

Jan. 6, 1970

J. W. LAUTENBERGER, JR

3,487,855

PULSATION DAMPENER

Filed Oct. 16, 1967

2 Sheets-Sheet 1

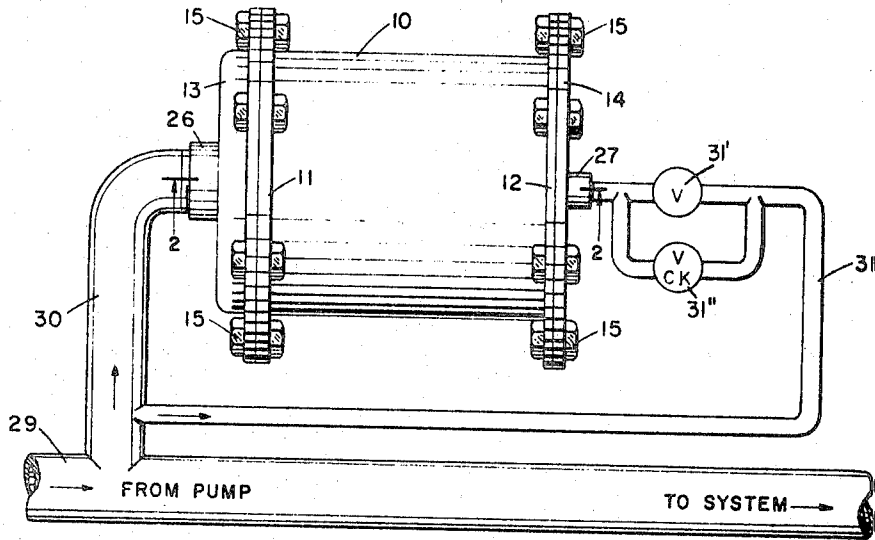


FIG. 1

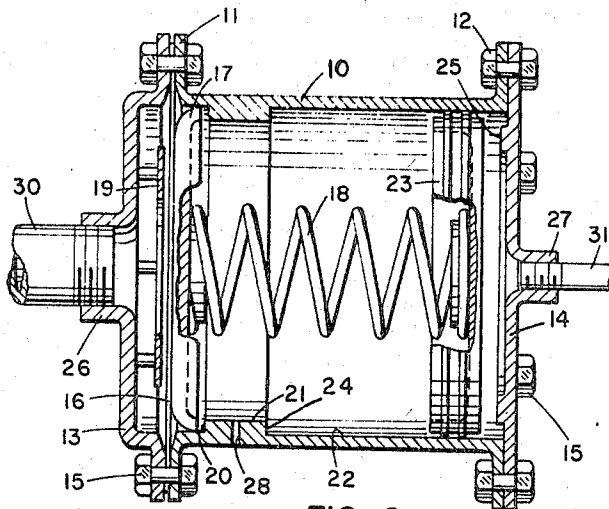


FIG. 2

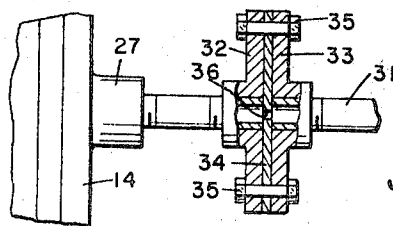


FIG. 3

INVENTOR.
J. WALTER LAUTENBERGER, JR.

BY

J. Walter Lautenberger, Jr.
ATTORNEY

Jan. 6, 1970

J. W. LAUTENBERGER, JR

3,487,855

PULSATION DAMPENER

Filed Oct. 16, 1967

2 Sheets-Sheet 2

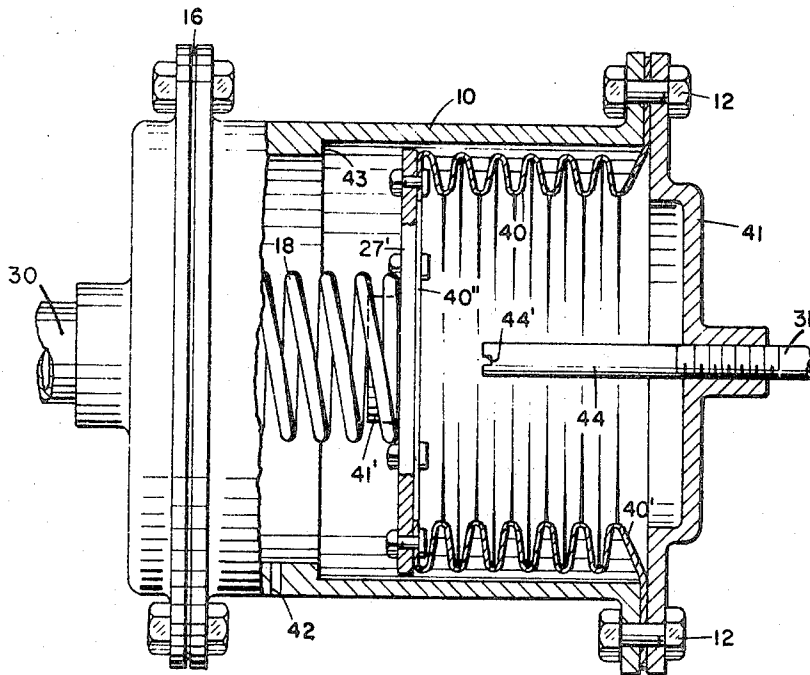


FIG. 4

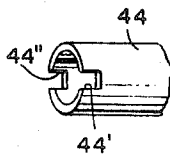


FIG. 5

INVENTOR
J. WALTER LAUTENBERGER, JR.

BY
[Signature]

ATTORNEY

1

3,487,855

PULSATION DAMPENER

Joseph Walter Lautenberger, Jr., 3979 S. Peardale,
Lafayette, Calif. 94549

Filed Oct. 16, 1967, Ser. No. 676,374

Int. Cl. F16l 55/04; F17d 1/10; E03b 5/00

U.S. Cl. 138—31

8 Claims

ABSTRACT OF THE DISCLOSURE

A fluid pulsation dampening or cushioning apparatus having a chamber connected to a pulsating fluid pressure system and a flexible diaphragm within the chamber against which the fluid acts. A spring is positioned within the chamber to act against the diaphragm, the spring pressure being variable in direct proportion to the average pressure in the fluid pressure system.

This invention relates to a pulsation dampener for a fluid system and more specifically to such a dampener or cushion which will function over a wide range of pressures and which is substantially self-regulating under varying average pressure conditions.

It is one object of this invention to produce a pulsation dampening device which is relatively simple and inexpensive in construction and trouble free in operation.

It is another object to produce such a device which is self-regulating over a wide range of average pressures in the system and which requires little or no attention.

These and other objects and advantages will become apparent as this description proceeds and reference is had to the accompanying drawing forming a part of this specification and in which like characters of reference refer to like parts.

In said drawing:

FIGURE 1 is a side elevational view of the device shown connected to a source of fluid under pulsating pressure, in this instance a pipe line;

FIGURE 2 is a longitudinal cross-section through the device substantially on the line 2—2 of FIGURE 1.

FIGURE 3 is a cross-sectional view of a restrictive orifice plate or valve which may be used in connection with the device.

FIGURE 4 is a view similar to FIGURE 2 partly in section and partly in elevation of a modified form of the invention.

FIGURE 5 is an enlarged perspective view of the intake pipe for the modified form.

The device comprises an outer casing 10 of generally cylindrical form with end flanges 11 and 12 respectively to which are secured end closure plates or heads 13 and 14 respectively by means of suitable fastening elements such as bolts 15.

One form of the invention provides for a diaphragm or other type of flexible member 16 clamped between the head 13 and the flange 11 at one end of the casing and preferably a diaphragm supporting element 17 positioned within the casing adjacent to and held in contact with the diaphragm by means of a spring 18 within the casing. The diaphragm supporting element 17 has limited free travel within the casing and is limited in one direction of movement by a stop 19 preferably carried by the head 13 and in the other direction by a stop shoulder 20 formed by a portion of reduced diameter 21 within the cylindrical bore 22 in the casing 10.

The spring 18, at its end opposite that which acts on the member 17, abuts a piston 23 which is slidably mounted in the casing 10 and may travel therein between shoulder 24 formed by the portion of reduced diameter

2

21 in one direction and a stop 25 preferably formed on the head 14 in the opposite direction. The piston is sealed to prevent leakage between the piston and the casing.

The head 13 is provided with means, such as a threaded boss 26, for connection of a conduit to the source of pulsating fluid to be cushioned, while head 14 is provided with a similar means 27 which may be of smaller size for connection to the same source of fluid.

Fluid occupies the interior cavities to the right of piston 23 and to the left of diaphragm 16. The casing 10 in the region of reduced diameter 21 is provided with a vent opening 28 whereby the space between the piston 23 and the diaphragm in casing 10 will be at atmospheric pressure.

FIGURE 1 illustrates the device hooked up to a pipe line in 29 in which fluid is flowing and in which pulsations or periodic pressure variations occur. The main connection is made through a relatively large pipe 30 to the diaphragm end of the device through boss 26 to act directly on the diaphragm 16. A second pipe 31 is connected between the pulsating fluid in the pipe line to the boss 27 to act on the piston 23. The pipe 31 may be provided with a restrictive valve or a check valve as hereinafter more specifically described.

The pulsations in pipe line 29 such as may be produced by a reciprocating pump or any sudden change in pressure such as may caused by the sudden closing of a valve in the system will be impressed upon the diaphragm 16 causing the same to be flexed or bulged inwardly against the member 17 to compress the spring 18 which will cushion the resulting shock or "hammer" in the system.

For a given normal fluid pressure in the system the compression of the spring 18 is normally such as to hold the member 17 away from the seat 20 in the casing and the diaphragm in a substantially neutral position. The diaphragm and piston are properly sized so that if the average fluid pressure in the system should increase this increased pressure will be impressed through pipe 31 on the piston 23 moving the same to the left and placing further compression on the spring 18 and thus hold the member 17 and diaphragm 16 in proper position to perform the cushioning function above described. Vent 28 in the casing keeps the air pressure at atmosphere and prevents a build-up of pressure in the casing between the piston and the diaphragm.

It should be noted that pipe 31 is shown smaller than pipe 30 for it is desirable to prevent sudden changes in pressure or sharp pulsations from acting on piston 23. The small pipe 30 thus acts as a restricted passage for the fluid to pass and act on piston 23 but to prevent sudden changes from acting thereon too rapidly.

If desired a valve such as a needle valve V 31' may be provided in pipe 31 to insure a restricted passage and one that may be manually adjusted to suit various conditions.

Similarly an orifice fitting may be used in pipe 31 as shown in FIGURE 3 in place of valve V. This fitting is simply composed of two flanged members 32 and 33 with plate 34 clamped therebetween by means of bolts 35, the plate being provided with a restricted orifice 36 of predetermined size.

Under certain conditions it may be found desirable to allow a quicker build-up of pressure acting on piston 23 than the needle valve V or the orifice fitting normally permits. In such a situation a conventional check valve VCK 31" shown in FIGURE 1 may be employed. This check valve is connected across or in parallel with valve V and is set to open when flow in pipe 31 is in a direction into the casing and to close when the pressure in the pipe line 29 suddenly drops.

Under other conditions the reverse may be desirable and the check valve is reversed to open upon a sudden pressure drop in the pipeline 29. Therefore, the check valve may be used in either direction, that is, the valve may be used to restrict the flow of liquid either into or out of the casing chamber.

The diaphragm and the piston perform separate and distinct functions according to their own particular operating characteristics. The diaphragm is especially suited to small, rapid and frequent movements. The piston can respond to larger movements but with less speed.

Another form of the invention is shown in FIGURES 4 and 5 wherein the operative piston 23 is replaced by a bellows 40 in which the end 40' is secured between the casing 10 and the flange 41. The opposite end 40'' of the bellows is substantially rigid and is movable relative to the casing 10. The movable end 40'' of the bellows is preferably provided with a member 41' secured to its outer surface for positioning the spring 18 thereon. The casing is provided with a vent 42 to prevent pressure from building up between the bellows and the diaphragm or flexible chamber dividing member 16. The movable end 40'' of the bellows is limited in its movement toward the member 16 by the shoulder 43. Extending through the plate 41 is the intake pipe 31 for admitting fluid to the interior of the bellows. If desired the pipe 31 may be extended to a point within the bellows, or an extension may be employed as shown by the numeral 44. This extension may be so such length as to provide a stop for the bellows when moved in the direction of the flange 41. To allow the fluid to move freely from the pipe 44 when the end of the pipe is in contact with the movable member 40'' there is provided slots 44' and 44''.

With this construction, the dampening apparatus will be completely closed to those fluids that may be difficult to seal against.

I claim:

1. In combination with a fluid pressure system subjected to pressure pulsations and shock pressure waves, a dampener comprising:
 - (a) a casing;
 - (b) a flexible dividing member in said casing separating the same into a first and second chamber;
 - (c) a support for said dividing member mounted adjacent one end of the second chamber and abutting the dividing chamber;
 - (d) a movable member mounted adjacent the opposite end of the second chamber adapted to move relative to the casing within said chamber;
 - (e) a resilient means positioned between the flexible dividing member and the movable member in said second chamber;
 - (f) a fluid connection between the fluid pressure system and the first chamber whereby fluid from the system acts upon the dividing member to flex the same against the resilient member to absorb pulsations and shock waves in the system, said fluid connection forming the only communication with said first chamber;
 - (g) a second fluid connection between the system and the second chamber whereby pressure from the system will act upon the movable member which in turn acts upon the resilient means in proportion to the average pressure in the system, and said second fluid connection forming the only communication with said second chamber on the pressure side of the movable member.
2. The combination defined in claim 1 in which the second fluid connection has a restricted passage to prevent sudden changes in pressure in the system from affecting the movable member.
3. The combination defined in claim 2 in which the restricted passage is in the form of a plate in the fluid connection, said plate having a restrictive orifice therein.

4. A pulsation and shock damper for a fluid system comprising:

- (a) a cylindrical casing; a first head plate closing one end of the casing and having a fluid connection means therein;
- (b) a diaphragm extending across the casing adjacent the first head plate and forming a chamber therewith;
- (c) a second head plate closing the other end of the casing and having a fluid connection means therein;
- (d) a piston slidably mounted in said casing adjacent the second head plate, a compression spring in said casing and positioned between the piston and the diaphragm.

5. The structure defined in claim 4 in which the diaphragm is clamped between the end of the casing and the first head plate and a stop abutment therein to limit deflection of the diaphragm toward the first head plate by the spring.

6. In combination with a fluid pressure system subjected to pressure pulsations and shock pressure waves, a dampener comprising:

- (a) a casing;
- (b) a flexible dividing member in said casing separating the same into a first and second chamber;
- (c) a bellows type chamber having one end fixed to the casing adjacent the opposite end of the second chamber and a closed opposite end movable relative to said casing and within said second chamber;
- (d) a resilient means positioned between the movable end of the bellows and the flexible chamber dividing member;
- (e) a fluid connection between the fluid pressure system and the first chamber whereby fluid from the system acts upon the dividing member to flex the same against the resilient member to absorb pulsation and shock waves in the system;
- (f) a second fluid connection between the system and the second chamber whereby pressure from the system will act upon the movable member which will in turn act upon the resilient member in proportion to the average pressure in the system.

7. In combination with a fluid pressure system subjected to pressure pulsations and shock pressure waves, a dampener comprising:

- (a) a casing;
- (b) a diaphragm in said casing, separating the same into a first and second chamber;
- (c) a diaphragm support mounted adjacent one end of the second chamber and abutting the diaphragm;
- (d) a piston slidably mounted adjacent the opposite end of the second chamber;
- (e) a compression spring between the diaphragm support and the piston in said second chamber;
- (f) a fluid connection between the fluid pressure system and the first chamber whereby fluid from the system acts upon the diaphragm to flex the same against the spring to absorb pulsations and shock waves in the system, said fluid connection forming the only communication with said first chamber;
- (g) a second fluid connection between the system and second chamber whereby pressure from the system will act upon the piston to compress the spring in proportion to the average pressure in the system, said second fluid connection forming the only communication with said second chamber on the pressure side of the piston.

8. In combination with a fluid pressure system subjected to pressure pulsations and shock pressure waves, a dampener comprising:

- (a) a casing;
- (b) a diaphragm in said casing, separating the same into a first and second chamber;
- (c) a diaphragm support mounted adjacent one end of the second chamber and abutting the diaphragm;

5

- (d) a piston slidably mounted adjacent the opposite end of the second chamber;
- (e) a compression spring between the diaphragm support and the piston in said second chamber;
- (f) a fluid connection between the fluid pressure system and the first chamber whereby fluid from the system acts upon the diaphragm to flex the same against the spring to absorb pulsations and shock waves in the system;
- (g) a second fluid connection between the system and second chamber whereby pressure from the system will act upon the piston to compress the spring in proportion to the average pressure in the system, said second fluid connection having a restricted passage to prevent sudden changes in pressure in the system from affecting the movable member, said

6

restrictive passage being in the form of an adjustable valve whereby the degree of restriction may be varied.

References Cited

UNITED STATES PATENTS

2,064,343	12/1936	Finley et al.	251—43
2,592,613	4/1952	Snyder	138—31
1,302,538	12/1918	Gulick	137—413

10 M. CARY NELSON, Primary Examiner
W. R. CLINE, Assistant Examiner

U.S. Cl. X.R.

15 137—568, 593