Nov. 26, 1963 A. E. BROUGHTON 3,111,957

CHATTER-PROOF VACUUM CONTROLLER UNIT

Filed Feb. 28, 1957

FIG. 1

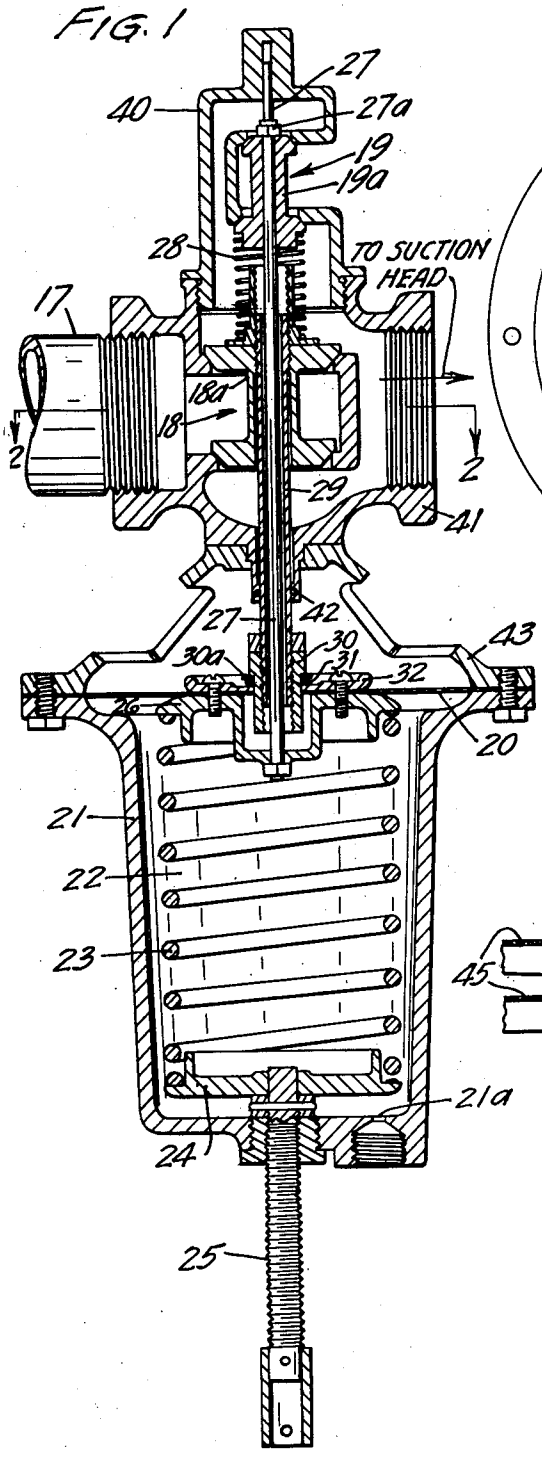


FIG. 2

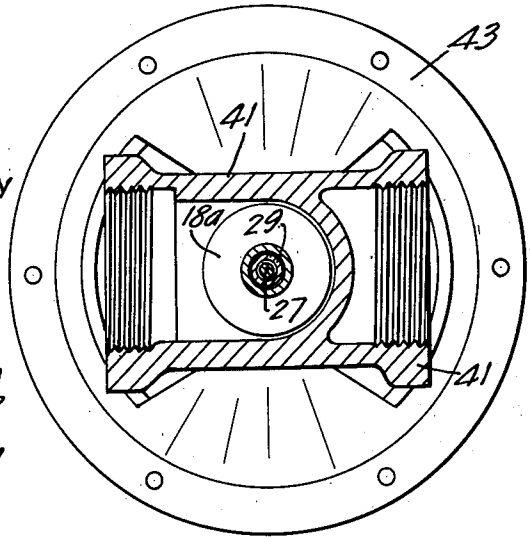
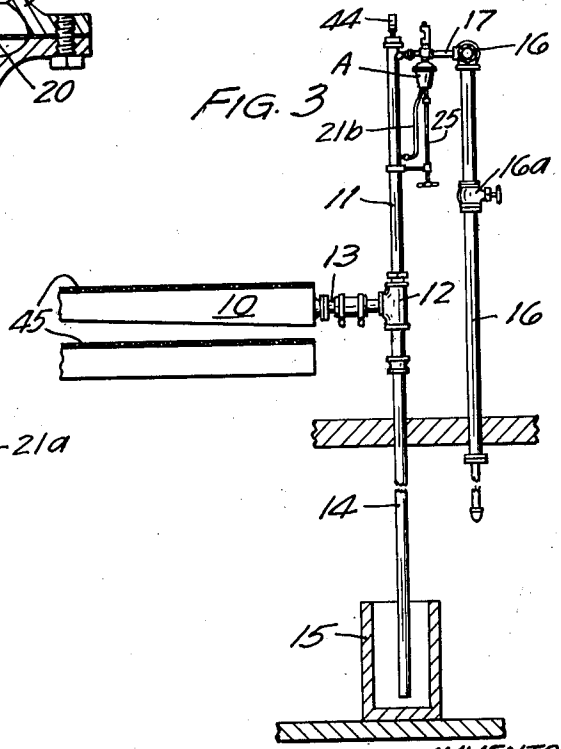


FIG. 3



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CHATTER-PROOF VACUUM CONTROLLER UNIT

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2 Claims. (Cl. 137—116.3)

This invention relates to vacuum controllers, particularly adapted for use with paper making machinery and more particularly relates to a controller having an independent air relief valve communicating directly with the source of suction supply.

While the vacuum controller disclosed in my U.S. Patent Number 2,745,322, granted May 15, 1956, has worked relatively successfully and has materially reduced the chatter from my prior controllers while materially increasing the sensitivity and accuracy of control over my prior controllers, I have found that the rapid fluctuations produced in the control chamber to which the diaphragm is responsive, still cause considerable chatter of the vacuum supply valve.

It is therefore an object of my present invention to provide a vacuum controller which is particularly constructed to eliminate chatter of the suction control valve.

More specifically, it is an object to provide a vacuum controller having a sealed control chamber communicating only with the source of suction supplied to the suction head.

Still more specifically, it is an object to provide a vacuum controller having a control chamber provided with a restricted communication passage affording communication with the source of suction supplied to the suction head, said controller including an air relief valve which communicates directly with the source of suction supplied to the suction head.

It is still a further object to provide a vacuum controller particularly designed to eliminate sudden pressure fluctuations within the control chamber.

These and other objects and advantages of my invention will more fully appear from the following description, made in connection with the accompanying drawings, wherein like reference characters refer to the same or similar parts throughout the several views, and in which:

FIG. 1 is a vertical sectional view showing my new controller; and

FIG. 2 is a horizontal sectional view taken substantially along the line 2—2 of FIG. 1; and

FIG. 3 is a side elevational view showing a suction system for paper making machines with my new controller incorporated therein.

As illustrated in FIG. 3, I provide a controller designated as an entirety by the letter A attached to a suction head such as the flat box **10** as by an air leg **11**, T-member **12** and withdrawal conduit **13**, A drop leg **14** is connected with the vertical portion of T-member **12** and is sealed at its bottom by being submerged in the liquid confined in a reservoir tank **15**. Any suitable source of suction supply may be provided such as a suction pump, not shown, and a suction conduit **16** communicates with the air leg **11** through a conduit **17** through which the flow of air is controlled by the vacuum controller A. The vacuum controller or control assembly designated by the letter A includes a vacuum control valve **18**, an air relief valve **19** and a valve actuating mechanism including a diaphragm **20** mounted in a casing or casting designated by the numeral **21**.

The lower portion of the casing **21** defines a valve control chamber **22** which is terminated at its upper end by the diaphragm **20**. The lower end of the casing **21** has a restricted opening **21***a* which affords communication with the air leg **11** through a sensing tube designated by the numeral **21***b*. The purpose of the restricted orifice **21***a* is to retard the rate at which the pressures within the chamber **22** will vary. A spring **23** normally urges the diaphragm **20** upwardly with an adjustable predetermined force. An adjustable lower spring seat **24** having the screw threaded stem **25** permits the force to be varied in accordance with the required vacuum. An upper spring seat **26** is securely fixed to the center portion of the diaphragm **20** and forms a mounting for the actuating rod **27** which opens the air relief valve **19** against the force of a spring **28**. The suction control valve **18** is actuated by a hollow tubular member **29** which is responsive to upward movement of the diaphragm **20** for opening the valve **18** against the force of spring **28**. Obviously, whenever the force exerted by the spring **23** exceeds the pull exerted by the vacuum in chamber **22**, the suction control valve **18** will be opened by the upward shifting movement of the diaphragm **20** produced by the spring **23**.

The rod **27** is securely anchored in fixed relation at its lower end to the diaphragm as by being fixed to the upper spring seat member **26**. This connection may form an air tight seal to prevent communication between the chamber **22** and the atmosphere above the diaphragm **20**. The upper portion of the rod **27** is slidably mounted in a guiding passage formed in a casting member **40** which is also formed to provide a double valve seat arrangement for the balanced air relief valve **19**. A valve element **19***a* slidably receives the rod **27** therethrough and has a pair of beveled sealing surfaces normally held in seated position against the valve seats of the casting **40** as by a spring **28**. When the suction in the chamber **22** exceeds the force exerted by the spring **23**, the diaphragm **20** will pull down on the rod **27** and a suitable stop element **27***a* fixed to the rod **27** will retract the valve member **19***a* downwardly to open the same against the force of the spring **28**, and thus permit positive air under positive atmospheric pressure to flow into the air leg **11** and thus reduce the suction in the flat box **10**. When the suction is reduced in the air leg **11**, the suction in the control chamber **22** is also relieved through the sensing tube **21***b* and restricted opening **21***a*. However, this will be relieved gradually, due to the restricted orifice **21***a* and also due to the fact that the flow of air under positive atmospheric pressure communicates with the chamber **22** only through the suction air leg **11** in which suction is always maintained so that the movement of the diaphragm upwardly will be gradual and chattering of the valve **19** will thus be eliminated.

When the force exerted by the spring **23** exceeds the force exerted by the suction in chamber **22**, the balanced vacuum control valve **18** will, of course, be opened to impose the vacuum in suction conduit **16** on the air leg **11**. Whenever the valve **18** is open, the air relief valve **19** is, of course, closed. The vacuum control valve **18** is actuated by the hollow tubular member **29** which slidably receives the actuating rod **27** for the air relief valve. The upper end of the tubular member **29** is fixed to the suction control valve element **18***a* and the lower end of said tubular member **29** has a sleeve member **30** fixed thereto as by being threadably connected therewith, and said sleeve member is slidably mounted through the diaphragm **20** to permit said diaphragm to flex downwardly for actuating the air relief valve **19** as described, but said sleeve has a shoulder **30***a* formed around an intermediate portion thereof and said shoulder has a suitable sealing and cushioning member **31** which engages an annular guiding and reinforcing ring **32** mounted in fixed relation to the diaphragm **20** and surrounding the lower portion

of said sleeve **30** in slidable relation thereto, but engaging the cushioned shoulder **30***a* to open the suction control valve **18** when the upwardly directed force of spring **23** exceeds the downward pull of the suction **22** on the diaphragm **20**.

A casting **41** provides a pair of suitable beveled valve seats for the balanced suction control valve element **18***a* and the lower portion thereof slidably receives the tubular member **29** and any suitable means for providing a seal therebetween may be provided, such as the O-ring **42**. An intermediate casting **43** is provided with a flange for clamping the top of the diaphragm **20** to the bottom casting **21** and is securely fixed to the lower portion of the casting **41** by any suitable means. A gauge **44** may be provided to indicate the suction in the air leg **11** and flat box **10**, and a manually operated valve **16***a* is provided in the main suction conduit **16**.

Obviously, a number of flat boxes **10** may be provided in underlying relation to the pulp carrying screen or wire **45** of the paper making machine, and each flat box is individually controlled by a separate controller assembly A to permit varying degrees of suction to be maintained on the layer of pulp supported by the wire **45**.

It will be seen that I have provided a greatly improved vacuum controller specifically designed to entirely eliminate chatter of the two valves **18** and **19**. This is done by connecting the control chamber **22** to the valve controlling positive air supply, only through the suction air leg **11** which by itself materially reduces the chatter, but also the restriction of the flow of air into and out of said chamber by the restricted orifice **21***a* to retard the rate of fluctuation of suction in the control chamber **22**. The rate of pressure change within the chamber is materially reduced thus reducing the rate at which the diaphragm will be oscillated by the changes in the suction in the flat box **10**. It is apparent that said control chamber **22** is sealed from the atmosphere except for the restricted opening **21***a*

to which is connected sensing tube **21***b* as previously described.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the parts without departing from the scope of my invention which consists of the matter shown and described herein and set forth in the appended claims.

What I claim is:

1. A vacuum controller and valve assembly actuated thereby comprising a control chamber, an actuating member communicating with said chamber and responsive for actuation to variations in the pressure in the chamber, a pair of axially aligned valves, a pair of concentrically arranged valve actuating elements operatively associated at one end with said pressure responsive actuating element and respectively connected at their other ends to said valve elements to selectively open and close said valve elements in response to variations in the pressure in said chamber.

2. The structure set forth in claim 1 and yieldable resilient means interposed between said two axially aligned valves to respectively urge the same apart, and valve seats for said valves being positioned to receive the respective valve elements when urged apart by said resilient means.

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