Sept. 4, 1956 S. OLDBERG 2,761,435

HYDRAULIC TAPPET HAVING COMBINED VALVE CAGE AND SPRING

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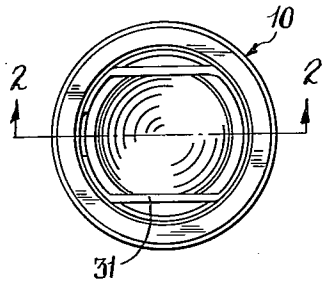

FIG. 1

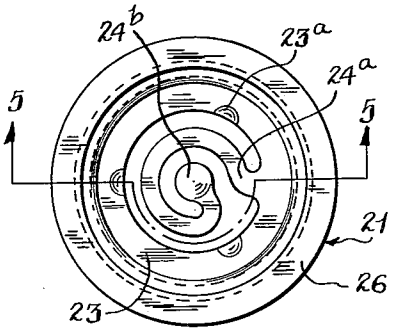

FIG. 4

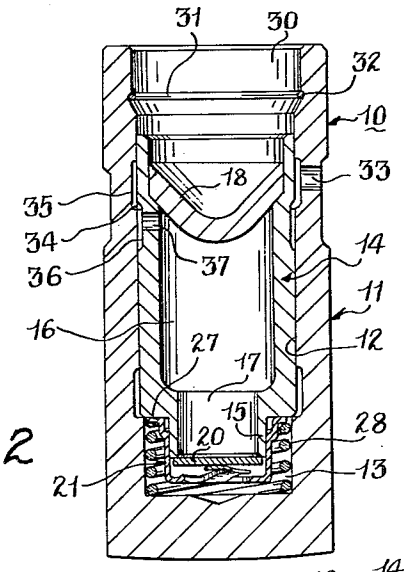

FIG. 2

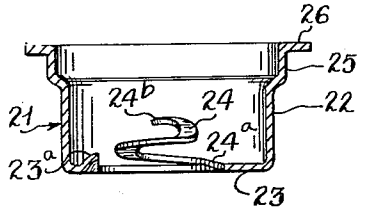

FIG. 5

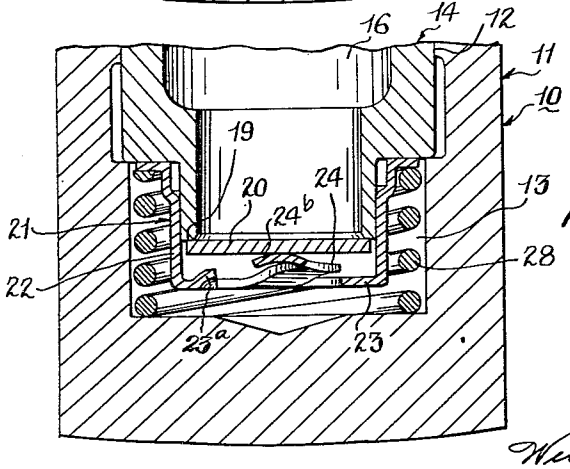

FIG. 3

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HYDRAULIC TAPPET HAVING COMBINED VALVE CAGE AND SPRING

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11 Claims. (Cl. 123—90)

This invention relates to valved hydraulic devices of the cooperating cylinder and plunger type. As one practical embodiment of such a valved hydraulic device embodying this invention, there is disclosed herein an engine valve take-up device or hydraulic tappet which is of a simple and economical construction.

An object of the invention is to provide an improved construction for a valved hydraulic device or tappet in which the movable valve is retained relative to a valve seat by a retaining member comprising a combined valve cage and valve spring.

Another object is to provide an improved hydraulic tappet, or the like, comprising cooperating cylinder and plunger members defining a fluid pressure chamber having a valve controlled passage connecting therewith and a sheet metal retaining member comprising a combined valve cage and valve spring retaining the valve in cooperation with such passage.

A further object is to provide such an improved hydraulic tappet, or the like, in which the sheet metal retaining member is movable with the plunger and comprises a sleeve portion defining a cage housing the movable valve and a transverse end wall having a sheared or partially sheared portion defining a valve actuating spring.

Still another object is to provide an improved hydraulic tappet, or the like, of the character above referred to in which the valve spring defined by the partially sheared portion of the retaining member is a spiral plate spring having a valve-engaging free end located substantially on the axis of the cage.

The invention can be further briefly summarized as consisting in certain novel combinations and arrangements of parts hereinafter described and particularly set out in the claims hereof.

In the accompanying sheet of drawings, forming a part of this specification:

Fig. 1 is an upper end view of a hydraulic tappet embodying this invention;

Fig. 2 is a vertical section taken through the tappet as indicated by section line 2—2 of Fig. 1;

Fig. 3 is a sectional view corresponding with a portion of Fig. 2, but showing the same on a larger scale;

Fig. 4 is a plan view of the combined valve cage and valve spring shown in detached relation and on a somewhat larger scale; and

Fig. 5 is a vertical section taken through the combined valve cage and valve spring as indicated by the irregular section line 5—5 of Fig. 4.

The hydraulic tappet 10 shown in the drawings comprises in general a tappet body 11 having a cylinder 12 therein which includes a pocket at the lower end thereof defining a fluid pressure chamber 13, and a plunger 14 slidable in such cylinder and having a lower end 15 of reduced size projecting into the chamber 13.

The plunger 14 is a hollow plunger having a reservoir chamber 16 therein adapted to contain a supply of suitable hydraulic fluid, such as oil, and which reservoir is connected with the pressure chamber 13 through a plunger

passage 17 extending through the reduced lower end 15. The hollow plunger 14 has the upper end thereof closed by a closure plug 18 suitably assembled thereinto.

The lower end of the plunger 14 is provided with an annular valve seat 19 formed on the reduced extension 15 and surrounding the plunger passage 17. Communication between the reservoir 16 and the fluid pressure chamber 13 through the plunger passage 17 is controlled by a check valve 20 cooperating with the valve seat 19 and having an opening movement toward the pressure chamber.

In accordance with the present invention, the valve 20 is retained relative to the seat 19 by a retaining member 21 which comprises both a valve cage and a valve spring. The retaining member 21 is a sheet metal member comprising a sleeve portion 22 defining the cage portion in which the valve 20 is retained and guided, and a transverse lower end wall 23 carrying the valve spring 24.

The valve spring 24 is a plate spring of a spiral shape, as shown in Fig. 4, and is formed by a sheared or partially sheared portion of the transverse end wall 23. The outer end 24^a of this spiral spring remains integrally connected with the end wall 23, and the free inner end 24^b is of a convexly rounded disk-like shape for engagement with the underside of the valve 20 and is located substantially on the axis of the cage.

For a portion of its length the sleeve portion 22 of the retaining member 21 is of a size to telescopingly engage the plunger projection 15 with a relatively close fit for mounting the cage on this projection. The upper portion 25 of the sleeve of the retaining member is of a somewhat larger diameter and terminates in an outturned substantially radially projecting end flange 26.

The retaining member 21 can be made of sheet metal having a suitable hardness and other desired characteristics and can be formed by die stamping or by other appropriate operations. The retaining member can also be further hardened or otherwise treated such that the spring 24 will have the desired rate characteristic, preferably a low rate characteristic, and a long life.

The retaining member 21 is movable with the plunger 14 and when mounted on the plunger projection 15 for retaining the valve 20 in cooperating relation to the valve seat 19, the upper end flange 26 of the cage seats against an annular shoulder 27 which surrounds the plunger projection. A compression spring 28 of the helically coiled wire type is disposed in the chamber 13 in surrounding relation to the retaining member 21 and with the lower end of the spring seating against the bottom of this chamber. The upper end of the spring 28 seats against the radial flange 26 and holds the latter against the annular shoulder 27, such that the force of this spring maintains or assists in maintaining the retaining member in its assembled position on the plunger projection 15.

When the retaining member is in this assembled position on the plunger 14, the spring 24 is under a desired initial load. The convexly rounded inner end portion 24^b of the spring 24 engages the valve 20 on the underside thereof and substantially centrally thereof and normally urges the valve toward its closed position in engagement with the valve seat 19.

The end wall 23 of the retaining member 21 is provided with stop means and limits the downward opening movement of the valve 20 in the cage portion 22 and also prevents the valve from assuming a tilted position in the cage when the valve is moved to its open position. This stop means is here shown as comprising a group of axially offset lugs 23^a, preferably three such lugs, formed on the end wall 23.

The plunger 14 is assembled into the tappet body 11 through the open upper end 30 thereof and is retained

in the cylinder 12 by a retaining spring ring 31 engaged in an internal groove 32. The upper end of the plunger 14 is engaged by the lower end of the stem of an engine valve being actuated or by the lower end of a push rod of an engine valve actuating mechanism (not shown), such stem or rod engaging the plunger through the open upper end 30 of the tappet body 11.

Adjacent the open upper end 30, the tappet body 11 is provided with a radial filling passage 33 in the wall thereof communicating with a space 34 formed between the plunger 14 and cylinder 12 by the internal annular groove 35 of the cylinder and the external annular groove 36 of the plunger. The plunger 14 is also provided with a radial passage 37 therein connecting the upper end of the reservoir 16 with the space 34 and through which the fluid supply is admitted to the reservoir.

During use in an internal engine, the hydraulic tappet 10 transmits thrust to the valve stem or push rod through the plunger 14 and the substantially incompressible body of the hydraulic fluid contained in the pressure chamber 13. The compression spring 28 urges the plunger 14 outwardly in the cylinder 12 so as to take up clearance or lost motion existing in the valve mechanism of the engine, and the check valve 20 permits hydraulic fluid from the reservoir 16 to flow into the pressure chamber 13 for substantially always mantaining this chamber filled with such hydraulic fluid. The valve spring 24 applies a desired spring load to the valve 20 which urges this valve towards its closed position for preventing a return flow of the hydraulic fluid from the pressure chamber 13 into the reservoir 16.

From the foregoing description and the accompanying drawing, it will now be readily seen that this invention provides a valved hydraulic device or tappet which is of a very simple and practical construction and in which the check valve retaining member is a one-piece sheet metal member comprising both a valve cage and a valve spring. Additionally, it will be seen that a retaining member of this form can be readily produced from sheet metal of desired characteristics, such that the plate spring formed by the partially sheared portion of the retaining member will have a long spring life and will have a desired low rate capacity for a proper actuation of the check valve of the device. Furthermore, it will be seen that by reason of the stamped sheet metal cup like-form of the combined valve cage and spring, this member can be rapidly and economically produced and can be quickly and easily assembled into its proper position in the device.

Although the improved hydraulic tappet and the combined valve cage and valve spring thereof have been illustrated and described herein to a somewhat detailed extent, it will be understood, of course, that the invention is not to be regarded as being limited correspondingly in scope, but includes all changes and modifications coming within the terms of the claims hereof.

Having thus described my invention, I claim:

1. In a valve take-up device, a body having a cylinder therein, a plunger movable in said cylinder, said plunger and cylinder defining a fluid pressure chamber and fluid flow passage means connecting with said chamber and including a valve seat, a movable valve controlling said passage, resilient means effective on said plunger and tending to move the same relative to said cylinder in a direction to enlarge said chamber, and a sheet metal member comprising a combined valve cage and valve spring retaining said valve in cooperating relation to said valve seat.

2. In a valve take-up device, a body having a cylinder therein, a plunger movable in said cylinder, said cylinder and plunger defining a fluid pressure chamber means and said plunger having a passage connecting with said chamber means, a valve seat on said plunger, a valve movable relative to said seat and controlling said passage, resilient means effective on said plunger and tending to move the same relative to said cylinder in a direction to enlarge said chamber, and a valve retaining member carried by said plunger and comprising a one-piece sheet metal member constituting a combined valve cage and valve spring for retaining said valve in cooperating relation to said valve seat.

3. A hydraulic tappet or the like comprising, a body having a cylinder therein including a fluid pressure chamber, a plunger movable in said cylinder and having a passage connecting with said chamber, a movable valve controlling said passage and having a normally closed position, resilient means effective on said plunger and tending to move the same relative to said cylinder in a direction to enlarge said chamber, and a one-piece sheet metal valve retaining member movable with said plunger and comprising a cage portion housing said valve and a spring portion extending into the cage portion and urging said valve toward said closed position.

4. In a hydraulic device having cooperating plunger and cylinder members one of which is provided with a pressure fluid passage and an associated valve seat, a valve movable relative to said seat and controlling said passage, resilient means effective on said plunger member and tending to cause a relative axial separating movement between said plunger and cylinder members, and a cup-shaped sheet metal cage carried by such one member for confining said valve relative to said seat, and a sprial sheet metal spring formed by a portion of the transverse end wall of said cage for urging said valve against said seat.

5. In a hydraulic device, cooperating plunger and cylinder members defining a fluid pressure chamber, said plunger member having a passage therein connecting with said pressure chamber and a valve seat thereon associated with said passage, a valve movable relative to said seat and controlling said passage, resilient means effective on said plunger member and tending to cause a relative axial separating movement between said plunger and cylinder members, and a one-piece cup-shaped sheet metal member constituting a combined valve cage and valve spring for retaining said valve in cooperating relation to said valve seat, said valve spring being a partially sheared portion of the wall of said sheet metal member and the portion of the wall from which said valve spring is sheared having valve-engageable stop projections integrally formed thereon.

6. In a hydraulic device, cooperating plunger and cylinder members defining a fluid pressure chamber and a reservoir chamber, said plunger member having a passage therein connecting said reservoir and pressure chambers and a valve seat thereon associated with said passage, a valve movable relative to said seat and controlling said passage, resilient means effective on said plunger member and tending to cause a relative axial separating movement between said plunger and cylinder members, and a one-piece sheet metal member carried by said plunger member and comprising a hollow cage portion retaining said valve adjacent said seat and a formed resilient spring portion integral with said cage portion and urging said valve toward said seat.

7. A hydraulic device as defined in claim 6 in which said sheet metal member includes a sleeve portion defining said cage portion and a transverse end wall, and in which said spring portion comprisse a partially sheared portion of said transverse end wall.

8. A hydraulic device as defined in claim 6 in which said sheet metal member includes a sleeve portion defining said cage portion and a transverse end wall, and in which said spring portion is in the form of a spirally extending plate spring portion partially sheared from said transverse end wall and having a valve-engaging free end located substantially on the axis of said cage portion.

9. A hydraulic tappet or the like comprising cooperating plunger and cylinder members defining a fluid pressure chamber, said plunger member having an end portion of reduced size and a passage in said end portion con-

necting with said chamber, a valve seat on such end portion, a valve movable relative to said seat and controlling said passage, resilient means effective on said plunger member and tending to cause a relative axial separating movement between said plunger and cylinder members, and a sheet metal valve retaining member movable with said plunger, said retaining member comprising a sleeve portion telescopingly engaging said reduced end portion and defining a cage housing said valve and a transverse end wall spaced from said end portion and having a partially sheared portion defining a resilient plate spring urging said valve toward said seat.

10. A hydraulic tappet as defined in claim 9 in which said plate spring is a spirally extending spring having its outer end connected with said end wall and a valve-engaging free inner end located substantially on the axis of said cage.

11. In a hydraulic tappet, a tappet body having a cylinder therein and a pocket at one end of the cylinder defining a fluid pressure chamber, a hollow plunger slidable in said cylinder, said plunger having a reservoir chamber therein and a reduced end projecting into said pocket and provided with a passage connecting said

reservoir chamber with said pressure chamber, a valve seat on said reduced end and associated with said passage, a shoulder on said plunger surrounding said reduced end, a valve cooperating with said seat and controlling said passage, a one-piece sheet metal retaining member movable with said plunger and comprising a sleeve portion telescopingly engaged with said reduced end and having an outturned end flange engaging said shoulder and a transverse end wall spaced from said valve seat, said sleeve portion and transverse end wall constituting a cage housing said valve, a spiral plate spring formed by a sheared portion of said transverse end wall and having a free end located substantially on the axis of said cage and engaging said valve, and a helical wire spring in said pocket and having a movable end effective on said plunger and holding said flange against said shoulder.

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