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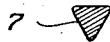
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2,185,461

AUTOMATIC PRESSURE RELEASE

Filed April 2, 1938

Fig. 3



Section A-A

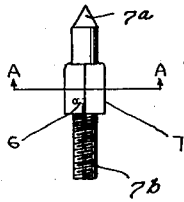
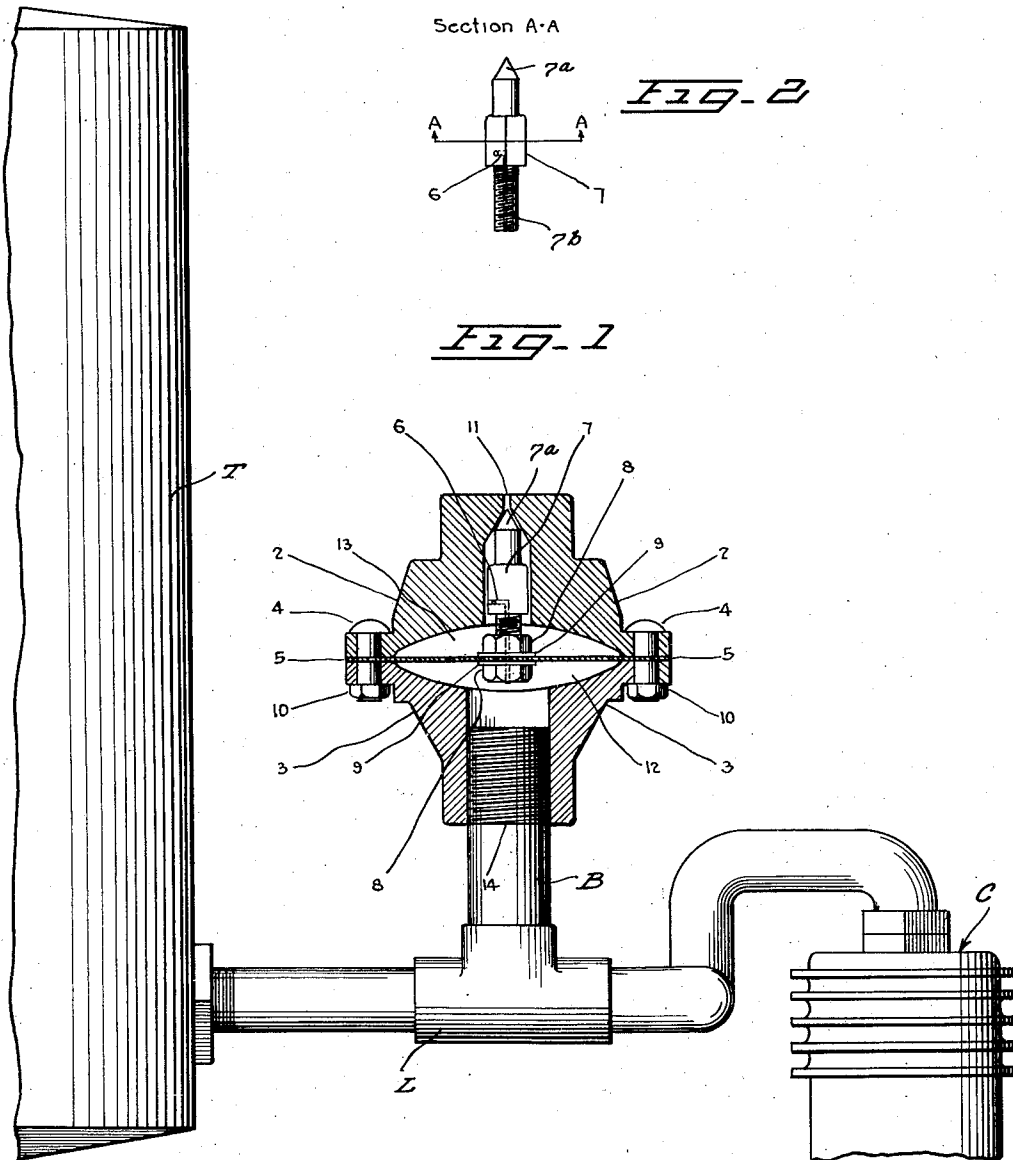


Fig. 2

Fig. 1



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AUTOMATIC PRESSURE RELEASE

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2 Claims. (Cl. 137—153)

This invention relates to the art of fluid pressure systems.

In systems in which fluid is conveyed under pressure or in which fluid pressure is built up or stored in a container remote from the point of power application by which the necessary pressure is created, it is well known that upon cessation of the motive power there remains in the system between the point of power application and the point of storage, a definite high pressure against which when the system is again put into operation, the motive force must start up prior to assuming its load. This necessarily entails a high power consumption at starting and lowers the efficiency of the system as a whole.

This is particularly noticeable in air compressor systems, pump lines, and the like. In such installations a fluid is compressed in some form of engine-driven compressor unit and is transferred under pressure to a storage receptacle from which it is subsequently taken in the performance of work. In such systems there must exist in the line a constant state of pressure between the compressor unit and the storage receptacle. Whenever a compressor unit is stopped for any reason, it must in starting up again work against the high pressure in that part of the system between the unit and the storage receptacle before it can assume the load. In other words, the engine or other motive force of the compressor unit must work against a high pressure while it is building up to assume its load.

An object of the present invention is to provide, in a fluid pressure system, means for relieving residual line pressure existing between the points of pressure input and discharge in the system upon the cessation of pressure at the point of input.

Another object is to provide a pressure release valve responsive to pressure fluctuation in fluid pressure line in a manner to open the line for exhaustion upon the cutting off of pressure supply and to maintain the line against exhaustion while the normal operating pressure is applied thereto.

Another object is to provide a pressure unloader valve for fluid pressure lines and which is capable of opening and closing in response to normal operating pressure fluctuation without loss of fluid within the system with which the valve is associated.

Other objects will be apparent from the description.

While the embodiment herein disclosed constitutes the best means I have thus far devised

for reducing the invention to practice, it is to be understood that changes may be made in the structural details thereof and any desired variations may be employed, such as fall within the scope of the invention as claimed.

In the drawing:

Figure 1 is substantially a central vertical section through a valve constructed in accordance with the invention and as associated with a fluid pressure system.

Figure 2 is an elevation of a valve element.

Figure 3 is a section taken on the line A—A of Figure 2.

As shown, the valve comprises a casing consisting of an upper section 2 and a lower section 3, preferably of circular form and provided with annular meeting edge flanges which are firmly bolted together by bolts 4 cooperating with nuts 10 by which the two casing sections are firmly clamped together to hold between them a flexible diaphragm 5.

The inner meeting faces of the two sections are oppositely dished to provide on opposite sides of the diaphragm the respective chambers 12 and 13. In the bottom section 3 the chamber 12 communicates with an internally threaded port 14 by which the casing is attached to a branch B leading from a point of a fluid line L between a fluid storage container such as a pressure tank T and a point of pressure application, such as a power driven compressor C. For purposes of description the compressor side of the line will be referred to as the input whereas the tank side of the line will be referred to as the output or discharge.

The chamber 13 in the upper section 2 communicates at its center with a cylindrical bore which terminates at its upper end in a conical seat portion having at its apex a restricted outlet port 11 leading to the atmosphere. The outlet port 11 is preferably disposed in the axis of the valve.

Disposed within the upper chamber 13 and extending upwardly into the cylindrical bore is a valve stem having an intermediate portion 7 of triangular cross section which plays within the cylindrical bore and which carries at its upper end a cylindrically reduced plug provided with a conical tip 7a adapted to engage the seat surrounding the discharge outlet 11 and to close the outlet when the plug is pushed firmly against the seat.

At its lower end the plug 7 is provided with an axially extending externally threaded shank 7b, which is passed axially through the dia-

phragm 5, it being secured firmly thereto by lock nuts 8 disposed on opposite side faces of the diaphragm and threaded over the shank 7b in cooperation with washers 9 to provide a seal and also an adequate mounting for the valve stem, whereby the stem moves in accordance with the fluctuation of the diaphragm.

The shank portion 7b of the valve stem is further provided with a reduced axial bleeder bore or passage 6 which opens at the lower end of the valve stem shank to the bottom chamber 12 and which extends upwardly within the valve stem to the intermediate portion 7 at which point it is directed laterally to open through one of the flat walls of the triangular body of the valve stem. The bleeder bore 6 thus establishes communication between the lower chamber 12 and the upper chamber 13, the upper end of the bore opening to the cylindrical bore in which the valve stem plays. The triangular cross sectional formation of the valve stem at the intermediate portion 7 insures a clearance between the walls of the bore and the face of the valve stem body from which the bleeder bore discharges.

For purposes of statutory compliance, the valve is shown as associated with an air compressor system having an engine-driven compressor C coupled to the input end of the line L, which line discharges at its outlet end into a conventional pressure tank T which is provided with the usual pressure return check valve means, not shown. It is to be understood, however, that the valve is applicable for use in any fluid pressure system or pump line.

In operation, assuming the compressor to be at rest, the valve parts will be in the position shown in Fig. 1 with the normal tension of the diaphragm and/or the weight of the valve stem normally retaining the valve stem in its lowered position with the plug seat 7a removed from its seat to open the discharge port 11. Under certain conditions when the compressor is started, the line L between the compressor and tank will be initially at atmospheric pressure due to the open communication between the chambers 12 and 13 through the bleeder bore 6. In starting up, the compressor thus will operate without having to buck against pressure in the line L and can rapidly build up to assume its load without any unnecessary expenditure of power. As the pressure output of the compressor increases, the pressure in the line L rises and as the area of the inlet port 14 is greater than the outlet area through the bleeder bore 6, the diaphragm will be flexed upwardly to force the valve stem into closed position against the seat to shut off the discharge port 11. Thus the pressure will operate in the normal manner to discharge through the line L into the pressure tank T.

Should the compressor be stopped for any reason, the valve stem will drop back to its open position through gravity and/or the influence of the diaphragm upon the cessation of pressure fluctuation within the line. This is possible by reason of the fact that the bleeder bore permits an equalization of pressure on opposite sides of the diaphragm within the respective chambers 12 and 13. When the valve drops down to open the port 11, there is immediately established communication between the line L and the atmosphere through the bleeder bore 6 of the valve stem and through the discharge port 11. This effects the gradual release of the residual pressure in the line L and when the compressor is again started up it does not have to buck against

any residual pressure in the line leading to the pressure tank.

In the normal operation of the system there is a pressure fluctuation within the line L due to the alternation of the compression and exhaust strokes of the compressor. The diaphragm 5 is responsive to such pressure fluctuation and effects an alternate opening and closing of the discharge port 11 in response to said fluctuation. If the device is associated with a pressure line in which such fluctuation, on intake strokes of the compressor bring about a condition of partial vacuum within the line L, air will be drawn in through the port 11 to compensate for such condition. If the line conditions and operating apparatus are such that the condition of partial vacuum will not be created, the valve will remain closed. In any event, whether opened or closed in response to the fluctuation of pressure in the line L there will be substantially no loss of fluid for the reason that the amount of air which passes out from the chambers 12 and 13 through the discharge port 11 is substantially equalized by the amount of air which is taken in when the diaphragm is flexed inwardly to open the valve, thus precluding the excessive loss of fluid from the system.

While the particular configuration of the valve casing is not material, I have found it expedient to form the two sections 2 and 3 as substantially circular castings of substantially counterpart formation, with the valve receiving bore of the upper casting 2 being axially aligned with the inlet bore 14 of the lower section, and the exhaust port 11 opening in the axis of the valve stem. It will be apparent by manipulation of the lock nuts 8 with respect to the threaded valve stem shank 7b, the valve stem may be adjusted vertically with respect to the diaphragm 5 so that the distance which the valve must travel in its opening and closing movement may be regulated as desired. The valve is preferably of the needle type, as shown, but obviously this particular construction may be varied without departing from the principles of the invention.

The valve mechanism is such that it closes on the rise of each pressure surge in the line L and opens on the decrease of each such surge. Under normal running conditions the pressure surges follow one another so rapidly that there is practically constant flow and to such an extent that, in effect, the valve remains closed. When the pressure application ceases, the valve follows its normal bias and moves to open position to permit the pressure release to the atmosphere in order to bleed off the residual pressure remaining in the line.

I claim:

1. Automatic pressure relief means for fluid pressure lines, comprising a casing, a diaphragm therein dividing the casing interior into separate chambers, a line pressure inlet in the casing and open to a chamber at one side of the diaphragm, a pressure exhaust in the casing at the opposite side of the diaphragm, said casing having a bore communicating with said exhaust port and the chamber on the side of the diaphragm opposite the line pressure inlet, a valve mounted on and movable with said diaphragm, said valve having a stem extending through the diaphragm and into said bore to open and close said exhaust port by flexing of said diaphragm in response to line pressure variations, and said valve stem having a bleeder bore therein opening at one end to the pressure inlet chamber and at its other end into

said casing bore at the other side of the diaphragm.

2. Automatic pressure relief means for fluid pressure lines, comprising a casing, a diaphragm therein dividing the casing interior into separate chambers, a line pressure inlet in the casing and open to the chamber at one side of the diaphragm, a substantially cylindrical bore in said casing at the other side of the diaphragm and open at one end to the chamber on that side, an exhaust port in the casing at the other end of said bore, a valve seat surrounding said exhaust port, a needle valve carried by said diaphragm

and movable thereby in said bore from or against said seat to open or close said exhaust port by flexing of the diaphragm in response to variations in line pressure, said valve having a portion extending through the diaphragm, said valve also having a portion of polygonal cross section in said bore, and a bleeder bore provided in the body of said valve opening at one end to the pressure inlet chamber and at its other end into said casing bore through one side face of said valve portion of polygonal cross section.

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