

Jan. 29, 1946.

D. E. CARTER

2,393,750

IMPACT DAMPENER

Filed Sept. 10, 1943

2 Sheets-Sheet 1

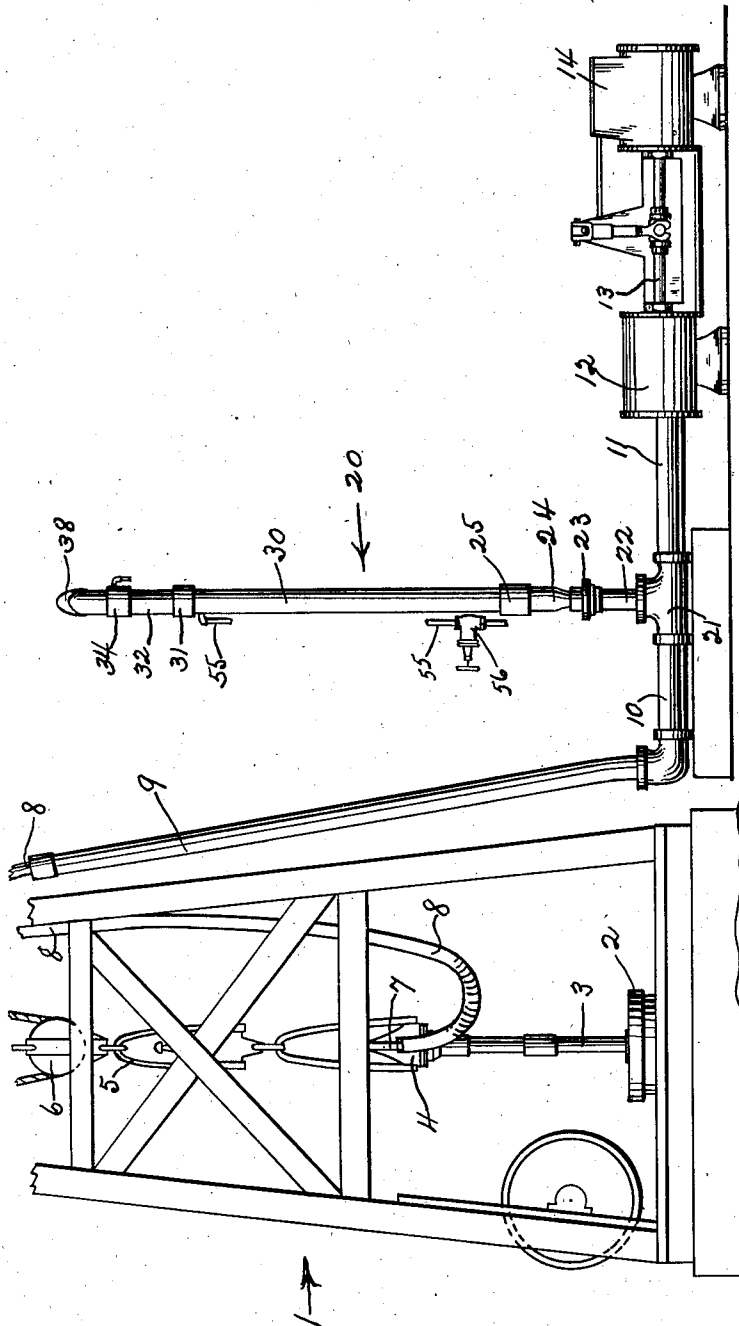


Fig. 1

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2 Sheets-Sheet 2

Fig. 3

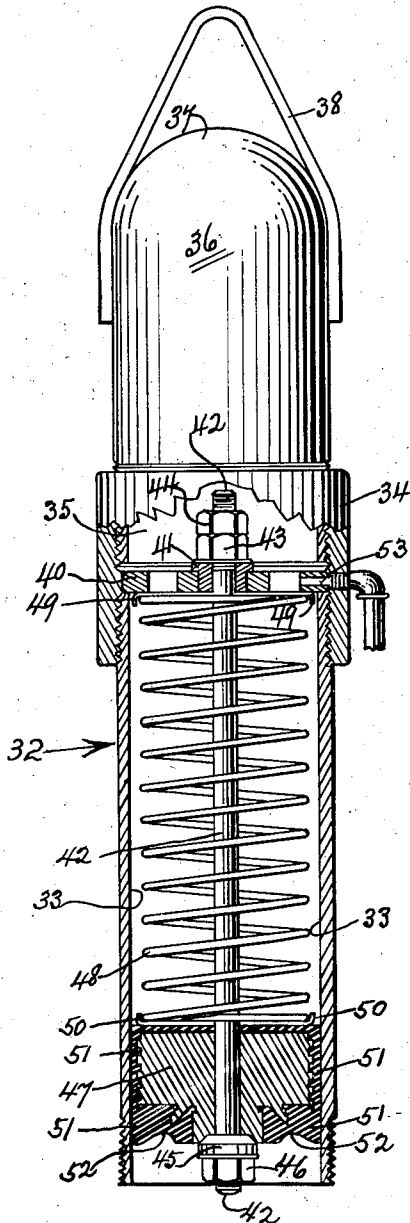
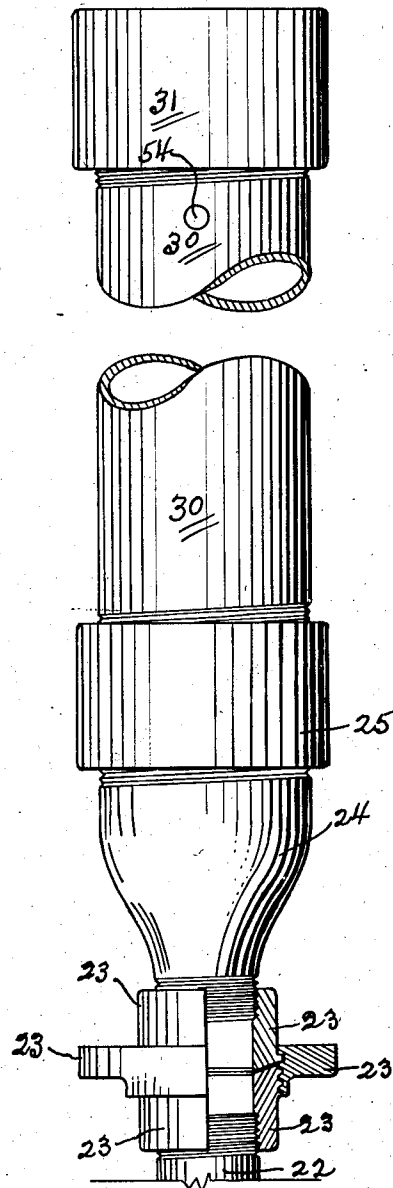


Fig. 2



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IMPACT DAMPENER

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2 Claims. (Cl. 138—31)

My invention relates to means for dampening impacts, and more particularly to dampening means or shock absorbers for pulsating fluid conveying lines.

In most pipe lines which are fed by pump pressure, other than from rotary pumps, the pulsation is insufficient to cause any material damage to the conveying line. However, in some cases and in some types of fluid conveying lines, the constant pump pulsation is so great that the line becomes weakened and is finally broken.

One such case is found in the drilling fluid line of usual rotary well drilling rigs. The drilling fluid in deep wells is often circulated under a normal line pressure of from 3000 to 4500 pounds per square inch. A portion of the drilling fluid or "mud" line consists of a section of "rotary hose" which connects the movable swivel and the stationary pump line. This section must be of hose because it must be pliable in order to be capable of compensation for alteration or adjustment in the height of the swivel in the derrick.

The fluid impact of the "mud" pumps materially increases the line pressure in the hose, the blow often amounting to as much as 1000 pounds per square inch. It is obvious that a bursting impact of this magnitude will greatly shorten the life of the hose when it is considered that this impact is repeated at every stroke of the pump, and that in drilling oil wells, the "mud" pumps operate for twenty-four hours per day.

The prime object of the present invention is to provide the mud line with a pump impact shock absorbing means which will dissipate most of the shock and prevent it from reaching the rotary hose.

Another object is to provide a shock absorbing means for the above described purpose which is automatic and positive in action; which is simple in construction; which is strong and durable; which is comparatively cheap to manufacture, and which has few moving parts to become worn and get out of order.

Other objects will be apparent from the following description when taken in connection with the accompanying two-sheet drawings, wherein:

Figure 1 is a fragmentary elevational view of a conventional oil well drilling rig, including a conventional drilling fluid hook-up, the device of the present invention being shown operatively installed in the "mud" line;

Figure 2 is a fragmentary elevational view of the lower portion of the device; and,

Figure 3 is an elevational view of the upper

portion of the device, parts being broken away to disclose the operative mechanism in partial section.

Like characters of reference designate like parts in all of the figures.

In the drawings:

The reference numeral 1 indicates as a whole, a conventional derrick mounted over a usual rotary table 2 which is adapted to rotate a usual drill pipe string 3. This string 3 is supported by a usual swivel 4 suspended from suitable elevating mechanism 5 and 6. The swivel 4 has a hollow "goose-neck" 7 to which is connected one end of a section of usual "rotary hose" 8. The rotary hose 8 extends from the swivel a desired distance upwardly into the derrick where it is swingably mounted intermediate its ends to the derrick. The other end of the rotary hose hangs downwardly from its point of attachment to the derrick, and is connected to the upper end of an upstanding section 9 of pipe. The other end of the pipe section 9 is in turn connected through pipe sections 10 and 11 to the exhaust end of the conventional "mud" pump 12. The pump 12 is powered by a piston rod 13 driven to reciprocation by a suitable steam chest 14.

The apparatus thus far described and indicated by the reference numerals 1 to 14 inclusive is not a part of the present invention, but have been shown in the drawings in order to illustrate the proper installation of my impact dampener, which will next be described in detail.

My impact dampener is indicated as a whole by the reference numeral 20 (Fig. 1) and is installed in the "mud" line. In the present instance, the device is shown mounted upon a pipe T 21 by suitable pipe connections 22, 23, 24 and 25.

The device per se consists substantially of a vertically disposed hollow stand-pipe 30 having its lower end threadedly engaged in the connection 25. The upper end of the stand-pipe 30 is connected by a pipe sleeve 31 to the lower end of a hollow cylindrical piston housing 32 having a smoothly dressed inner surface 33. The upper end of the housing 32 is attached by a pipe sleeve 34 to the lower open end 35 of a dome 36. The upper end 37 of the dome 36 is closed, and its exterior surface is equipped with a suitable loop or stirrup 38 whereby the device may be engaged by suitable hoisting equipment, not shown, in order to facilitate its movement as a whole, if desired.

With the device installed as shown in Fig. 1, any fluid impact from the pump will reach the

stand-pipe 30 before it is delivered to the hose 8. This is obvious because the stand-pipe is open to the "mud" line, and lies between the pump and the rotary hose.

As a means for absorbing or dampening the pump impact which is travelling along the body of drilling fluid from the pump toward the rotary hose, the piston housing 32 is equipped with the following described mechanism:

Within the sleeve 34 and rigidly held in place by the adjacent ends of the housing 32 and the dome 36 there is provided a flat metal disc 40 having a central bore which receives a bearing bushing 41. A piston rod 42 is slidably mounted within the bushing 41 and has a nut 43 and lock-nut 44 upon its upper end to limit downward movement of the rod. The lower end of the rod 42 extends downwardly within the housing 32 and is equipped with a conical nut 45 and lock-nut 46 for holding a piston head 47 upon the rod. A compression spring 48 is provided around the rod 42 between the disc 40 and the upper end of the piston head 47. Cups 49 and 50 are provided around the rod 42 for seating the ends of the spring 48 in an obvious manner.

The piston head 47 is preferably made of metal, and its exterior surfaces are covered with a resilient or elastic material 51 such as rubber which is firmly vulcanized thereto. The lower end surface of the rubber covering 51 is formed with an annular depression 52 which tends to cause the edge portion of the covering to expand radially when fluid pressure is exerted against the lower end of the head covering.

The piston housing 32 is provided with an outlet or breather opening 53 which permits intake and exhaust of air above the piston.

Operation

With the device installed in the drilling fluid line between the pump and the rotary hose, substantially as shown in Fig. 1, the stand-pipe 30 will be filled with air, and since the piston 47 completely closes the upper end of the stand-pipe, this air is trapped against escape. The blow of each pump impact which is exerted upon the fluid in the line (pipes 10 and 11) will be imparted to the body of trapped air in the stand-pipe. Since air is to some extent a compressible fluid, the fluid impact will partially compress the air in the stand-pipe. If the impact is sufficient, the compressed air will force the piston 47 upwardly against the resilient pressure of the spring 48.

Since air, although to some extent compressible, is more or less limited in its compressibility, it would be necessary to entrap a great volume of it in order for the air alone to give a sufficient cushion to entirely dampen the pump impact. The provision of the spring retarded pis-

ton, however, increases this cushioning effect to such an extent that the stand-pipe 32 does not have to be burdensomely large in cubical content.

For instance, the above described dampening structure will function efficiently with the stand-pipe completely filled with the non-compressible drilling fluid. For such manner of operation, the upper end of the stand-pipe will be provided with a bleeder opening 54. The opening 54 will be equipped with a pipe 55 and a shut-off valve 56 for bleeding off the air originally residing in the stand-pipe below the piston. Opening of the bleeder line will permit the drilling fluid to enter and completely fill the stand-pipe up to the bottom end of the piston 47. Under this arrangement pump impact will be directed through the column of drilling fluid in the stand-pipe directly against the piston, and the spring 48 will therefore act as a sole means for dampening such impact.

When the device is to be operated in the manner last above described, the stand-pipe 30 may be materially shortened without loss of efficiency.

In fact, the stand-pipe 30 could well be eliminated, and the piston housing 32 could be mounted directly into the pipe connection 25. In this instance the opening 54 would be placed in the element 24, with the bleeder pipe 55 connected therein.

It is pointed out that the piston and retarding spring arrangement is such in both of the above described embodiments of the present device, that the pump impact will be efficiently dampened before it can reach the rotary hose 8.

I claim:

1. The combination with a fluid conveying line carrying a pulsating fluid pressure, of a pulsation dampener including: an air chamber having one end in communication with said line; a piston in said chamber and closing the other end portion thereof for entrapping air therein; said piston adapted to be moved by pulsations in the line being exerted upon the entrapped air in said chamber; resilient means for retarding movement of the piston; and an escape vent for air for permitting free movement of said resilient means.

2. The combination with a fluid conveying line carrying a pulsating fluid pressure, of a pulsation dampener including: an air chamber having one end in communication with said line; a piston in said chamber and closing the other end portion thereof for entrapping air therein; said piston adapted to be moved by pulsations in the line being exerted upon the entrapped air in said chamber; a spring for retarding movement of the piston; and an escape vent for air for permitting free movement of said spring.

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