United States Patent

Powell

[15] **3,656,715**

[45] **Apr. 18, 1972**

[54] HOIST HOOK CONTROL

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[73] Assignee: **D. W. Zimmerman Mfg., Inc.**, Madison Heights, Mich.

[22] Filed: **May 20, 1969**

[21] Appl. No.: **826,251**

[52] **U.S. Cl.**.....**254/168**, 254/186, 137/114, 91/28

[51] **Int. Cl.**.....**B66d 1/00**

[58] **Field of Search**.....254/168, 186; 91/6, 28; 60/53 W, 53 R; 137/114

[56] **References Cited**

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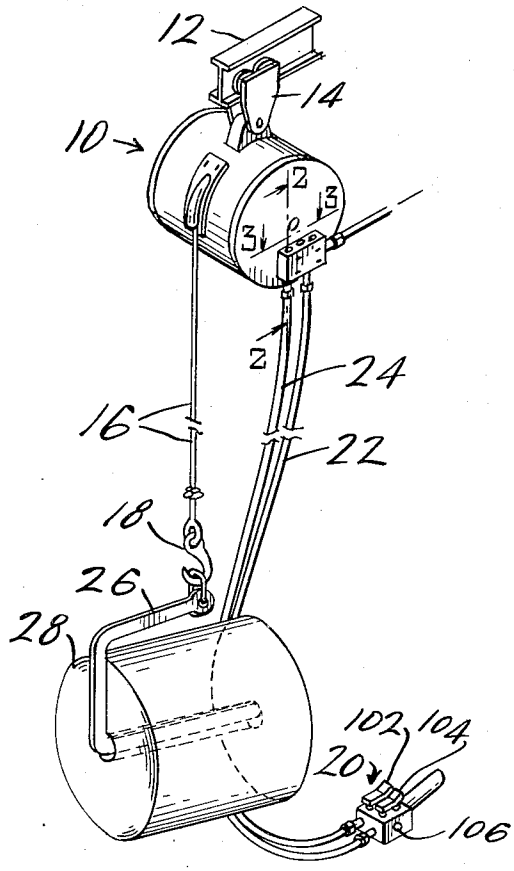
927,016 7/1909 Wisner.....91/6

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[57] **ABSTRACT**

A control is provided for maintaining a predetermined position of a hoist hook. The control is designed particularly for a pneumatically operated hoist of the type shown in U.S. Pat. No. 3,325,148. In a hoist of that type, when the hoist hook is at rest or inactive in a predetermined position over a period of time, whether or not loaded, the hook will tend to slowly drop as air in the hoist tends to dissipate and the pressure decreases. The new control supplies regulated air to the hoist chamber to maintain a constant pressure therein when the hoist is not being operated, to prevent lowering of the hook. This air is supplied directly to the chamber, by-passing the remotely operated controller used to raise and lower loads.

10 Claims, 8 Drawing Figures



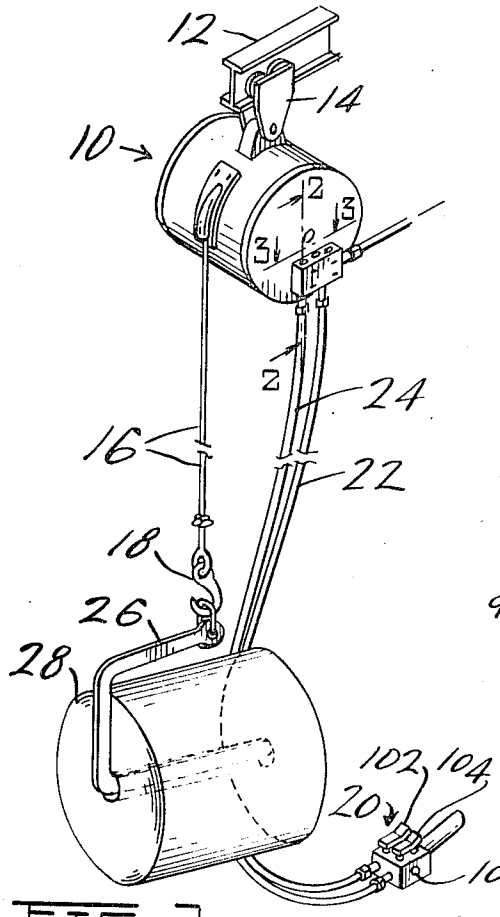


FIG-1-

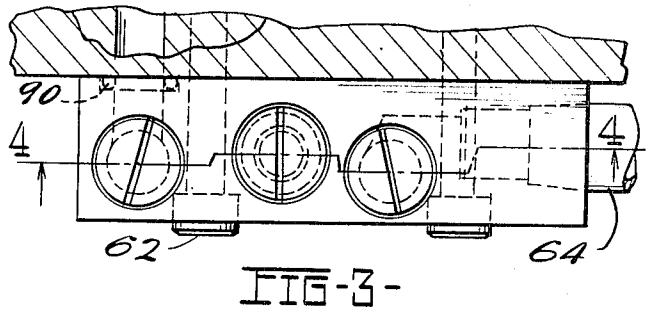


FIG-3-

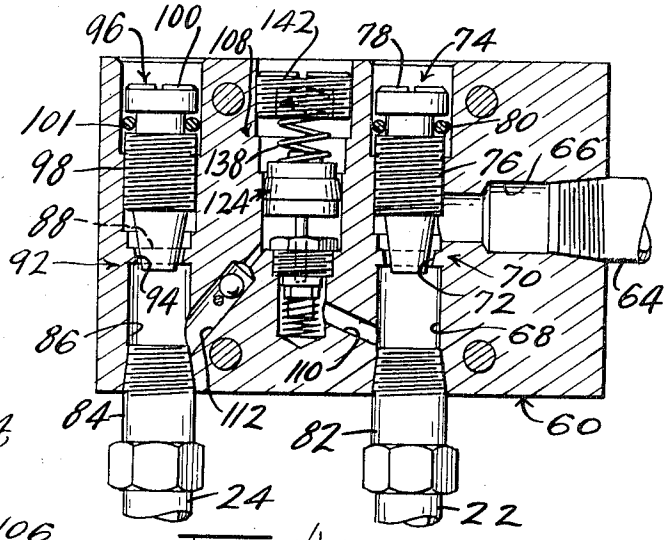


FIG-4-

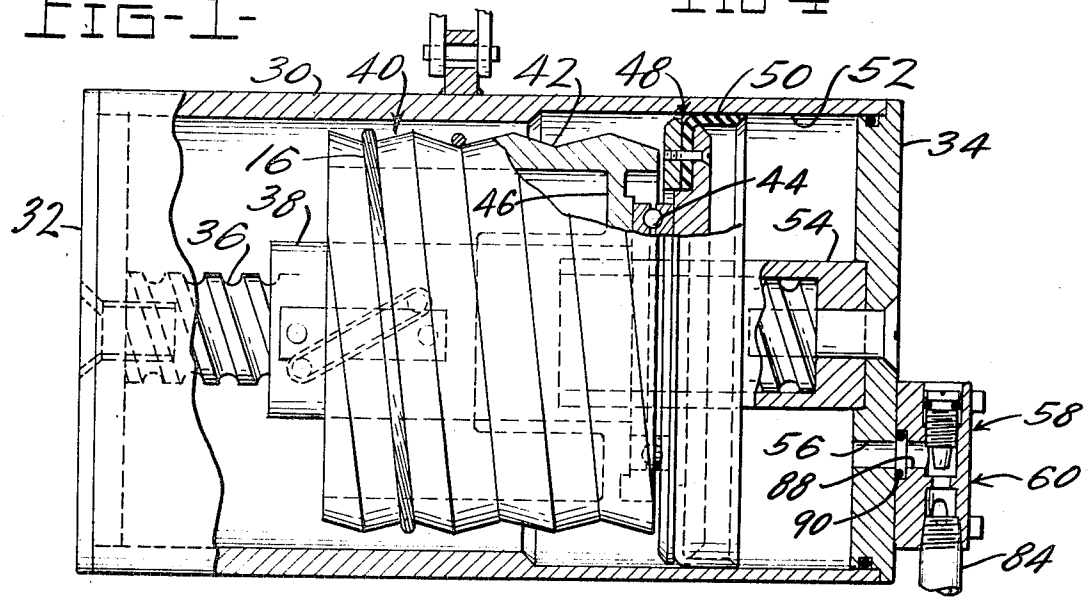


FIG-2-

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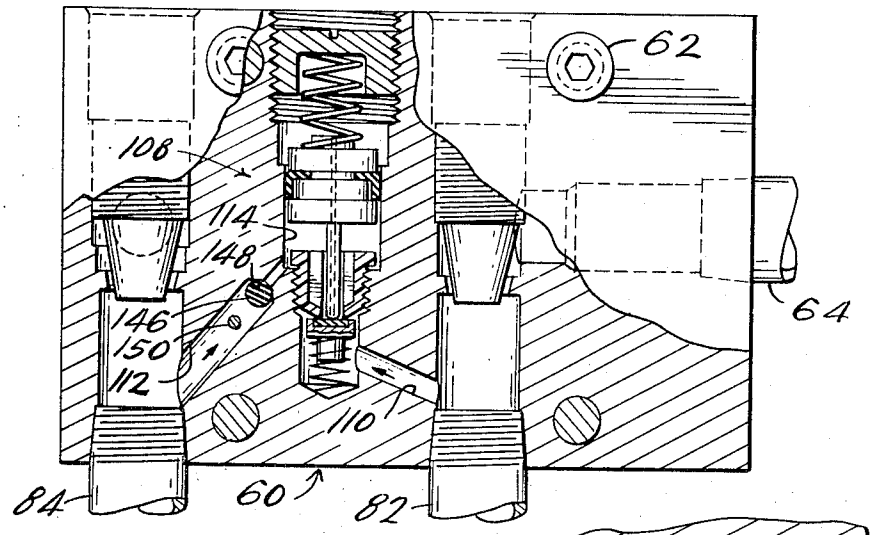


FIG-5-

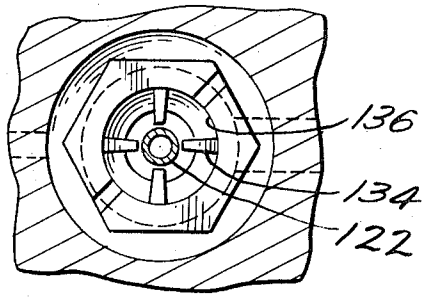


FIG-7-

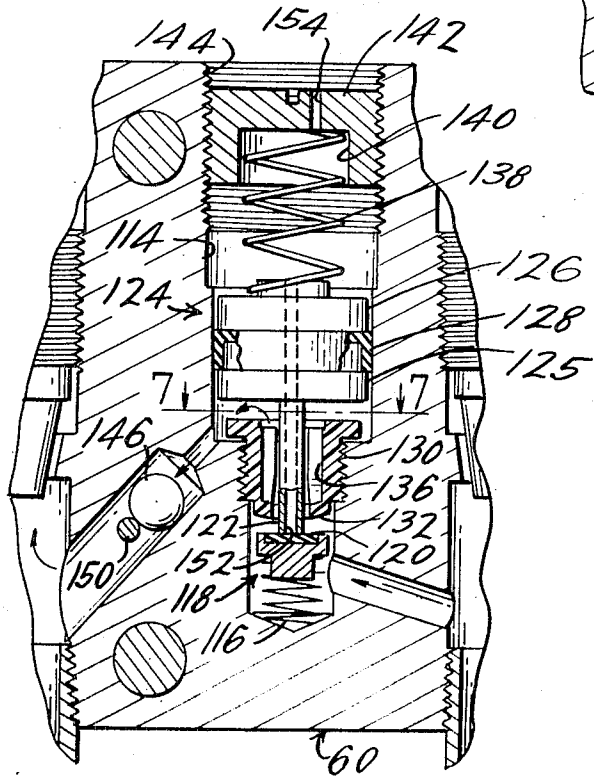


FIG-6-

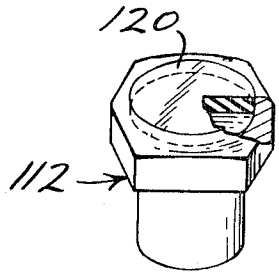


FIG-8-

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HOIST HOOK CONTROL

This invention relates to a pneumatically operated hoist and particularly to such a hoist with a control for maintaining the hoist hook in a predetermined position when the hoist is not being operated for a period of time.

A pneumatically operated hoist to which the invention relates is capable of raising and lowering loads with facility and speed, and also enables the operator to manually move the hoist load to a precise position once it is moved to an approximate position through the gas pressure of the hoist. A hoist of this type is disclosed in my U.S. Pat. No. 3,325,148. In addition to enabling a load to be precisely manually positioned by the operator, the hoist has relatively few moving parts and requires little maintenance. The hoist can move a load rapidly and the speed can be readily varied by the operator. The hoist also can be tailored to the requirements of a variety of applications with a minimum amount of adjustments and modifications thereto.

It has been found that with hoists of this type, if the hoist is inactive or not used for a period of time, and the hoist hook is above its lowest position, the hook will slowly lower or drop. This will occur whether or not a load is on the hook at the time. While such an occurrence is often of little consequence, it can become quite serious should the hoist be located above a moving conveyor or above an aisle in a factory, by way of example.

The present invention provides a pneumatic hoist control which overcomes the above problem. The new control embodies a small gas regulator which by-passes the remotely operated hand controller and maintains a predetermined pressure in the hoist chamber when the hand-operated controller is not in use. The regulator can be externally adjusted to regulate the gas in the hoist chamber to any selected pressure to enable the hoist hook to maintain a predetermined position over a substantially infinite period of time, regardless of the weight of the load, if any, on the hook.

It is, therefore, a principal object of the invention to provide a pneumatically operated hoist with means for maintaining the hoist hook in a predetermined position over an extended period of time when the hoist is not in use.

Another object of the invention is to provide an improved pneumatically operated hoist with a control having a by-pass regulator for maintaining pressure in the hoist at a constant value to retain the hoist hook in a predetermined position.

Many other objects and advantages of the invention will be apparent from the following detailed description of a preferred embodiment thereof, reference being made to the accompanying drawings, in which:

FIG. 1 is a view in perspective of a pneumatically operated hoist and a hand-operated controller embodying the invention, the hoist being shown supported from an overhead rail and in turn supporting a load through a hoist hook;

FIG. 2 is a somewhat schematic view in longitudinal cross section, with parts broken away and with parts in section, of the internal components of the hoist;

FIG. 3 is a top view of a hoist control embodying the invention, and a portion of an end of the hoist housing;

FIG. 4 is a view in vertical cross section taken along the line 4-4 of FIG. 3;

FIG. 5 is an enlarged view in front elevation, with parts broken away and with parts in section, of the hoist control of FIG. 4, portions being shown in slightly different positions;

FIG. 6 is a further enlarged view of a portion of the hoist control of FIG. 5;

FIG. 7 is a fragmentary view in transverse cross section taken along the line 7-7 of FIG. 6; and

FIG. 8 is a further enlarged view in perspective of a valve component of the hoist control.

Referring particularly to FIG. 1, a pneumatically operated hoist embodying the invention is indicated at 10 and is supported from an overhead beam 12 by a hoist trolley 14. The hoist 10 has a lifting cable 16 extending downwardly therefrom and terminating at a hoist hook 18. A remote, hand-operated hoist controller 20 is located below the hoist 10 and

connected thereto by flexible gas or air lines 22 and 24. For purposes of illustration, the hoist hook 18 is connected to a load-supporting bracket 26 which carries a large roll 28 of paper. Assuming the roll 28 is to be loaded on a spindle with hoists heretofore known, the controls had to be carefully manipulated until the roll was in exact alignment with the spindle. This was often time-consuming and required substantial skill on the part of the operator. With the hoist 10, however, the roll 28 is moved to an approximate position relative to the spindle by means of the controller 20. The exact positioning of the roll can then be accomplished by the operator who simply pushes the roll upwardly or downwardly slightly to the exact position. Such manipulation is possible because the gas in the hoist 10 can expand or contract somewhat, thereby enabling the load to yield according to the external force provided by the operator.

The internal components of the hoist 10 will not be discussed in detail since they can be the same as those shown in my aforementioned U.S. Pat. No. 3,325,148. Briefly, the hoist 10 includes a housing 30 having end walls 32 and 34. A ball screw 36 extending longitudinally through the housing is fastened centrally to the end walls, and a ball screw assembly 38 is mounted on the ball screw 36 and moves longitudinally in the housing when turned relative to the ball screw. A cable drum 40 is mounted on the ball screw assembly 38 and moves therewith, both rotatably and longitudinally relative to the screw 36 and the housing 30. The drum 40 has a shallow spherical groove 42 which receives the cable 26 when the load is raised and the cable is wound on the drum.

A thrust bearing 44 is located adjacent the drum 40 and bears against a portion of a hub 46 of the drum. The bearing 44 also is arranged to bear against a piston 48 having a peripheral seal 50 which engages and slides in a cylindrical portion 52 of the housing 30 in substantially gas-tight relationship. With this arrangement, the end wall 34, the cylindrical surface 52, and the piston 48 form a power or gas chamber to receive gas for operating the hoist. The piston 48 is slidably mounted on a cylindrical sleeve 54 which can be an integral part of the ball screw 36, if desired, and is in sealing contact therewith by means of a suitable O-ring seal (not shown).

When gas of sufficient pressure is supplied to the power chamber, the piston 48 is moved toward the left as shown in FIG. 2 and, through the thrust bearing 44, forces the drum 40 toward the left. This movement causes the drum to rotate in a manner to raise the cable 26 and the load 28.

The gas is supplied to the power chamber through an inlet opening 56 in the end wall 34, with the volume and pressure of the gas controlled by a gas control 58 mounted on the end wall. The control 58 includes a body or housing 60 affixed to the end wall by four bolts 62 which enable the control 58 to be quickly removed for replacement or repair. Gas or air is supplied to the control 58 through a supply line 64 to an inlet passage having a first portion 66. The inlet portion 66 communicates with a second portion 68 with a flow control device 70 therebetween. This flow control device includes a conical valve seat 72 in the passage portion 68 and a needle valve 74. The needle valve 74 has a threaded shank 76 and a slotted head 78 by means of which the valve can be externally turned toward and away from the seat 72 to control the volume of gas flowing through the first inlet passage portions 66 and 68. An O-ring 80 is located between the slotted head 78 and the threaded shank 76 and is oversized to provide a drag on the valve 74 and to maintain it in any given position even though subjected to vibration or the like.

The second inlet passage portion 68 is connected by a suitable fitting 82 to the first flexible line 22 which leads to the controller 20. The second flexible line 24 leads back to the control body 60 to which it is connected by a suitable fitting 84. The line 24 communicates with an outlet passage and specifically a first outlet passage portion 86 which connects with a second outlet passage portion 88. The latter communicates with the inlet opening 56 and is sealed against the end wall 34 by an O-ring 90. A second flow control device 92 controls

flow of gas through the outlet passage portions **86** and **88**. The flow control device **92** is similar to the device **70** including a conical valve seat **94** and a needle valve **96**. The needle valve **96** has a threaded shank **98** and a slotted head **100** to enable the valve **96** to be turned toward and away from the valve seat **94**. The valve **96** also has a large O-ring **101** to retain the valve in a given position.

The hand-operated controller **20** functions in the same manner as the corresponding controller of my U.S. Pat. No. 3,325,148 and will not be discussed in detail. Referring to FIG. **1**, when a valve lever **102** is depressed, it opens a valve in the controller enabling flow of gas from the line **22** to the line **24** so that the gas at the supply pressure in the line **64** then flows through the lines **22** and **24** to the hoist chamber. When a second valve lever **104** on the controller **20** is depressed, it connects the line **24** with a vent **106** in the controller, thereby enabling gas in the hoist chamber to be vented back through the line **24** and to atmosphere. The flow control devices **70** and **92** control the rate of the supply of gas to the chamber and, therefore, the rate at which the hoist hook **18** is raised when the lever **102** is depressed. Further, the flow control device **92** controls the rate at which gas is vented from the hoist chamber when the lever **104** is depressed, thereby controlling the rate at which the hoist hook **18** and the load are lowered.

When the hoist hook **18** is in a position above its lowest position for an extended period of time, it will tend to gradually lower or drop. This results from a loss of gas in the hoist chamber which can pass around the piston seal **50** over a period of time and possibly through other means of egress to the atmosphere. Particularly because the friction is minimal between the ball screw **36** and the ball screw assembly **38**, the hook **18** will drop even without a load on it. While this is not ordinarily serious, if the hoist **10** is located above a moving conveyor, by way of example, the hook can drop onto the conveyor and become engaged therewith, or with articles thereon, resulting in damage. The hoist **10** may also be located above an aisle in a factory, by way of example, with the hook **18** dropping into the path of vehicles or people using the aisle, causing possible injury.

To overcome the above problems, and in accordance with the invention, the control **58** is equipped with a regulator indicated at **108** which maintains the pressure in the hoist chamber at a predetermined value regardless of any loss of gas therefrom. The regulator **108** receives the unregulated supply gas from the line **64** through a transverse inlet passage **110** communicating with the passage **68**. The regulator **108** then supplies regulated gas through a transverse outlet passage **112** and through the passages **86** and **88** to the hoist chamber through the inlet opening **56**. The regulator is externally adjusted so that the hoist hook **18** is balanced, at which time the hook will remain balanced and in a fixed position regardless of the length of time it is not in use. The regulator **108** can also be adjusted to balance the hook **18**, in the event a load is carried by the hook, particularly if the load will be left or stored on the hook over a period of time.

Referring to FIGS. **5** and **6** in particular, the overall regulator **108** is housed in a recess **114**. In the bottom of the recess is seated a small spring **116** which seats against and urges upwardly a valve body **118** having a rubber disc or valve seat **120** on its face. The valve body **118** is urged against an end of a hollow stem **122** which extends upwardly to a piston assembly **124** comprising a pair of metal discs **125** and **126** with a rubber sealing ring **128** therebetween. The stem **122** extends through a plastic guide nut **130** which forms an annular valve **132** at the lower end to seat against the valve seat disc **120** and form an effective seal. The guide nut **130** further has inwardly extending guide fins **134** (also see FIG. **7**) which guide the stem **122** in a vertical path and form a passage **136** therearound for the flow of gas upwardly past the stem.

A main regulator spring **138** is located above the upper disc **126** and seats thereagainst. The upper end of the spring **138** is received in a recess **140** of an adjusting screw or cap **142** which can be turned inwardly and outwardly in an upper threaded end **144** of the recess **114** to adjust the spring and, hence, the output pressure of the regulator. Turning the cap **142** inwardly increases the force of the spring **138** on the piston assembly **124** and increases the output pressure of the regulator, and vice versa.

In the operation of the regulator **108**, when the pressure in the hoist chamber equals that desired, the regulator will be positioned as shown in FIG. **5**. In this position, the spring **116** urges the valve body **118** against the annular valve **132** formed at the bottom of the plastic nut **130** to prevent flow of gas beyond the passage **110**. As gas dissipates from the hoist chamber and the pressure in the chamber decreases, the pressure in the recess **114**, between the guide nut **130** and the piston assembly **124**, will decrease, so that the upper regulator spring **138** will urge the piston assembly downwardly, causing the valve stem **122** to push the valve body **118** and the valve seat **120** away from the valve **132**. This enables gas to flow through the passage **110**, between the valve seat **120** and the valve **132**, through the passage **136**, and out the transverse passage **112** to the hoist chamber. The flow occurs until the pressure in the chamber again reaches the desired value at which time the pressure will cause the piston assembly **124** to rise and enable the valve body **118** again to seat against the valve **132**.

When a full volume of unregulated gas is supplied to the hoist chamber by the operation of the valve lever **102** to supply gas from the line **22** to the line **24**, this surge of gas will cause a rubber check valve **146** to seal against a conical valve seat **148** in the passage **112** to prevent the high-pressure gas from entering the regulator recess **114**. When the valve lever **102** is released and the control is not used, the check valve **146** will move away from the seat and rest on a transverse pin **150** when the gas pressure in the passage **112** becomes less than the pressure in the passage **110** to enable the regulator **108** to take over again and maintain a constant pressure in the hoist chamber and by-pass the controller **20**, until the hoist is subsequently operated.

In the event that high pressure is built up below the piston assembly **124**, the pressure will cause the assembly **124** to move upwardly against the force of the spring **138** until the bottom of the valve stem **122** moves upwardly beyond the valve seat **120** of the valve body **118**. The high-pressure gas can then be vented through a central passage **152** located in the valve stem **122** with this gas entering the recess **114** above the plunger assembly and being vented to atmosphere, either through a small vent **154** in the cap **142**, or around the threads of the cap.

It will thus be seen from the above that the regulator **108** which by-passes the hand-operated controller **20** and maintains gas at a predetermined pressure in the hoist chamber when the controller is not in use, thereby retains the hoist hook **18** in a desired position without dropping. The regulator **108** further is simple to adjust since all that is required is that an operator adjust the cap **142** by turning it inwardly or outwardly until the hook **18** remains in a stationary position.

Various modifications of the above described embodiment of the invention will be apparent to those skilled in the art and it is to be understood that such modifications can be made without departing from the scope of the invention, the embodiment shown and described being primarily for purposes of illustration and not limitation.

I claim:

1. A hoist for raising and lowering loads, said hoist comprising a housing forming a gas chamber and a gas inlet communicating with the chamber, a piston in said housing forming an end of said chamber, a cable drum in said housing movable longitudinally of said housing with said piston, means in said housing rotatably supporting said drum, said drum to rotating when moved longitudinally; a control device comprising a body having a gas inlet passage, a gas outlet passage communicating with said gas inlet of said housing, flow control means associated with said passages to control the flow of gas

therethrough, a first gas line communicating with said gas inlet passage, a second gas line communicating with said gas outlet passage, a regulator communicating between said inlet passage and said outlet passage to supply gas at a predetermined pressure from said inlet passage to said outlet passage independently of flow through said first and second gas lines; and a remote controller connected to said first and said second gas lines and having a first valve arranged to control flow from said first gas line to said second gas line, a vent, and a second valve to control the flow of gas from said second line to said vent.

2. A hoist according to claim 1 characterized by said control device having externally adjustable means for controlling said regulator to adjust the outlet pressure of gas passing through said regulator.

3. A hoist according to claim 1 characterized further by said regulator having means for venting excess pressure therefrom.

4. A hoist according to claim 1 characterized by a check valve between said regulator and said outlet passage to prevent gas at high operating pressure in said outlet passage from reaching said regulator.

5. A pneumatically operated hoist for raising and lowering loads and including means forming a gas chamber with a gas inlet communicating therewith, and means responsive to the pressure of gas in said chamber for raising and lowering a load, a control device associated with said hoist comprising a body having gas inlet passage means for receiving a supply of gas, gas outlet passage means communicating with said gas inlet of said hoist, a first gas line communicating with said gas inlet passage means, a second gas line communicating with said gas outlet passage means, a gas controller connected to said first and second gas lines and having means to control flow of gas from said first gas line to said second gas line and having means to vent gas from said hoist chamber, and a regulator connecting said inlet passage means and said outlet passage means to supply gas at a selected pressure from said inlet passage means to said outlet passage means independently of flow through said first and second gas lines and said controller.

6. A hoist according to claim 5 characterized by said control device having externally adjustable means for controlling said regulator to adjust the outlet pressure of gas passing through said regulator.

7. A hoist according to claim 5 characterized further by said regulator having means for venting excess pressure therefrom.

8. A hoist according to claim 5 characterized by a check valve between said regulator and said outlet passage to prevent gas at high operating pressure in said gas outlet passage means from reaching said regulator.

9. A pneumatically operated hoist including means forming a power chamber with a gas inlet communicating therewith and means responsive to the pressure of gas in said chamber for raising and lowering a load, a control device associated with said hoist comprising a body having first passage means for receiving a supply of gas, second passage means communicating with said gas inlet of said hoist, controller means communicating between said first and second passage means for supplying gas from said first passage means to said second passage means and to said hoist chamber, said controller including means for venting gas from said hoist chamber, a regulator communicating with said first passage means upstream of said controller, said regulator communicating with said second passage means downstream of said controller, said regulator being effective to control gas pressure in said hoist chamber independently of said controller when said controller is not being operated.

10. A hoist according to claim 9 characterized further by said regulator having externally adjustable means to control the outlet gas pressure in said hoist chamber.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,656,715 Dated April 18, 1972

Inventor(s) Edgar R. Powell

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, Line 71 - Claim 1, delete the word "to".

Signed and sealed this 5th day of September 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334