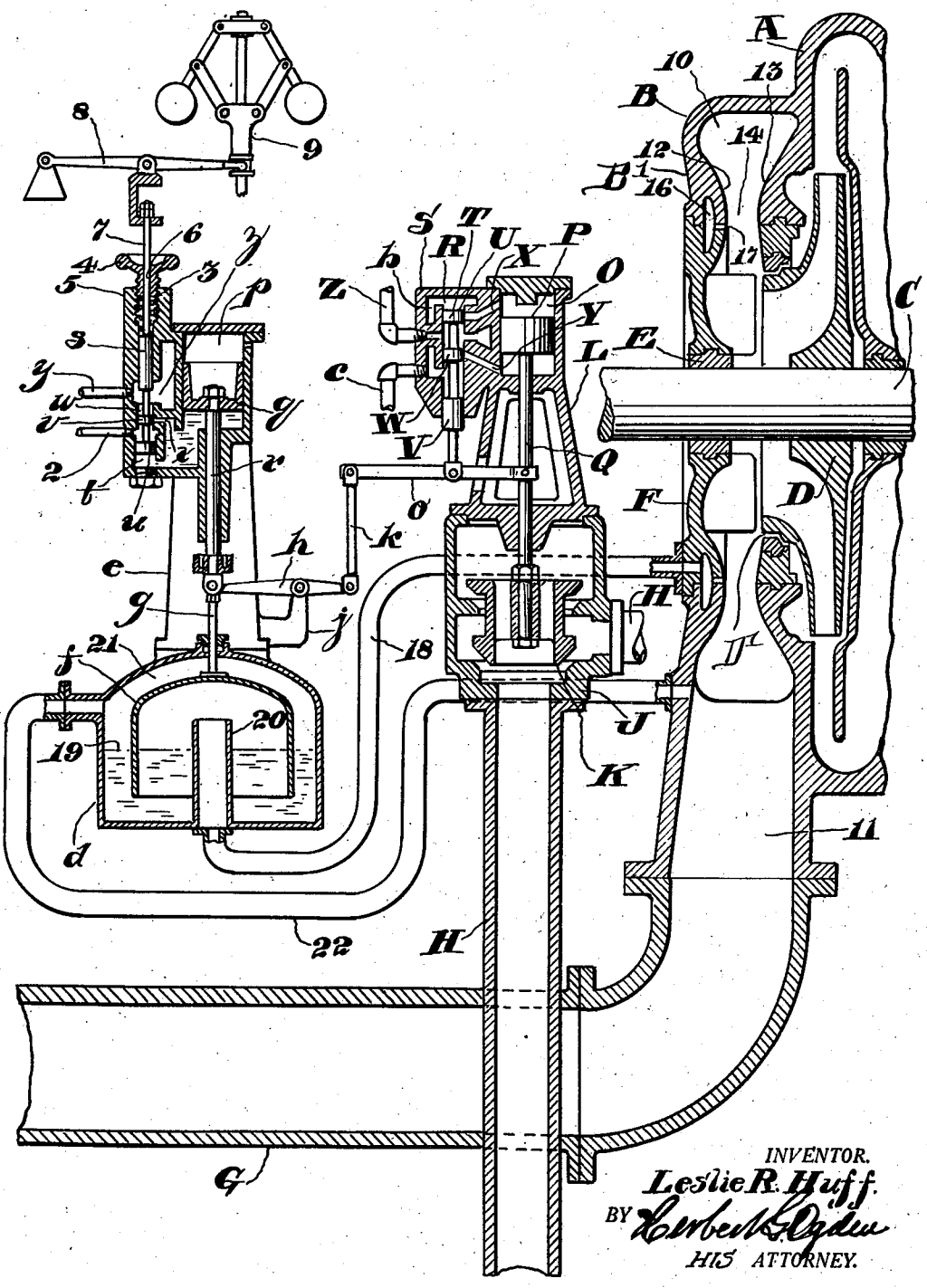
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L. R. HUFF

CONSTANT VOLUME REGULATOR

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INVENTOR.
Leslie R. Huff.
BY Herbert G. Ogden
HIS ATTORNEY.

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LESLIE R. HUFF, OF PHILLIPSBURG, NEW JERSEY, ASSIGNOR TO INGERSOLL-RAND COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

CONSTANT-VOLUME REGULATOR.

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This invention relates to volume regulators, but more particularly to a constant volume regulator for turbo blowers, turbo compressors and the like.

The objects of the invention are to insure a constant intake volume of air to a turbo blower or other similar machine irrespective of any fluctuations which may occur in the discharge pressure of the machine, to increase the efficiency of devices of this character, and to cheapen and simplify the construction thereof.

Other objects will be in part obvious and in part pointed out hereinafter.

The invention consists of the combination of elements and features of construction having the general mode of operation substantially as hereinafter described and more particularly pointed out in the appended claims and illustrated in the accompanying drawing.

The figure in the drawing is a sectional elevation of so much of a turbo blower as will serve to illustrate the invention.

Referring more particularly to the drawing, the turbo blower designated generally by A has a casing B through which extends a rotatable shaft C carrying an impeller D. The shaft C, only a portion of which is shown, may be driven by any suitable motor, as for instance, by a steam turbine (not shown) and is provided with a packing ring E which cooperates closely therewith for preventing leakage of fluid to the casing. The packing ring E may be held against endwise movement in any suitable manner and in the present instance, is supported by a closing ring F seated in the end of the casing B. A conduit G secured to the base of the casing B serves to convey air to the blower.

Steam for actuating the motor whereby the blower is driven may be conveyed from a suitable source of supply through a pipe H having interposed therein a valve chamber J in which is located a steam admission valve K of a well known type for controlling the flow of the steam through the pipe H. A bracket L seated on the valve chamber J forms a closure for one end of said valve chamber and carries at its other end a cylinder O in which is arranged a piston P. The piston P and the valve K in this instance are connected operatively and held in spaced relation with respect to each other by a rod Q.

Suitable means are provided for controlling the admission of power such as oil under pressure to the ends of the cylinder O for actuating the piston P and consequently the valve K. To this end a chamber R is formed in a valve chest S preferably adjacent the cylinder O to receive slidably a pilot valve T having end heads U and V and a central head W. The head U in this instance controls a passage X leading to the upper end of the cylinder O and the central head W controls a passage Y leading to the lowermost end of the cylinder O. The head V acts merely as a guide for the valve and also forms a closure for one end of the chamber R. Oil for actuating the pilot valve T is conveyed through a suitable pipe Z leading from a source of supply, such as a pump, and communicating with the chamber R at a point intermediate the passages X and Y. The passages X and Y serve both as inlet and exhaust passages for the ends of the cylinder O, as will be explained more fully hereinafter.

Whenever the pilot valve T is in position to exhaust the oil from the cylinder O, such oil may flow through the passages X and Y and through the chamber R into a passage *b* communicating with the chamber R. A pipe *c* leading from the passage *b* conveys the discharged oil to a sump or reservoir from whence it may again be used if desired.

In devices of this character, suitable pressure responsive means are usually provided for controlling the delivery of power to the motor whenever fluctuations occur in the discharge line of the blower so that a constant intake volume of air may at all times be delivered to the blower. To accomplish this in the present instance, a receptacle or tank *d* is secured to a bracket *e* which in turn may be secured fixedly in a convenient position on the blower. A hollow bell shaped float *f* is disposed in the tank *d* and is suspended from a rod *g* slidable through the roof of the tank *d*. A balancing lever *h* pivoted on an arm *j* of the bracket *e* is pivoted at one end to the rod *g* and at its other end to a link *k* connecting the balancing lever *h* to a lever *o*, said lever *o* being pivotally connected to the pilot valve T and

one end of the lever *o* is connected pivotally to the rod Q.

At the upper end of the bracket *e* is formed a cylinder *p* in which is arranged a piston *q* having connected thereto a rod *r* whereby the piston *q* is operatively connected to the rod *g*. A controlling valve *s* slidable in a valve chamber *t* controls the admission and exhaust of oil under pressure into the cylinder *p* beneath the piston *q* for counteracting the movement of the bell float *f*. The valve *s* has a large end head *u* and a central head *v* of smaller diameter than the end head and slidable in a chamber *w* from which chamber leads a port *x* to communicate with the cylinder *p*. The oil intended to be controlled by the valve *s* may be conveyed from a suitable source of supply through a pipe *y* communicating with a chamber *z*. A pipe 2 leading from the chamber *t* from a point intermediate the ends thereof is adapted to convey discharged oil from the cylinder *p*.

In the present instance a spring 3 bears with one end on the valve *s* and at its other end against a regulating nut 4 screwed in a boss 5 formed on the cylinder *p*. The regulating nut 4 in this instance is provided with a bore 6 through which extends slidably a rod 7 carried by the valve *s* and which rod is connected to a governor lever 8 to one end of which is connected operatively a speed governor 9 of the motor.

According to the present invention, an annular chamber 10 having a central outlet opening D′ is formed in one end of the casing B to encircle the shaft C and has a tapered passage 11 which communicates with the conduit G for conveying air to the said chamber 10. The end walls 12 and 13 of the chamber 10 are curved inwardly and converge to form a restricted portion or throat 14 between the outlet opening D′ and the passage 11 for increasing the velocity of the air flowing from the chamber 10 to the outlet opening D′.

In an outer end wall B′ and adjacent the restricted portion 14 of the chamber 10 is an annular passage 16 which communicates with the restricted portion 14 preferably through a plurality of ports 17. These ports are preferably spaced equi-distantly around the restricted portion 14 so that an average of the pressure in the said restricted portion may be obtained in the annular passage 16.

A suitable connection in the form of a pipe 18 is provided between the annular passage 16 and the interior of the bell float *f*. The cross sectional area of the bore of this pipe 18 is preferably of a size substantially equal to the combined areas of the ports 17.

In order to prevent the passage of water 19, or other sealing liquid, in the bell float *f* from being drawn into the pipe 18, a tube 20 wherewith the pipe 18 communicates extends into the bell float to a point well above the surface of the water 19.

A suitable connection between a chamber 21 of the receptacle *d* and the tapered inlet 11 of the casing B is provided in the form of a pipe 22 connected to the tapered inlet and the receptacle *d* in any suitable manner.

By thus connecting the interior of the float *f* with the restricted portion 14 and the chamber 21 with the inlet 11, the float will be subjected to differential pressures due to the difference in areas of the restricted portion 14 and the inlet 11. In this way the float *f* will be actuated for regulating the various elements which control the admission of power to the motor.

In the operation of the device; assuming that the turbo blower is running at its normal speed, air drawn thereby through the tapered inlet 11 will pass into the annular chamber 10, from thence through the restricted portion into the impeller D. Due to the restricted portion 14 the flow of the air will be accelerated and will therefore pass through said restricted portion at a greatly increased velocity over the flow of the air through the tapered inlet 11. Owing to this difference in the velocity of the flow of the air through the portions of the casing wherewith the pipes 18 and 22 are connected, a greater suction will be created in the interior of the bell float *f* than will be created in the chamber 21. If, for any well known reason, the motor speed is accelerated, the bell float *f* will be drawn downwardly in the direction of the force acting on the interior thereof. This downward movement of the bell float will cause the pilot valve T to move upwardly in the chamber R and thus admit oil through the passage X into the cylinder O above the piston P. The oil thus admitted will then force the piston P and the steam admission valve K downwardly, and, in consequence, reduce the flow of steam through the pipe H to the motor. Such reduction of the amount of steam flowing through the pipe H will result in a lower speed of the motor and therefore in a decreased flow of pressure fluid through the restricted portion 14. As a result the suction on the interior of the bell float *f* will be decreased, thus permitting the bell float *f* to rise somewhat, which upward movement of the bell float will have the effect of again moving the pilot valve T downwardly in the chamber R.

Since the piston *q* is connected rigidly to the bell float *f*, any movement of the bell float will result in a corresponding movement of the piston *q*. As a result of this construction when the bell float *f* is being drawn downwardly, the piston *q* will also move downwardly in the cylinder *p* and thus displace the oil in the cylinder *p*.

During the downward movement of the piston *q*, the oil in the cylinder will act

against the end face of the enlarged head *u* of the valve *s* and will move the said valve upwardly against the force of the spring 3 until the head *v* of the valve uncovers the port *x*, whereupon oil will flow through said port, through the chamber *t*, and thence from the said chamber through the discharge pipe 2.

If, then, while the parts are in this position, resistance to the discharge pressure of the blower again increases, the velocity of the air flowing through the restricted portion 14 will be reduced and a reduced suction in the interior of the bell float *f* will be obtained, thus permitting the oil in the cylinder *p* to raise the piston *q*. As the piston *q* moves upwardly, the pressure of the oil in the cylinder *p* will be decreased to a value which will permit the spring 3 to move the valve *s* downwardly and admit oil from the chamber *z* through the chamber *w* and the ports *x* into the cylinder *p* to again move the piston *q* upwardly. Such movement of the piston *q* will be transmitted through the various linkage connecting the piston *q* to the pilot valve T and move the pilot valve to its lowermost limiting position in the chamber R. With the valve T in this position, the passage Y will be uncovered to admit oil under pressure beneath the piston P and at the same time the passage X will be uncovered to permit the oil in the top of the cylinder O to escape into the chamber R, from whence it may escape through the pipe Z.

The upward movement of the piston P caused by the oil acting against the lower face thereof will open the steam admission valve K to wider limits and thus admit a greater portion of steam into the motor. By so doing the speed of the motor will be increased to a point sufficient to permit the impeller D to supply a constant volume of air through the discharge pipe of the blower irrespective of any undue resistance to the discharge pressure.

Heretofore, in devices of this character, it has been customary to interpose a Venturi meter in the intake conduit of the blower to obtain a restricted portion in the inlet for the purpose of actuating the bell float or other equivalent means employed for actuating the controlling mechanism. Such meters have added greatly to the cost of manufacturing blowers of this type. This disadvantage has been overcome by means of the present invention in which the passages and chambers which comprise the velocity increasing means may be cast in the casing and require little, if any, machining.

I claim:

1. In a constant volume regulator for a motor driven turbo blower, the combination of a casing, an intake conduit for conveying air into the casing, a shaft rotatable in the casing, an impeller carried by the shaft, a chamber around the shaft communicating with the intake conduit and having an outlet opening for delivering air to the impeller, said chamber having a restricted portion between the intake conduit and the outlet opening to increase the velocity of the air flowing from the chamber to the impeller, and pressure responsive means actuated by the differential pressures in the chamber and the restricted portion for automatically regulating the speed of the motor to deliver a constant volume of air to the impeller.

2. In a constant volume regulator for a motor driven turbo blower, the combination of a casing, an intake conduit for conveying air to the casing, an annular chamber in the casing to receive the air from the conduit, said chamber having an annular restricted portion for increasing the velocity of the air flowing from the chamber, an annular passage in an outer wall of the casing adjacent the restricted portion, ports to establish communication between the restricted portion and the annular passage, and pressure responsive means actuated by the differential pressures in the chamber and the annular passage for automatically regulating the speed of the motor to deliver a constant volume of air to the blower.

3. In a constant volume regulator for a motor driven turbo blower, the combination of a casing, an intake conduit for conveying air to the casing, an annular chamber in the casing to receive the air from the conduit, said chamber having an annular restricted portion for increasing the velocity of the air flowing from the chamber, an annular passage in an outer end wall of the casing adjacent the restricted portion, ports to establish communication between the restricted portion and the annular passage, a receptacle, a float in the receptacle, operative connections actuated by said float for controlling the power delivered to the motor, means connecting the interior of the float with the annular passage, and means connecting the receptacle exterior of the float with the annular chamber.

In testimony whereof I have signed this specification.

LESLIE R. HUFF.