Jan. 28, 1969 A. R. ERBACH 3,424,198

VALVE MEANS

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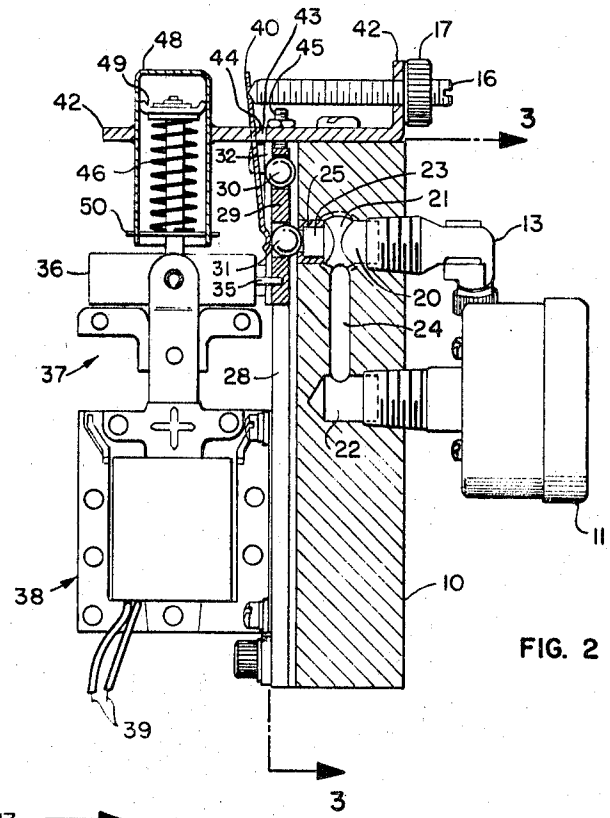


FIG. 2

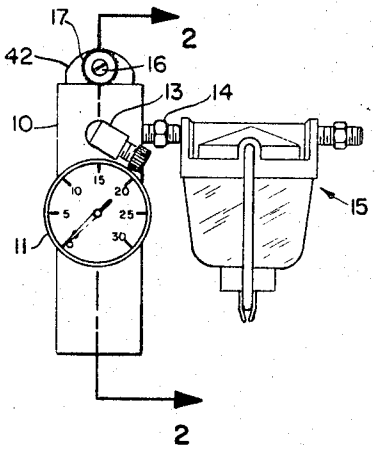


FIG. 1

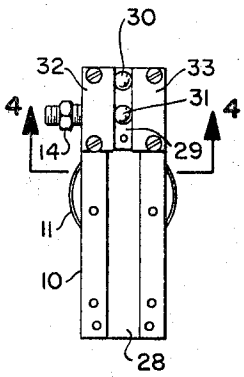


FIG. 3

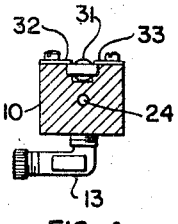


FIG. 4

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VALVE MEANS

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Int. Cl. A46b 11/02; F16k 45/00; G01d 15/18

ABSTRACT OF THE DISCLOSURE

A combined pressure regulating and pressure release valve having a manifold block, a carriage positioned in a guide groove, a solenoid for moving the carriage from one extreme position to another, and a pair of balls so rotatably mounted in the carriage that one always seals an orifice except while the carriage is being moved from one position to the other pressure is vented to atmosphere through the orifice. A spring attached to the carriage urges a ball against the orifice with adjustable force to provide pressure regulation when the carriage is in the one position.

This invention relates to a valve means and more particularly to a pressure regulating dump valve which may be used, adaptable for example, in recorders utilizing pressurized ink supply systems.

There are various pressure regulating valves known in the art. In certain instances. It is desirable to utilize such valves and to provide a simple and efficient means of dumping pressure, so some desired pressure, such as atmospheric, in the system to which the valve is connected. One system in which such valves may be utilized, is a pressurized ink supply system for an oscillographic recorder. It is sometimes desirable to pressurize the ink supply connected to the writing pen or pens in such a recorder in order to enable the recorder to provide improved ink traces. An example of a pressurized ink supply system may be found in British patent specification 707,894 published April 28, 1954.

In that British patent, an ink pressurizing system for an oscillographic pen recorder is provided and includes an air pump which is connected through a dump valve to an ink reservoir. Ink in the reservoir is pressurized by the air pressure, and is fed through suitable tubing means to one or more pens for providing traces or inscriptions on a moving chart. The motor serves to maintain the proper pressure on the ink in the reservoir, and the dump valve serves to reduce this pressure when desired, such as, when the recorder is turned off.

When the recorder is not in use, it is desirable to maintain the ink supply instantly available at the stylus tip, for providing a trace as soon as the recorder is turned on. It is also desirable to prevent the ink at the stylus tip from bleeding ink onto the stationery chart or chart platen when the recorder is turned off. Additionally, there are instances when extremely slow chart speeds are required and slowly varying signals are being recorded. Under these latter conditions, it is advantageous to reduce the ink system pressure to prevent heavy inking and writing of overly-thick traces. The valve of the present invention, although having other applications, is particularly useful in improving the performance of pressurized ink systems.

Accordingly, it is an object of the present invention to provide an improved pressure regulating valve which has novel means for quickly reducing the pressure being regulated

It is another object of the present invention to provide a regulating valve having electromagnetically actuated control means for dumping the pressure being regulated to substantially atmospheric pressure.

It is an additional object of the present invention to provide an improved valve, including means for maintaining a selected output pressure and for reducing this pressure when desired.

In accordance with a specific exemplary embodiment of the teachings of the present invention, an improved valve is provided including a manifold block, a carriage and sealing means positioned in a guide groove in said block, blasting means for urging a sealing means against a valve orifice in said block, and actuating means for moving the carriage. The manifold block is provided with a pressure inlet port, a pressure outlet port, the valve orifice, and preferable a guage port, all of which are interconnected by a passage in the block. The guide groove passes across the valve orifice. The carriage carries a plurity of sealing means which may take the form of balls, and the motion of the carriage is controlled by the actuating means. In a first position of the carriage, one sealing means is seated in the valve orifice thereby closing it to the atmosphere. In a second position of the carriage, a second sealing means likewise covers the valve orifice thereby sealing it from the atmosphere. In between these positions of the carriage, the valve orifice is opened to the atmosphere. Typically, the actuating means holds the carriage in the first position during recording, and moves the carriage to the second position when the recorder is stopped. During the time the carriage moves from one position to the next, the pressure in the ink system is vented to the atmosphere. The travel time of the carriage may be increased with a dash pot arrangement of similar device attached to the carriage or to the actuating means.

Other objects and features of the present invention will become more readily apparent through a consideration of the following written description taken in connection with the appended drawing in which:

FIG. 1 is a plan view of a valve constructed in accordance with the teachings of the present invention;

FIG. 2 is a sectional view of the valve of FIG. 1 taken along the lines **2—2** and shows the construction of the valve in greater detail;

FIG. 3 is a view of the back of the manifold block of the valve taken along the lines **3—3** of FIG. 2, and shows in greater detail the ball carriage and guide groove therefor; and

FIG. 4 is a sectional view of the manifold block taken along the lines **4—4** of FIGS. 2 and 3, and shows the ball carriage and guide grooves in further detail.

Turning now to the drawing, FIG. 1 is an over-all view of the valve of the present invention and illustrates a manifold **10** and a pressure gauge **11**. A source of pressure, such as a motorized pump (not shown) is connected through a suitable fitting **13** to an inlet port of the manifold **10**. An outlet port of the manifold **10** is connected through a fitting **14** to an outlet device such as a reservoir **15** of the type employed in the pressure ink system of the aforesaid British patent. An adjusting screw **16** and nut **17** are provided for setting the outlet pressure.

In utilizing the valve shown in FIG. 1 in a pressure ink system of a recorder for example, the source of pressure is connected to the fitting **13**, ink is located in the reservoir **15**, and the outlet of the reservoir **15** is connected through suitable tubing to the writing pen or pens. In that manner, ink pressure is set by the adjustment of screw **16**.

FIG. 2 which is a view taken along the lines **2—2** in FIG. 1 illustrates the valve of the present invention in detail. The main structural and support member of the valve is the manifold block **10** having a pressure inlet port **20** to which the fitting **13** is connected. A pressure outlet port **21** is connected through the fitting **14** (FIG. 1) to the reservoir **15**. A gauge port **22** is provided for

receiving the pressure gauge **11**. A valve orifice **23** is provided, and the ports **20** through **22** and the orifice **23** are interconnected by means of a passage **24**. A valve seat **25**, which may be fashioned from a relatively resilient material, is secured into the valve orifice **23**.

On the side of the manifold block **10** in which the valve orifice **23** is located, a guide groove **28** is provided which passes centrally across the valve orifice **23**. A carriage **29** carrying sealing means such as two precision balls **30** and **31** is positioned in the groove **28**. The carriage is free to slide in the groove **28**, and is retained in the groove by suitable retainer plates **32** and **33** (see FIG. 3).

The motion of the carriage **29** in the groove **28** is controlled by a pin **35** mounted in an adapter **36** which in turn is fastened to an armature **37** of a power solenoid **38**. Application of electrical power through lines **39** to the solenoid **38** causes the armature **37** to be pulled into a closed or first position and the pin **35** moves the carriage **29** to position the upper ball **30** over the valve seat **25**. In this position, the ball **30** is urged to seat against the sealing surface of the valve seat **25** by the force of a spring **40**, the force of which is adjustable by means of the screw **16** and nut **17**. The screw **16** is threaded into a bracket **42** which includes a substantially rectangular opening **43** through which the spring **40** passes. The opening **43** in the bracket **42** includes a tab or protuberance **44** loosely engaging a slot in the spring **40** for maintaining the spring in an aligned relationship with respect to the balls **30** and **31**. A screw **45** threaded into the bracket **42** is provided as an adjustable stop for the carriage **29**. This screw **45** may be adjusted to precisely position the ball **31** over the seat **25**.

When power is removed from the solenoid **38**, the armature **37** and the carriage **29** are moved away from the solenoid **38** by means of a return spring **46** thereby positioning the ball **31** to seal the valve seat **25**. When used with the pressure ink system of a recorder, the solenoid **38** normally is energized when the recorder is turned on. Thus, under power and no power conditions the pressure system is sealed to the atmosphere, while being open to the atmosphere during the period of time required for the carriage **29** to complete its travel.

Normally, the time for the travel stroke of the carriage **29** is very short in both directions. In order to lengthen the time for the carriage **29** to move to its power-off position, a dash-pot arrangement including a closed cylinder **48** is mounted on the bracket **42** in line with the armature **37**, and a cup piston assembly **49**, which is fastened to the armature **37**, is provided within the cylinder **48**. The return spring **46** acts against the piston assembly **49**, and the spring is anchored at one end to the cylinder **48** by a retainer clip **50**. The piston is of a suitably soft material to allow bypass of air freely in one direction (down for example) and very restricted bypass of air in the opposite direction, thus effectively adding a time delay to the return stroke. The cup piston permits rapid down stroke and damped upstroke. The time delay provided thereby allows pressure in the system to drop to atmospheric before the pressure system is again resealed.

FIG. 3 is a view taken along the lines **3**—**3** in FIG. 2 (with the lower components omitted), and FIG. 4 is a view taken along the lines **4**—**4** in FIG. 3. Each of these figures further illustrates the manner in which the carriage **29** is retained in the groove **28** by the retainer plates **32** and **33**.

When using the valve of the present invention in the pressure ink system of a recorder, the inlet port **20** is connected to a pressure source, and the outlet port **21** is connected to an ink reservoir, such as the reservoir **15** shown in FIG. 1. The pressure source, such as a motor driven pump, is turned on and off with the main drive of the recorder. When the recorder is turned on, the armature **37** of the valve moves to its energized position immediately by virtue of the bypass feature of the piston assembly **49** and pressure is available to pressurize the ink reservoir and thereby force the ink from the tip of the recording stylus. The ball **30** which is seated in the valve seat **25** maintains the pressure in the system as determined by the position of the adjusting screw **16** and spring **40**, with excessive pressure leaking past the ball **30** to the atmosphere. The screw **16** may be locked by means of the nut **17**.

When the recorder is turned off, the solenoid **38**, as well as the pressure source (if a motor driven pump is used) are de-energized. The pressure source ceases delivery and the armature **37** begins a slowed return to its upper position under the urging of the return spring **46**. During this return, the pressure in the system is vented through the valve orifice **23**. At the fully returned position, the ball **31** covers the valve seat **25** and again seals the system thereby preventing gravitational withdrawal of ink from the pen tip. Hence, ink will be rapidly available for recording when the recorder again is turned on.

It will be understod that although an exemplary embodiment of the present invention has been disclosed and discussed, other applications and arrangements are possible and that the embodiment disclosed may be subjected to various changes, modifications, and substitutions without necessarily departing from the spirit of the invention.

What is claimed is:

1. A pressure regulating and dump valve having interconnected inlet and outlet ports comprising
- a manifold block having a valve orifice communicating from outside of said block with a passage between said inlet and outlet ports,
- said manifold block having a guide groove,
- a ball carriage retained in a sliding relationship in said guide groove,
- said ball carriage having apertures therein, and balls located in said apertures,
- retainer means secured to said manifold block for maintaining said carriage and balls in said groove whereby said carriage may be moved between a plurality of positions for locating a different ball over said orifice in each of said positions,
- biasing means for urging a ball into a sealing relationship with respect to said orifice, and
- actuating means for moving said carriage to a plurality of said positions.

2. A valve as in claim **1** wherein
- adjusting means is connected with said biasing means for adjusting the biasing force thereof, and
- dash pot means is connected with said actuating means to slow the movement thereof in one direction of travel.

3. A valve as in claim **2** wherein
- said actuating means includes a solenoid having an armature coupled with said carriage, and
- said dash pot means includes a movable member connected with said armature.

4. A valve as in claim **3** wherein
- said manifold block includes a port adapted to receive a pressure gauge for monitoring the pressure to be regulated by said valve.

5. A valve including a manifold block having interconnected inlet and outlet ports comprising
- said manifold block having a valve orifice communicating with said inlet and outlet ports,
- a carriage member supporting a plurality of sealing means,
- means for maintaining said carriage member in an aligned relationship with respect to said valve orifice,
- actuating means for moving said carriage member to locate any one of said plurality of sealing means adjacent to said valve orifice, and
- biasing means for urging a sealing means into a sealing relationship with respect to said orifice.

6. A valve as in claim **5** wherein
- each of said sealing means is a ball,
- said carriage member supports said balls, and

said biasing means includes an adjustable spring member located in the general proximity of said valve orifice for urging a ball into sealing relationship with respect to said orifice.

7. In a recorder having a pressure ink system, a pressure regulating and dump valve having interconnected inlet and outlet ports comprising

a manifold block having a valve orifice communicating from outside of said block with a passage between said inlet and outlet ports,

a carriage member supporting a pair of sealing means, each for sealing said valve orifice when adjacent thereto,

actuating means for moving said carriage member from one position to another thereby to locate one of said sealing means adjacent said valve orifice, said actuating means including a solenoid adapted to be energized along with said recorder and having an armature coupled with said carriage member.

8. Apparatus as defined in claim 7 further comprising adjustable means for biasing said sealing means against said orifice when at least one of said sealing means is adjacent thereto.

9. Apparatus as defined in claim 7 wherein said means for returning said carriage member to said one position when said solenoid is de-energized comprises a spring to urge said carriage member to said one position and a dash pot for retarding motion of said carriage member from the other position to said one position.

10. Apparatus as defined in claim 9 wherein said spring is a coiled spring axially aligned with said armature, and said dash pot comprises a piston assembly in a cylinder axially aligned with said coiled spring and armature.

11. Apparatus as defined in claim 10 wherein said piston is attached to the end of said armature, whereby said armature comprises a piston arm, and said spring is disposed about said armature for compression between said piston and a retainer clip connected to said cylinder when said solenoid is energized.

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U.S. Cl. X.R.

251—55, 129; 137—539; 346—140