United States Patent

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[15] **3,638,499**

[45] **Feb. 1, 1972**

[54] DEVICE FOR SAMPLING FLUID OF HYDRAULIC CIRCUIT

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[22] Filed: **May 13, 1969**

[21] Appl. No.: **824,172**

[30] **Foreign Application Priority Data**

May 13, 1968 France 151567

[52] **U.S. Cl.** ..... **73/422 R,** 251/DIG. 4

[51] **Int. Cl.** **G01n 1/10**

[58] **Field of Search** ..... 73/422 R; 251/354, 522, 348; 222/518

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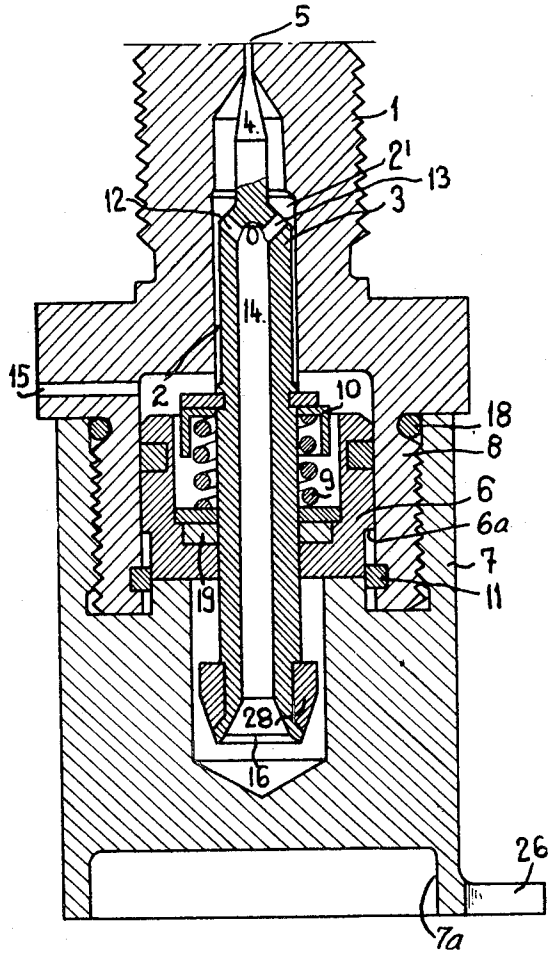
[57] **ABSTRACT**

A device for taking samples of fluid from a hydraulic circuit while operating under pressure comprises a hollow body having a chamber which is connected into the circuit through a very small opening which is normally closed by a point at the end of a spring-pressed plunger slidable in the chamber and having near its point lateral channels leading into a central longitudinal channel through which the sample is discharged when the plunger is pulled down against its spring so as to open the opening. A controlled-leakage passage prevents accumulation of solid particles and keeps the device clean so that subsequent samplings are not contaminated.

9 Claims, 4 Drawing Figures



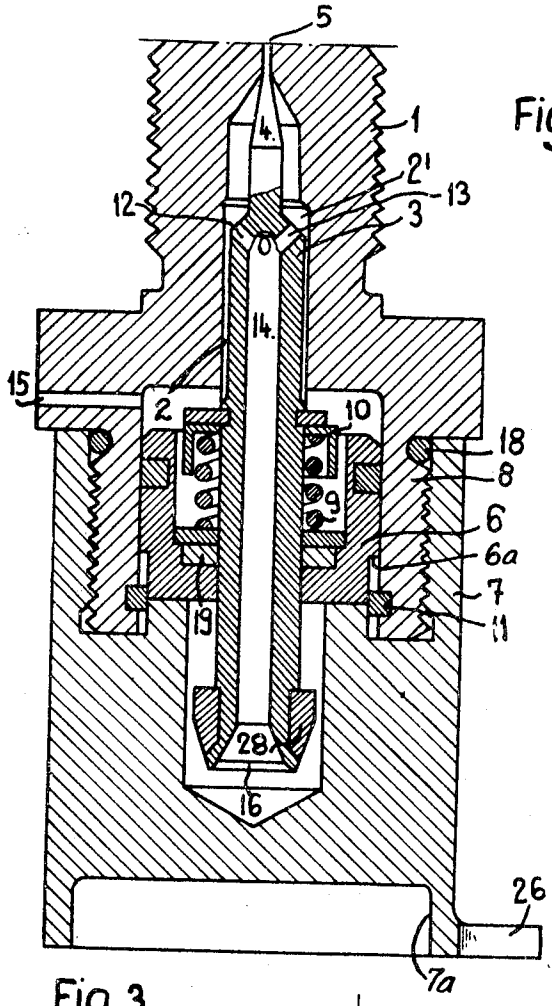


Fig. 1

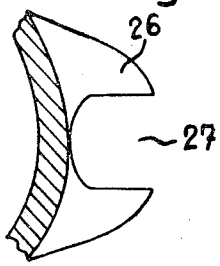
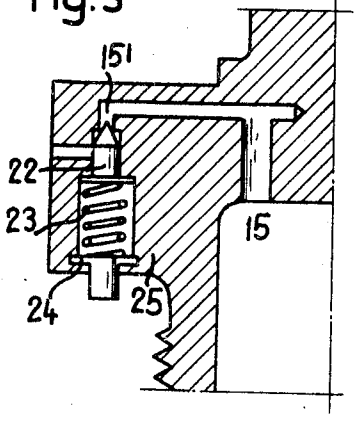


Fig. 4

Fig. 3



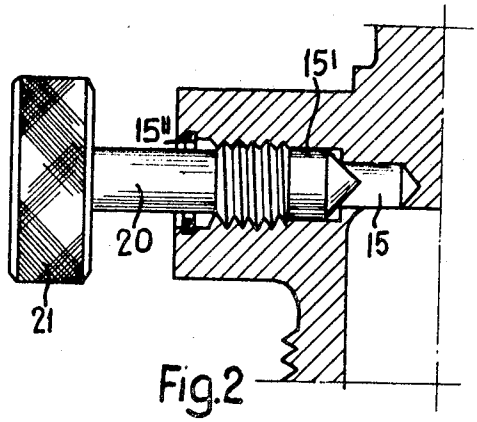


Fig. 2

DEVICE FOR SAMPLING FLUID OF HYDRAULIC CIRCUIT

The present invention relates to a device for taking samples of the fluid of a hydraulic circuit.

It is frequently necessary to take samples of the fluid of a hydraulic circuit under pressure in order to examine the state of the hydraulic fluid to check on its state of cleanliness and to carry out physical and chemical analysis. Such sampling should be effected during operation of the machine so that any impurities will be in suspension. If a sample is taken of the fluid while the machine is at rest, any impurities will have been deposited and the sample will not give true results. As an example, such sampling should be frequently carried out on hydraulic circuits of aircraft.

In order to effect such samplings, there have been utilized according to prior techniques arrangements of valves and couplers which are subject the double inconvenience of not being practical at the high pressures under consideration and of leaking. This is why, on modern circuits, sampling is effected by means of a movable member which is displaced to an unblocking position by the pressure of the fluid against the opposition of an elastic member. Thus, there is known an arrangement in which a closing valve under the force of an opposing elastic member calibrated to the pressure prevailing in the circuit opens the sampling orifice when the cap which blocks it in closed position is unscrewed. The body of the valve carries a helix in relief. Its diameter is very near the inside diameter of the sampling chamber. The existence of the spiral and the small space between the body of the valve and the interior wall of the chamber is for the purpose of reducing the effect of the high pressure of the fluid. The fluid is thus constrained to flow along the spiral. However, this precaution is not sufficient and the functioning of this device is poor for pressures higher than 300 or 400 atmospheres. Furthermore, over a period of time the lubricant soils the spiral so that subsequent samplings of fluid, in themselves quite proper, appear to be dirty.

In another device of the same sort, the valve is simply subjected to the force of an opposing elastic body supported on an internal shoulder in the sampling chamber. This elastic member is thus submitted directly to the high pressure of the fluid which limits the possibilities of using the apparatus. MOreover, in this second variant, the fluid soils the springs and thus contaminates subsequent samples. The excessive size of dead spaces without circulation causes an accumulation of pollutants.

The present invention overcomes these objections. It is an object of the invention to take samples of hydraulic circuits under pressure characterized by the fact that it is formed as a hollow body of which the chamber is put in communication with the hydraulic circuit by an orifice which is of very small diameter and is closed by the point of a needle valve member which is pierced by a lateral canal opening into a central canal, the movement of the member toward the base of the needle assuring opening of the orifice, the passage of the fluid into the chamber of the hollow body and its sampling by the lateral canals and central canal to the base of the needle valve member.

The liquid is thus never in contact with any springs or other mechanism since it passes directly to the base of the needle valve member in the canals where it cannot pick up any impurities. This assures the neutrality of the apparatus with respect to subsequent samplings.

The chamber of the hollow body preferably conforms closely to the form of the point of the needle valve member so that the dead space will be reduced as much as possible and the walls will be very nearly vertical so as to avoid all deposits. Moreover, a leakage passage is provided so that the liquid is not retained in the dead space and the leakage circuit thus assures a constant cleaning of the apparatus.

The invention will be more fully understood from the following description with reference to a nonlimiting example illustrated in the annexed drawings in which:

FIG. 1 is a generally vertical section of apparatus according to the invention;

FIG. 2 is a detailed section of a first closing device of the leakage passage;

FIG. 3 is a detailed section of a second closing device of the leakage passage, and

FIG. 4 is a partial section along the line IV—IV of FIG. 1.

With reference first to FIG. 1, the apparatus will be seen to comprise a body 1 having an interior chamber 2 in which a cylindrical plunger or needle valve member 3 provided at its upper extremity with a point 4 is displaceable. The chamber 2 of the body 1 is put in communication with the hydraulic circuit where a sampling is to be effected by an orifice 5 of very small diameter. By way of example and without any limitation, the diameter of this orifice selected according to the pressure of the circuit and of which the narrowness has for its object the avoidance of too great a discharge of fluid, is of the order of 0.25 mm. The orifice 5 is placed in the vicinity of the center of the fluid vein where the fluid is in a zone of high velocity.

The orifice 5 is closed by the upper extremity of the point 4 when the member 3 maintained in its uppermost position by being resiliently supported on a collar 6 resting on a cap 7 which closes the lower end of the chamber 2. The cap 7 is screwed onto the body 1 by threads 8.

A compression spring 9 is supported by the collar 6 and the upper end of the spring engages a collar 10 which is fixed on the member 3. The spring 9 is calibrated in such manner that the force it exerts on the member 3 is approximately equal to or slightly greater than the force exerted by the pressure of the fluid in the circuit, the calibration being effected when the cap 7 is unscrewed so that a shoulder 6*a* of the collar 6 comes to rest on an abutment 11 in the body 1.

When the cap 7 is screwed on, the spring 9 is thereby tightened to assure absolute security.

The member 3 is pierced near its point by lateral canals 12 and 13 which opens into the upper end of a central canal 14 extending down to an outlet 16 at the bottom of the member 3 below the lower end of the body 1. The walls of the chamber 2 are so constructed as to be as close as possible to the point 4 in order to leave only a small dead space 2' communicating with the exterior by a leakage circuit 15.

When it is desired to effect a sampling, the cap 7 is completely unscrewed and removed whereupon the shoulder 6*a* of the collar 6 comes to rest on the abutment 11, the spring 9 still exerting a sufficient force opposing the fluid pressure of the circuit on the member 3 to prevent discharge through the orifice 5. The member 3 is then manually forced downwardly so that fluid can escape through the orifice 5, the lateral channels 12 and 13 and the central channel 14 and can be sampled by the outlet 16 of the member 3. The cap 7 is provided with a recess 7*a* which can, if desired, be used to catch the fluid escaping through the outlet 16.

According to an important industrial advantage of the invention, the fluid is not in communication with an mechanism such as the spring 9. It passes for the most part in the central channel 14 where no deposit of solids can occur, thereby assuring the neutrality of the apparatus with respect to future samplings. It is to obtain this advantage that the volume of the dead space 2' is reduced to a minimum. A small part of the fluid escapes by the leakage passage 15. This escapement further reduces the formation of deposits in the dead space 2' and assures that it stays perpetually clean.

Packings 18, 19, etc., are used at the joints to avoid all parasitic leakage.

FIGS. 2 and 3 show two possible arrangements for closing the leakage passage 15. The first arrangement, shown in FIG. 2, is a simple needle valve 20, manually manipulated by a knurled button 21, closing the orifice 15' of the leakage passage 15. A stop 15'' prevents the needle from being screwed completely out.

The second variant, as illustrated in FIG. 3, comprises a pressure responsive valve 22 subjected to the force of a spring 23 supported by a small collar 24 blocked by an abutment 25.

The said valve **22** closes a canal **15'** of the leakage passage **15** and assures the escape of fluid by the channel **15''** when the pressure of fluid in the canal **15'** is sufficient to open the valve **22** against the force of the spring **23**.

The description of these two arrangements is not intended to be limiting since there are other ways of closing the leakage passage **15**.

The leakage passage provides a means of achieving a circulation in the mechanism without contact with the liquid which is sampled by means of the central canal **14** and the outlet **16**.

The system of closing the leakage passage such as that illustrated in FIGS. **2** and **3** or any other system, is for the purpose of preventing the oozing of liquid due to the accidental imperfect closing of the point **4** on its seat. It will be seen that the valve member **3** such as that represented is large with respect to the actual dimensions of the dead space by the order of tens of cubic centimeters. In the arrangement used heretofore the dead spaces were in general so great as to cause the risk of deposit of solids and of contaminating subsequent samplings.

With reference to FIG. **4** it is seen that the cap **7** can be provided with a lateral projection **26** having a notch **27** of a size to slip over the above member **3** above the shoulder **28**. When the cap has been removed, it is possible by means of the notch **27** to pull down on an annular shoulder **28** provided on the stem of the member **3** and thereby open the orifice **5**. This detail of construction is designed to simplify use of the apparatus, it being understood that it is not intended to be limiting and it is not necessary to the functioning of the apparatus according to its fundamental characteristics.

What I claim is:

1. A device for taking a sample of the fluid of a hydraulic circuit while operating under pressure which comprises a hollow body having a chamber communicating with said circuit by a small diameter orifice, a collar slidable in said chamber, a reciprocable plunger slidable in said collar and having at one end a point engageable in said orifice to close it, a central channel extending through said plunger to the opposite end of said plunger and at least one lateral channel opening from said central channel into said chamber near said point, means for limiting movement of said collar in a direction away from said orifice, compression spring means surrounding said plunger and acting between said collar and said plunger for urging said plunger toward said orifice to close said orifice by said point, said spring means being calibrated normally to exert on said plunger a force greater than the force exerted on said plunger by the pressure fluid of said hydraulic circuit, said plunger being retractable against the force of said spring means to open said orifice and permit a sample of hydraulic fluid to flow through said channels and to be discharged from said opposite end of said plunger.

2. A sampling device according to claim **1**, further comprising a cap screwed onto an end of said body opposite said orifice and engageable with said collar to move it toward said orifice and thereby increase the pressure exerted on said plunger by said spring.

3. A sampling device according to claim **1**, in which said plunger conforms closely to the walls of said chamber so as to avoid excessive dead space in which solid particles can collect.

4. A sampling device according to claim **1**, in which a removable cap closes an end of said hollow body opposite said orifice, and in which said cap includes means engageable with said plunger to retract said plunger and thereby open said orifice.

5. A sampling device according to claim **1**, comprising a removable cap for closing an end of said hollow body opposite said orifice, said cap comprising means cooperating with said spring means to increase the force exerted by said spring means for urging said plunger toward said orifice when said cap is in closed position.

6. A device for taking a sample of the fluid of a hydraulic circuit while operating under pressure which comprises a hollow body having a chamber communicating with said circuit by a small diameter orifice, a plunger reciprocable in said chamber and having at one end a point engageable in said orifice to close it, a central channel extending through said plunger to the opposite end of said plunger and at least one lateral channel opening from said central channel into said chamber near said point, spring means for urging said plunger toward said orifice to close said orifice by said point, said spring means being calibrated normally to exert on said plunger a force greater than the force exerted on said plunger by the pressure fluid of said hydraulic circuit, said plunger being retractable against the force of said spring means to open said orifice and permit a sample of hydraulic fluid to flow through said channels and to be discharged from said opposite end of said plunger, said plunger conforming closely to the walls of said chamber so as to avoid excessive dead space in which material can collect, said body being provided with a restricted leakage passage for conducting fluid from space between said plunger and the walls of said chamber to a discharge outlet to avoid retention in said space of fluid which might contaminate future samplings.

7. A sampling device according to claim **6**, comprising valve means controlling the discharge of fluid through said leakage passage.

8. A sampling device according to claim **7**, in which said valve means comprises a manually controlled valve.

9. A sampling device according to claim **8**, in which said valve means comprises a pressure-responsive valve.

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