Aug. 18, 1936. A. ARUTUNOFF 2,051,019

MEANS FOR STABILIZING THE FLUCTUATING FLOW OF LIQUIDS IN PIPE OR CONDUIT SYSTEMS

Filed Aug. 21, 1933

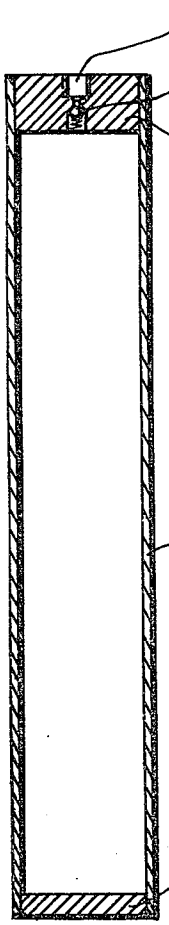


Fig. 1.

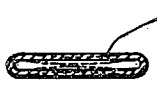


Fig. 2.

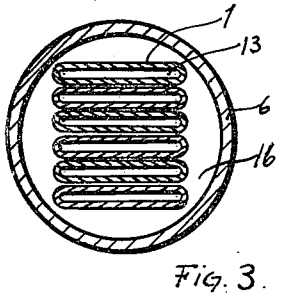


Fig. 3.

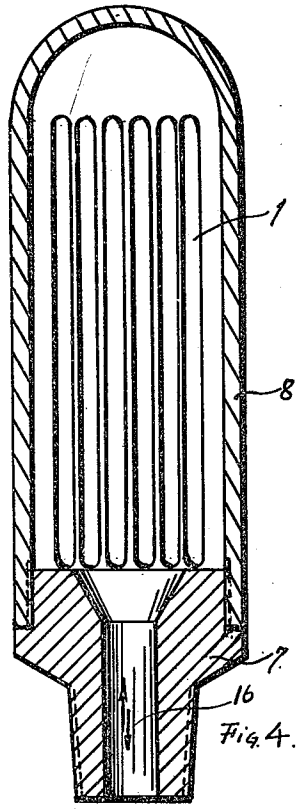


Fig. 4.

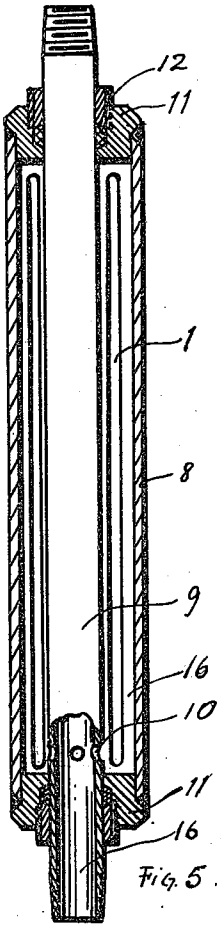


Fig. 5.

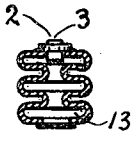


Fig. 7.

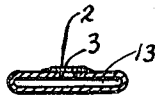


Fig. 8.

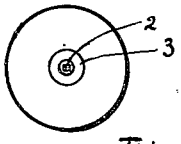


Fig. 9.

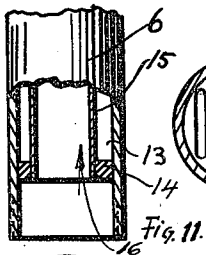


Fig. 11.

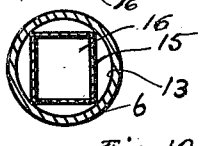


Fig. 10

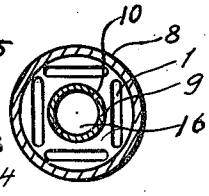


Fig. 6.

INVENTOR.
Armais Arutunoff
BY
J. B. Hudson
ATTORNEYS.

Patented Aug. 18, 1936 2,051,019

UNITED STATES PATENT OFFICE

2,051,019

MEANS FOR STABILIZING THE FLUCTUATING FLOW OF LIQUIDS IN PIPE OR CONDUIT SYSTEMS

Armais Arutunoff, Bartlesville, Okla.

Application August 21, 1933, Serial No. 686,694

5 Claims. (Cl. 138—30)

My invention relates to a means for stabilizing the fluctuating flow of liquids in pipe or conduit systems. It particularly relates to a means for stabilizing the flow of liquids delivered by reciprocating pumps, and is intended for the class of work ordinarily assigned to the air chamber. The air chamber is a necessity in a pump driven by a crank motion, for two reasons. One reason is to protect the pipe system and the other is the protection of the pump itself.

In the pipe system, the uniform flow afforded by action of such a device as an air chamber enhances the life of connections, keeps friction losses of fluid to a minimum and eliminates objectionable noises, while for the pump, the employment of such a device as an air chamber means even more, as by eliminating the pounding and hydraulic ram phenomena, it preserves the working parts from overloads and breakage.

However, ordinary air chambers, as known, have several disadvantages or shortcomings.

One drawback consists in the necessarily large dimensions of the air chamber. Particularly large dimensions are required for high pressure pumps such as for pressures above 60 atmospheres when for each cubic inch of compressible gas under working pressure, it is required to have more than sixty cubic inch capacity of the air chamber at atmospheric pressure.

Another drawback consists in that, that air contained in the air chamber, no matter of how large capacity, dissolves itself in liquid and is gradually carried out of it, rendering the air chamber inoperative.

One object of my invention is to provide a device for the class of work described which will be free from the above mentioned objectionable features of air chambers.

Another object is to utilize elasticity of metals for such work.

With the above and other objects in view, which will appear as the description proceeds, my invention consists in the novel features herein set forth, illustrated on the accompanying drawing and more particularly pointed out in the appended claims.

Referring to the drawing, in which numerals of like character designate similar parts throughout the several views,

Figure 1 is a longitudinal cross section of the compressible element of my invention.

Figure 2 is a cross section of the compressible element shown on Figure 1.

Figure 3 is a cross section of the cylindrical tube or conduit or housing with a number of compressible elements assembled in it.

Figure 4 is a cross section of the complete assembly of my compensator for use in the same place where formerly an air chamber was installed.

Figure 5 is the embodiment of my invention for use in deep wells and in connection with reciprocating pumps such as used in oil fields where a string of sucker rods has to pass through the tubing.

Figure 6 is a cross section of Figure 5.

Figures 7, 8 and 9 are modifications of the compressible element of my invention.

Figure 10 is a cross-sectional view of Figure 11 showing modification when compressible element is in the form of a flat walled conduit through which the fluid is passing. For the sake of simplicity, the compression element is shown with four walls although the octagonal form is preferable.

In the drawing,

1 represents the compressible element, 2 is a normally plugged threaded opening, 3 is check valve arrangement, 4 is top piece welded to 1, 5 is bottom piece, 6 is tubing, conduit, or housing, 7 is connection to line part of compensator, 8 is housing, 9 is tubing of a deep well reciprocating pump in which sucker rods are operated, 10 indicates communicating holes to compensator, 11 designates the weld connection between 8 and the end pieces, 12 is stuffing box or compression joint, 13 designates air filled space, 14 is welded on end piece of compressible element 15. 16 is the space occupied or passed by liquids.

The compressible element 1 is in a form of flattened tube, sealed and welded on both ends.

When such element is subjected to pressure, the walls bend in as shown in dotted lines on Fig. 2; when pressure is released the walls expand to normal position. The elasticity of spring tempered walls is thus utilized for work ordinarily done by air in conventional air chambers. It will be noted from Fig. 2 that element 1 of my design, although highly compressible, is not collapsible; i. e., will not form remaining deformation under any practical pressure for which it is dimensioned as to the thickness of the walls.

As it may be seen from Fig. 2, the compressible element may be so dimensioned that maximum deflection is well within elastic limits of material used and as the walls, deflecting, meet and support each other, the resistance to collapsing is increased with increase of deflection.

It is evident that for any given pressure the

compression element utilizing elasticity of spring tempered metal, will have more capacity and can do more work for given space than the ordinary air chamber, however, in order to utilize more advantageously all available space, I have provided a check valve arrangement 3 through which element may be charged with air to a suitable pressure and in that way a comparatively light wall element may be used for high pressure conditions.

Elasticity of metal and compressed air are taken advantage of in a simple compact and effective arrangement. The compressed air cannot escape as the element is sealed, and the opening 2 is plugged before installation. Although by allowing only very small deflections of working wall, the element may last indefinitely even if deflection changes its sign in regard to a neutral position; i. e., the wall bends in at high pressure and bulges out at low pressure, I am preventing changing of sign of deflection of air charged elements and so increasing the useful life of the elements by having a wall so formed that under pressure of compressed air supporting it, the wall, normally is practically flat as shown on Figure 2.

Various forms of elements may be used and various arrangements of elements may be employed for different conditions. Some forms and some arrangements are shown on the drawings, all of which have in common the property that they are compressible but not collapsible under any, encountered in practice, pumping pressure.

The underlying principle of supporting the walls of the compressible element may be applied not only to construction when the liquid is exerting pressure from the outside of each element but also to conditions when the liquid acts from the inside of the compressible element, as shown in simplified form on Figures 10 and 11. I am also fully aware of the fact that my invention may be modified in form so that the walls of any pipe conducting the fluid may be flattened to benefit by their elasticity, and to acquire compensator action out of the pipe itself. However, in such modification of my invention, the material ordinarily used for tubular goods is deficient in spring qualities and their use may not be advisable, and must be changed to a better quality material with higher fatigue resisting properties.

From the foregoing, it is believed that my invention may be clearly understood without further description, it being borne in mind that numerous changes in the details of construction may be made without departing from the spirit of my invention, and I desire to claim the invention both broadly and specifically as set forth in the following claims.

What I claim and desire to secure by Letters Patent is:

1. A compensator for use in connection with deep well reciprocating pumps, comprising a section of tubing forming a conduit for the fluid being pumped, a jacket around said tubing and spaced therefrom to form a surrounding chamber, communicating passages between said tubing and chamber, and at least one elongated flat walled substantially tubular compressible element disposed longitudinally in said chamber and forming an enclosed air space, the latter being charged with compressed air prior to installation.

2. A compensator for use in connection with deep well reciprocating pumps comprising a section of tubing forming a conduit for the fluid being pumped, a jacket around said tubing and spaced therefrom to form a surrounding chamber, communicating passages between said tubing and chamber, and a plurality of independent elongated flat walled, substantially tubular compressible elements disposed longitudinally in said chamber around said tubing and forming a series of enclosed air spaces which are charged with compressed air prior to installation.

3. A compensator for use in connection with deep well reciprocating pumps, comprising a section of tubing forming a conduit for the fluid being pumped, a jacket around said tubing and spaced therefrom to form a surrounding chamber, communicating passages between said tubing and chamber, and at least one compressible element disposed longitudinally in said chamber, said element being substantially tubular in form, closed at its longitudinal extremities and composed of resilient spring tempered flat metal walls.

4. A compensator as claimed in claim 3 wherein said chamber is provided with a plurality of said compressible elements, each independent of the other.

5. A compensator for use in connection with deep well reciprocating pumps comprising a section of tubing forming a conduit for the fluid being pumped, a jacket around said tubing and spaced therefrom to form a surrounding chamber, communicating passages between said tubing and chamber, and a plurality of independent longitudinally extending compressible elements in said chamber around said tubing, each of said elements being composed of resilient metal in the form of an elongated flattened tube, substantially elliptical in cross section and closed at its longitudinal extremities.

ARMAIS ARUTUNOFF.