Aug. 3, 1965 W. M. ASHLEY, JR 3,198,376

HYDRAULIC RESERVOIR DIFFUSER

Filed Feb. 19, 1963

FIG. 1.

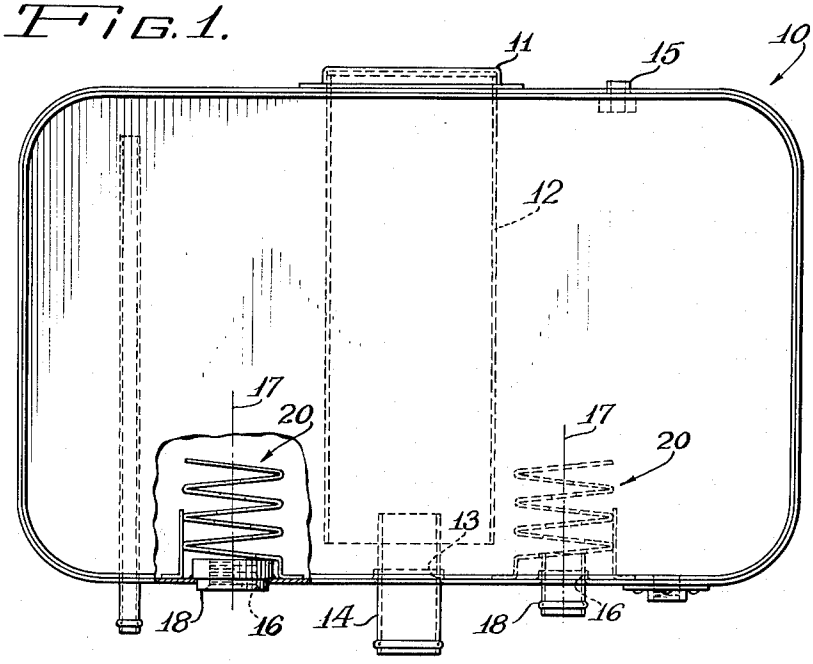


FIG. 2.

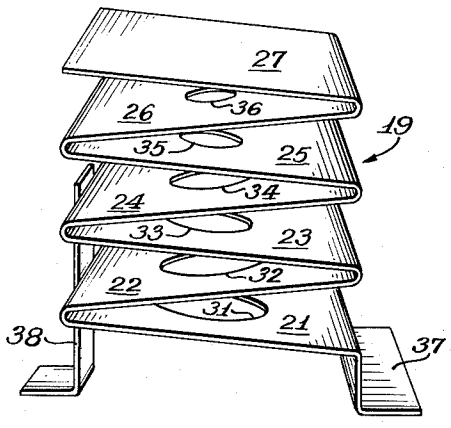
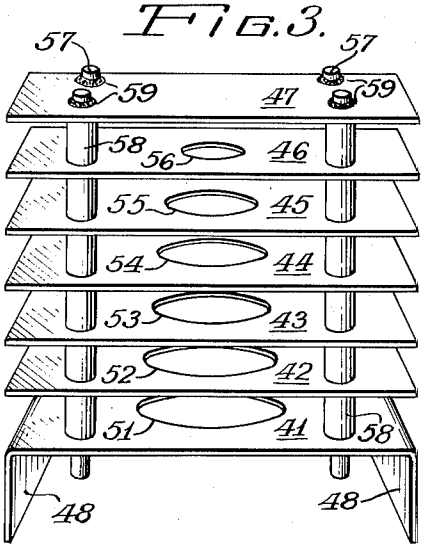


FIG. 3.



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HYDRAULIC RESERVOIR DIFFUSER

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The present invention relates generally to improvements in hydraulic reservoir diffusers and more particularly to a diffuser for controlling the high velocity oil discharging into a hydraulic reservoir.

In a hydraulic system, it has been the practice in the past to discharge the return fluid directly into the tank. Since the hydraulic oil in such a system is often moving at a high velocity, a considerable amount of turbulence is created by the discharge into the reservoir. This turbulence has many undesirable effects, such as causing cavitation in the hydraulic circuit. Another undesirable effect is that the turbulence causes oil to be lost through the reservoir air vent. This not only results in a permanent loss of the oil but also causes an oil coating to be formed on the exterior of the equipment which soon collects a layer of dirt and grime. In the past hydraulic reservoirs have been provided with baffles and the direction of the discharge has been varied in an attempt to correct the above problems. However, these solutions have not proven entirely satisfactory under all conditions of service.

The general purpose of this invention is to provide a diffuser that will direct the material in all directions over a considerable depth and thereby permit a high velocity discharge of oil to fill a reservoir in an orderly fashion keeping the turbulence to an absolute minimum. To obtain this, the present invention contemplates a unique arrangement of superimposed, generally parallel, plates having aligned apertures of decreasing area forming a diffuser to be mounted over the reservoir's inlet opening.

An object of the present invention is the provision of a liquid diffuser for controlling the high velocity oil discharging into a reservoir.

Another object is to provide a diffuser which will direct the discharge oil in all directions over a considerable depth.

A further object of the invention is the provision of a liquid diffuser that is simple and inexpensive to manufacture.

These and other objects of the invention will become more apparent from the specifications and drawings, wherein:

FIGURE 1 is an elevation view of a reservoir having a pair of diffusers mounted therein;

FIGURE 2 is a perspective view of one embodiment of the diffuser; and

FIGURE 3 is a perspective view of a second embodiment of the diffuser.

Referring now to the drawings, wherein like reference characters designate like or corresponding parts throughout the several views, there is shown in FIGURE 1 (which illustrates a preferred embodiment) a reservoir, generally designated **10**, having a cap **11** that opens into a tubular baffle **12**, an outlet opening **13**, a connecting tube **14** extending through said outlet opening, an air vent **15**, and a pair of inlet openings **16**. Connecting tubes **18** extend outwardly of the reservoir from said inlet openings **16** and the longitudinal axis of these tubes **18** is identified by reference numeral **17**. Although a pair of inlet openings have been illustrated, it should be understood that this is by way of illustration and that any number could be utilized. As seen in FIGURE 1, a diffuser **20** is mounted internally of the reservoir over each of the inlet openings **16**.

Referring now to FIGURE 2 which illustrates a preferred embodiment of the diffuser, it is seen that an elongated strip of sheet material **19** is bent along parallel fold lines such that a plurality of plates designated **21** through **27** are formed. The plates **21–27** inclusive are considered to be transverse to the longitudinal axis **17**. Aligned apertures designated **31** through **36** are formed in plates **21** through **26**. The aperture **31** formed in the first plate **21** is equal to or slightly larger than the inlet opening formed in the reservoir. The last or baffle plate **27** is solid, having no aperture formed therein. The intermediate plates **22** through **26** have apertures which decrease in area as the plates are positioned further from the first plate. Ideally, in a diffuser having seven plates, six of which have apertures formed therein as herein illustrated, the area of aperture **32** is 5/6 of the area of aperture **31**. The area of aperture **33** is 4/6 of the area of aperture **31**. The area of aperture **34** is 3/6 of the area of aperture **31**. The area of aperture **35** is 2/6 of the area of aperture **31**, and the area of aperture **36** is 1/6 of the area of aperture **31**. Thus, it is seen that a stream of oil flowing into the inlet will have approximately 1/6 of its volume diffused by each plate. The first plate **21** has an integral piece of sheet material extending therefrom bent to form mounting means **37**. A support **38** can be secured to the diffuser as by welding on the side opposite said integral mounting means to function both as a mount, as a means for holding the plates in their relative position. The number of plates in a diffuser such as this can vary, but for purposes of illustration in this application seven plates have been shown.

Referring now to FIGURE 3, which illustrates another embodiment of the diffuser, it is seen that separate generally parallel plates designated **41** through **47** are superimposed upon each other and spaced from each other by the use of rods **57** and spacers **58** being secured as by welding **59**. In this embodiment aligned apertures designated **51** through **56** are formed in plates **41** through **46** decreasing in area in the same manner as described above. The first plate **41** has turned-over sections forming legs **48** for mounting the diffuser over the inlet opening.

Operation

In a hydraulic system the oil is often returned to the reservoir at a very high velocity. This would occur, for example, when the fluid is forced from a large hydraulic cylinder. Normally, the returning oil will cause a considerable amount of turbulence; however, if the reservoir is provided with a diffuser of the type disclosed in the present application, the high velocity oil can be controlled and turbulence within the reservoir is held to an absolute minimum. The oil entering the reservoir is moving in a path defined by the longitudinal axis **17** of the inlet opening. The diffuser **20** is mounted within the reservoir over the inlet opening such that the plates are generally transverse to the longitudinal axis **17**. In the diffuser illustrated in FIGURE 1, all of the oil will pass through the aperture **31** formed in the first plate **21**; however, since the aperture **32** formed in plate **22** is smaller than aperture **31** the outer core of the stream of oil intersecting plate **22** and will be deflected outwardly in all directions from aperture **32**. Since plates **21** and **22** are integrally connected at their fold line the oil will be dispersed around an arc of 270° in a direction generally transverse to its original direction of flow. The stream of oil passing through plate **22** will proceed along the longitudinal axis **17** until plate **23** is encountered wherein again the outer core of the remaining stream will be diffused and distributed around an arc of 270° on a plane above the plane of the oil diffused by plate **22**. This process continues for plates **24**, **25**, and **26** leaving a final stream of

oil which encounters the last or solid baffle plate **27** and is itself then distributed around an arc of 270° in a plane between plates **26** and **27**. Thus it is seen that the diffuser directs the oil in all directions normal to the original longitudinal axis **17** of the inlet port in a plurality of planes. Upon leaving the diffuser the oil velocity is slowed in proportion to the area of the discharge tube divided by the peripheral area of the diffuser. The diffuser distributes the low velocity oil in many directions over a depth equal to the height of the diffuser unit and thus minimizes turbulence within the reservoir.

The diffuser illustrated in FIGURES 1 and 2 can be manufactured very simply and economically. An elongated strip of sheet material is provided with a series of apertures as by punching, and the sheet is then bent along the series of parallel fold lines to form the diffuser unit. The support **38** is then secured as by welding to the side of the diffuser.

It should be understood, of course, that the foregoing disclosure relates to only preferred embodiments of the invention and that numerous modifications or alterations may be made therein without departing from the spirit and the scope of the invention as set forth in the appended claims.

I claim:

1. A liquid reservoir including a tank, an inlet opening formed in said tank, and a diffuser mounted within said tank over said opening comprising: a first plate spaced above said inlet opening and lying in a plane transverse to the longitudinal axis of said inlet opening, an aperture formed in said first plate centered about the longitudinal axis of said inlet opening and corresponding in size to said inlet opening, a last solid plate spaced above said first plate and lying in a plane transverse to the longitudinal axis of said inlet opening, intermediate plates spaced between said first and last plates lying in planes transverse to the longitudinal axis of said inlet opening, apertures formed in said intermediate plates centered about the longitudinal axis of said inlet opening, the area of the apertures formed in said intermediate plates decreasing progressively in the direction from the first to the last plate, and means supporting said plates in their respective positions.

2. The invention as set forth in claim **1**, wherein the difference in the area of the apertures formed in said first and intermediate plates are equal and the difference is equal to the area of the aperture formed in the intermediate plate adjacent said last solid plate.

3. A liquid diffuser adapted to be mounted over a liquid inlet opening comprising: an elongated strip of sheet material folded upon itself such that a plurality of superimposed plates are formed spaced from each other, mounting means on said sheet material for mounting said diffuser over the inlet opening in a position such that the flow of material from the inlet opening is substantially transverse to the plane of said plates, a series of aligned apertures formed in said plates, said apertures decreasing progressively in area in a direction away from said inlet opening.

4. The invention as set forth in claim **3** wherein the plates adapted to be furthest from said inlet opening does not have an aperture formed therein.

5. The invention as set forth in claim **1** wherein said first, last and intermediate plates all lie in generally parallel planes.

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THERON E. CONDON, *Primary Examiner.*