bowl, and firmly locked in place by the snap ring **30**.

From the foregoing, it is apparent that when the unit is connected within a compressed fluid line, fluid entering the head **13** through the inlet **14**, impinges upon the depending wall **16**, and the cone-shaped member **18** where it is directed downwardly of the member and through the openings **19**, and by reason of the upstanding flanges adjacent the openings **19** caused to engage the body wall and assume a swirling action within the body. During this movement of the fluid, some particles of solid matter and objectionable liquids will be separated therefrom, and collect within the lower part of the bowl, which is, in reality, a storage trap for accumulated matter.

The automatic means generally indicated by the numeral **10** includes a thimble **32** placed within the discharge outlet **27** of the bowl, and having at its upper end, an outwardly extending flange **33** receivable within an annular recess formed in the bowl and surrounding the opening, the flange preventing the thimble from passing through the outlet. The lower end of the thimble has a peripheral groove receiving a retaining ring **34** holding the thimble in place with respect to the bowl. The thimble has midway of its length, a peripheral groove adapted to receive a packing or O ring **35** preventing leakage between the thimble and bowl.

Fitting snugly within the thimble is the reduced end of a tubular element **36**, the upper end of which is closed and provided with an external flange, both of which form

a stationary piston **37**, the peripheral edge of which receives a suitable O ring **38**. The extreme lower end of the tubular element **36** extends beyond the thimble **32**, and has an annular groove receiving therein a retaining ring **39**, thus holding the tubular element firmly within the thimble. That portion of the tubular element **36**, between the thimble and the piston, is slightly enlarged with the lower face of the enlargement resting upon the upper face of the thimble, and within this part of the tubular element are two rows of radial openings or passages **40** and **41**, the latter forming communication between the interior of the bowl and the atmosphere for the passage of any matter that might accumulate within the storage trap of the bowl.

The piston **37**, has extending through its center, an opening, the upper half of which is enlarged to receive the end of a tubular nipple **42**, the upper end of which is reduced in diameter and receivable within the end of a tubular section **43**, extending upwardly within the bowl, and having its upper end closed by a plug **44**, provided with a reduced passage **45** through which pressurized fluid from within the bowl may enter the tubular section.

The upper face of the thimble flange **33** is provided with an annular recess having therein, a ring formed of some resilient material, serving as a seat for the lower end portion of a sleeve valve **46**, when in a closed position. The sleeve valve **46** is formed of an elongated tubular member of two external diameters having concentric bores of unequal diameters, the inner faces of which snugly engage the peripheral surfaces of the piston **37** and the tubular element **36**. The sleeve valve **46** is reciprocable vertically, in a manner hereafter described, of both the piston and tubular element and adapted to open and close the radial passages **41** through which accumulated solids and liquids from within the bowl may pass to atmosphere. The passages **40** provide an escape to atmosphere, through the element **36**, of any pressurized fluid or foreign matter that might collect between the lower face of the piston and the body of the sleeve valve **46**.

The upper end of the sleeve valve **46** extends beyond the upper face of the piston, and has fitted therein, and in spaced relation to the piston, a flanged plate **47** retained in place by suitable means, such as a retaining ring **48**. The central portion of the plate **47** has passing therethrough, the tubular nipple **42** having an O ring or the like forming a seal between the two. From this structure it will be apparent that an expansible chamber **49** is formed by the stationary piston and the reciprocable sleeve valve.

Movable vertically of the tubular section **43** is a float **50** made of some buoyant material, preferably cellular rubber, and having centrally of its body, a tubular insert **51**, adapted to telescope over the upper portion of the tubular section **43**. The insert **51** projects up above the float body, and is closed by a valve element **52**, the under face of which is engageable with the projecting end of the plug **44**, within the end of the tubular section **43**, when the float is in its lowermost position relative to the tubular section. Beneath the valve element **52**, that portion of the insert **51** which projects beyond the float body is provided with several ports **53** through which pressure fluid may pass from the bowl into the tubular section **43**, when the float and the valve element are moved upwardly.

That portion of the tubular nipple **42**, slightly above the upper face of the piston **37**, and below the under face of the plate **47**, is provided with a number of radial passages **56** through which pressurized fluid admitted to the tubular sections **42** and **43** may enter the expansible chamber **49** separating the plate **47** and piston, and moving the sleeve valve **46** connected to the plate upwardly, uncovering the radial openings **41** permitting free communication between the bowl and the atmosphere.

The central opening of the piston **37** has positioned therein, from its under face, a headed plug **54**, screwing

within the end of the tubular nipple 42, locking the same firmly to the piston 37. The plug 54 has an axial passage 55 through which any pressurized fluid within the tubular sections and expansible chamber may continuously bleed to atmosphere. The screw plug 54 has within its head, a socket adapted to receive the end of a suitable tool when inserting the plug within the tubular nipple 42. The upper end of the plug has a recess for the reception of a filtering element of predetermined density intended to provide a more minute control of pressure fluid escaping from the expansible chamber and the tubular element 43 through the passage 55.

When the float drops during the discharge of collected matter from the storage trap, it closes the upper end of the tubular section 43 against further entrance of pressure fluid into the sections 42 and 43, and also the expansible chamber 49. The sleeve valve still is in an open position, and will so remain until pressure fluid within the tubular sections and chamber has escaped to atmosphere, and this is only permitted through the bleed passage 55 of the plug 54. The time interval necessary for the complete escape of this pressure fluid is governed by the size of the bleed passage. The objective being to drop the valve and close the discharge passages at approximately the precise moment when the discharge from the storage trap is complete, thus eliminating excessive escape of pressure fluid from the bowl.

Normally, the sleeve valve 46 is maintained in a down position closing the discharge passages 41 by an expansion element, such as a spring 57, which encircles the tubular element 36 between the piston and the lower portion of the sleeve valve. The tension of the spring is merely sufficient to move the valve. It is considerably less than the pressure of the fluid, but slightly greater than the force exerted by the pressure fluid upon the lower faces of the valve.

In operation, and assuming that the unit has been connected into a line conveying compressed fluid from a source to its point of consumption, and that the discharge passages 41, from the bowl to atmosphere, are closed by the sleeve valve 46 under the influence of the expansion element or spring 57, fluid enters the body through the inlet 14, pressurizing both the body and bowl, and further engaging the upper face of the sleeve valve, insuring its closed position. This condition continues until the foreign matter separated from the fluid has accumulated within the storage trap to such a height as to move the float and its valve element 52 from engagement with the upper end of the tubular section 43, when this occurs, pressurized fluid enters the tubular section 43, and passes through the radial passages 56 to the expansible chamber 49 separating the plate 47 and piston 37, and during the upward movement of the plate 47 the sleeve valve 46 connected thereto is likewise moved upwardly of the piston and tubular element 36 uncovering the radial passages 41 and permitting the discharge to atmosphere of any liquid or foreign matter collected within the storage trap. This upward movement of the sleeve valve is accomplished by the force exerted upon the under face of the plate 47 of the sleeve valve 46 and its lower face, that surrounding the tubular element 36, the combination of the two are greater than that bearing upon the upper face of the plate 47, and the expansion force of the spring 57.

When the contents of the storage trap are exhausted, the float 50 drops upon the tubular section 43, and the valve carried by the float engages the upper end of the tubular section 43 cutting off the flow of pressurized fluid from the bowl into the tubular section 43. Pressurized fluid within the tubular section 43 and the expansible chamber 49 escapes through the radial passages and the reduced passage in the plug to atmosphere gradually permitting the sleeve valve 46 to drop, under the influence of the expansion element or spring 57 to close the discharge passages 41. When the sleeve valve has completely closed the passages, foreign matter and objectionable liquids again start to collect within the storage trap, and continue to do so whereupon the cycle of operation repeats itself.

Although the present invention has been described in connection with its preferred embodiment, it is to be understood that modifications and variations may be resorted to without departing from the spirit and scope of the invention, as those skilled in the art will readily understand. Such modifications and variations are considered to be within the purview and scope of the invention and appended claims.

What I claim is:

1. A device within a compressed air line for removing water therefrom, said device including a receptacle through which the air flows, said receptacle having means for separating the water from the air and retaining the same, a water outlet from the receptacle to atmosphere, automatic means within the outlet controlling the discharge therethrough, said automatic means including a tubular element fixed in said outlet, and having radial passages for the discharge from said receptacle, a flange on the tubular element forming a piston, a sleeve valve encircling the piston and tubular element and reciprocable of both to open and close said radial passages, a closure movable of the tubular element above the piston and fitting within the upper end of the sleeve valve forming an expansible chamber therebetween, the upper end of the tubular element having a restricted passage for the admission of air from the receptacle into the element, radial passages within the tubular element admitting air from the element into the chamber, a float reciprocable of the tubular element upon the rise and fall of water within the receptacle, a valve at the upper end of the tubular element and operative by the float to close the upper end of the tubular element when the float is at its lowermost position, means within the tubular element for the continuous escape of air from the element and chamber to atmosphere at a rate less than that entering its upper end and thereby effect the gradual closing of the sleeve valve, said float and valve movable upon the rise of collected water admitting air into the element and chamber causing the upward movement of the sleeve valve and the opening of the radial passages for the discharge of collected water, and expansible means between the piston and valve exerting an additional force to the closing of the sleeve valve upon the gradual escape of air from the chamber to atmosphere.

2. A device within a compressed air line for removing water therefrom including a receptacle through which the air flows, said receptacle having means for separating the water from the air and retaining the same in its lower end, said end provided with an outlet for the passage of water to atmosphere, automatic means within the outlet controlling the discharge therethrough, said automatic means including a tubular element positioned within the outlet and having radial passages affording communication between the receptacle and atmosphere, a flange on the tubular element forming a piston, a sleeve valve encircling the piston and element and reciprocable of both to open and close said radial passages, a closure slidable upon the tubular element and fixed within the valve in spaced relation to the piston forming an expansible chamber therebetween, the upper end of said tubular element having a restricted opening for the passage of air from the receptacle into the tubular element, radial passages in the tubular element for the flow of air into the chamber, means within the tubular element providing a restricted passage for the continuous escape of air from the chamber to atmosphere, a float reciprocable of the tubular element upon the rise and fall of collected water, a valve at the upper end of the tubular element and operative to close the upper end of the tubular element when the float is at its lowermost position, said float and valve movable upon the rise of collected water admitting air into the expansible chamber and the upward movement of the

sleeve valve opening the radial passages for the discharge of collected water, and expansible means between the piston and valve gradually moving the latter to close the discharge upon the escape of air from the chamber to atmosphere.

3. A device within a compressed air line for removing water therefrom said device including a casing through which air under pressure flows, said casing having means to precipitate water entrained in the air and collect such in its lower end, an outlet through which collected water passes to atmosphere, automatic means within the outlet controlling the discharge, said automatic means including a tubular element formed of two sections one larger in diameter than the other, the end portion of said larger section positioned in said outlet and having radial passages affording communication between interior of the casing and the atmosphere, a flange on the larger section at its junction with the smaller forming a piston, a sleeve encircling the piston and the tubular section thereunder and reciprocable of each to open and close the passages within the latter, a closure slidable upon the smaller section and fixed within the valve end forming between the two an expansible chamber, the upper end of said smaller section having a restricted opening for the passage of air from the casing into the tubular section, radial passages in the tubular section for the flow of air therefrom into the expansible chamber, the lower end of said section being restricted permitting the continuous escape of air from the chamber and section at a rate less than that entering its upper end, a float positioned upon the smaller section and reciprocable thereof upon the rise and fall of collected water, a valve element associated with said float and closing the upper end of the tubular section against the passage of air therethrough when the float is at its lowermost position, said valve and float movable upon the rise of collected water admitting air to the expansible chamber causing the upward movement of the sleeve valve and the opening of the radial passages for the discharge of water, and expansible means between the piston and sleeve valve gradually moving the latter to close the water discharge passages upon the escape of air from the chamber to atmosphere.

4. A device within a compressed air line for removing water therefrom including a receptacle through which the air flows, said receptacle having means for separating water from the air and storing the same, a water outlet from the receptacle to atmosphere having therein automatic means controlling the discharge of water therethrough, said automatic means including a stem having passages for the escape of water from the receptacle to atmosphere, a piston at the upper end of the stem, a sleeve valve encircling the piston and stem and slidable upon both to open and close said passages, a tubular element projecting upwardly from said piston having radial passages adjacent the piston face, a closure movable of said element and retained within the upper end of said sleeve valve in spaced relation to said piston forming therebetween an expansible chamber receiving air from the receptacle through said radial passages, the lower end portion of the sleeve valve underlying the piston, a float reciprocable of the tubular element upon the rise and fall of water within the receptacle, means operative by said float for controlling the flow of air from the receptacle to the expansible chamber causing the sleeve valve to move upwardly opening the passages within the stem and the escape of water to atmosphere, said piston having means for the gradual release of air from the expansible chamber and the downward movement of the sleeve valve closing the escape passages within the stem, and expansible means between the piston and the underlying portion of the sleeve valve exerting additional energy in moving the valve to a closed position.

References Cited by the Examiner

UNITED STATES PATENTS

1,738,809	12/1929	Walter	137—195 X
2,726,732	12/1955	Faust	137—195 X
2,970,806	2/1961	Rexford	251—282 X

References Cited by the Applicant

UNITED STATES PATENTS

758,965	5/1904	Gulland.
1,529,334	3/1925	Winkeleer.
2,664,912	1/1954	White.
2,692,026	10/1954	Frantz.
2,746,476	5/1956	Dopkeen.
2,949,925	8/1960	Everett.
3,093,467	6/1963	McLaughlin.

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