Jan. 27, 1959 E. L. DAYTON 2,870,757

HYDRAULIC VALVE TAPPET

Filed July 30, 1956

FIG.1.

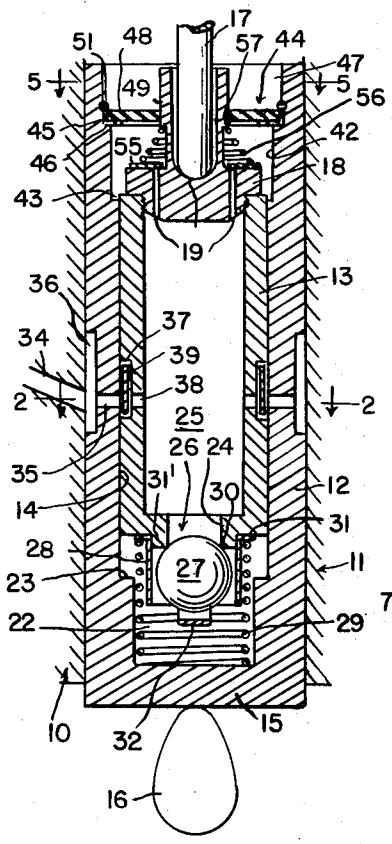


FIG.2.

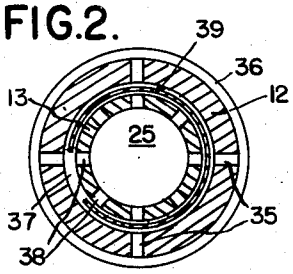


FIG.5.

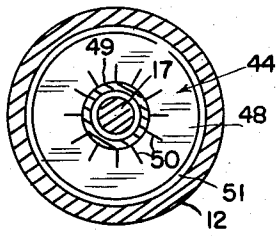


FIG.3.

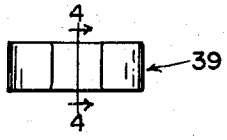


FIG.4.



FIG.6.

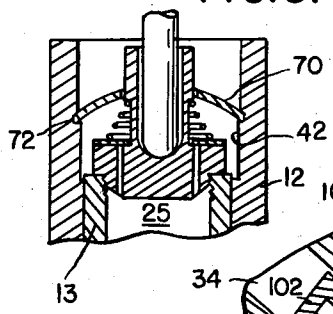


FIG.10.

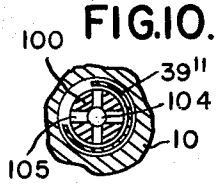


FIG.8.

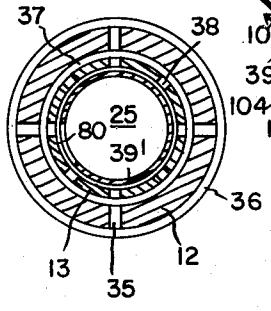


FIG.9.

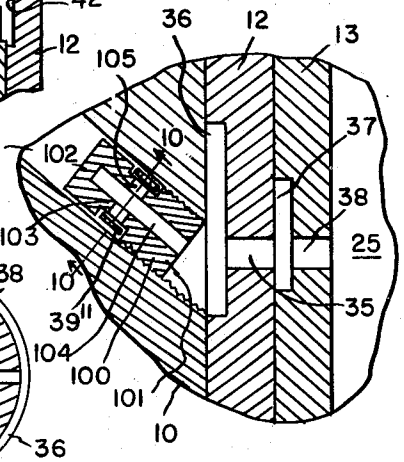
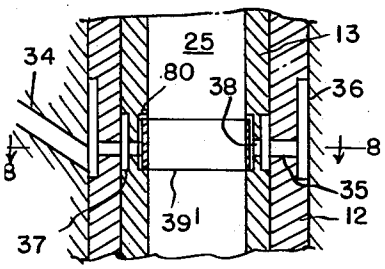


FIG.7.



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HYDRAULIC VALVE TAPPET

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25 Claims. (Cl. 123—90)

This invention relates to an improved hydraulic valve tappet assembly of the type suitable for use in connection with internal combustion engines.

Hydraulic tappet assemblies, as used in internal combustion engines, are usually supplied with oil from the lubricating system of the engine and function to take up clearance between the valve push rods and tappets automatically as soon as such clearance exists. The specific structure of hydraulic valve tappets varies considerably but, in general, they comprise a cylinder and a tubular plunger or piston slidably supported in the cylinder. When installed, the bottom of the cylinder is usually engaged by a cam on the camshaft of the engine and the top of the piston is closed by a plug which ordinarily engages the valve operating push rod.

An adjusting chamber is normally provided in the cylinder below the piston and the bottom of the piston has a valve controlled port communicating with the adjusting chamber. Hydraulic fluid, such as oil, is admitted to the adjusting chamber through radial ports formed in the cylinder and piston to the interior of the piston and then to the adjusting chamber through the valve controlled port. The arrangement is such that the clearance between the piston and push rod is taken up by the oil column below the piston.

One serious problem of hydraulic tappets is that lubricant contained in the cylinder below the piston leaks past the piston when the engine stands idle for a length of time and while provision is made in the form of a passage for supplying lubricant to the cylinder below the piston when the engine is again started, nevertheless, this passage is ordinarily highly restricted. Hence, in cold weather or when the viscosity of the oil is high, some considerable time is required for the oil to flow through the restricted passage in sufficient quantity to take up the clearance between the valve and push rod. Consequently, a severe knock may prevail in the engine until the viscosity of the oil is lowered sufficiently to flow freely through the restricted passage and establish the required oil column below the piston.

With the above in view, it is an object of this invention to provide a hydraulic tappet assembly constructed in a manner such that the effective area of the passage is substantially increased when the engine is cold, and is reduced to establish the required restricted flow of lubricant under normal operating conditions where the engine is warm. Thus, the oil below the piston is quickly replenished when the engine is started regardless of the high viscosity of the oil without interfering with the performance of the tappet assembly during normal operation of the engine.

Another object of the invention is to provide a hydraulic tappet assembly in which the tendency of oil to deposit a residue upon the internal surfaces of the cylinder is reduced to a minimum. When a motor vehicle stands idle for any length of time, the piston of the tappet assembly may move to the bottom of the cylinder, and the cylinder wall above the piston may develop a deposit

of oil residue on its internal surface. Then, when the engine is again put in operation, the residue on the cylinder wall will obstruct the proper functioning of the tappet at least during the initial stages of operation. Then, too, if for any reason it is desired to disassemble the tappet assembly by removing the piston from the cylinder, deposits on the internal surfaces of the cylinder may render this difficult.

It is a feature of the present invention to accomplish the object set forth in the preceding paragraph first of all by providing an oil retainer extending across the cylinder above the piston so as to prevent oil from splashing over the top of the cylinder and thus to retain a quantity of oil in the cylinder above the piston. Thus, any deposits in the oil will remain dissolved or suspended therein rather than form a residue on the cylinder. Another feature of the invention is to provide a tappet cylinder with a portion of enlarged internal diameter beyond the extended position of the piston so that any oil deposits that may develop in this region will not prevent the removal of the piston from the cylinder.

Still another feature of the invention is to provide a cap for the piston which is securely attached thereto so that the buildup of pressure within the piston tending to open the valve controlled port in the piston to replenish the adjusting chamber with oil will not be dissipated by unseating the cap.

Other objects of the invention will become more apparent as the following description proceeds, especially when taken into consideration with the accompanying drawings, wherein:

Figure 1 is a longitudinal sectional view of a tappet assembly embodying the invention.

Figure 2 is a sectional view taken along the line **2—2** on Figure 1.

Figure 3 is a side elevational view of one part of the structure shown in Figures 1 and 2.

Figure 4 is a sectional view taken along the line **4—4** on Figure 3.

Figure 5 is a sectional view taken along the line **5—5** on Figure 1.

Figure 6 is a fragmentary sectional view of a tappet assembly having a modified construction.

Figure 7 is a fragmentary sectional view of a tappet assembly having still another modified construction.

Figure 8 is a sectional view taken along the line **8—8** on Figure 7.

Figure 9 is a fragmentary sectional view of another modification.

Figure 10 is a sectional view taken along the line **10—10** on Figure 9.

Referring now more particularly to the drawings and especially to Figures 1–5, the numeral **10** indicates a part of an internal combustion engine and the numeral **11** designates a hydraulic valve tappet assembly embodying the invention. The tappet assembly comprises a cylinder **12** and a piston **13** supported within the cylinder for longitudinal sliding movement. The internal diameter of the cylinder is substantially the same as the external diameter of the piston so that the piston has a close sliding fit in the cylinder. The cylinder **12**, in turn, is slidably mounted in a bore **14** formed in the part **10** and the bottom of the cylinder is closed by a wall **15**. The bottom surface of wall **15** forms a bearing for engagement with a cam **16** forming a part of the usual engine camshaft (not shown). The top of the cylinder is open for receiving a push rod **17** which is operatively connected to one valve of the engine in a manner forming no part of this invention and, hence, is not shown herein.

The piston **13** is tubular in cross section and the top of the piston is closed by a cap **18** which is securely fixed to the piston. In the present instance, the cap **18** has a

restricted vent 19 therethrough and has a reduced part 20 externally threaded for threaded engagement with internal threads formed in the upper end of the piston. The top of the cap has a hemispherical central recess 21 for engaging a corresponding hemispherical portion at the lower end of the push rod 17. The arrangement is such that the hydraulic tappet assembly provides a connection between the cam 16 and push rod 17 for operating the push rod in response to rotation of the cam 16.

The internal diameter of the cylinder 12 is reduced at the bottom to provide an adjusting chamber or oil reservoir 22 and to also provide an internal annular shoulder 23 for engaging the bottom of the piston in the collapsed or leak-down position of the piston within the cylinder. As shown in Figure 1, the bottom of the piston has a port 24 which establishes communication between the adjusting chamber 22 and the space or chamber 25 within the piston. The transfer of lubricant through port 24 is controlled by a ball check valve 26 at the bottom of the piston. The check valve 26 comprises a ball member 27, a retainer 28 and a coil spring 29. The ball member 27 is of a diameter to engage the annular seat 30 surrounding port 24 at the bottom of the piston and the retainer 28 holds the ball in a manner to enable movement of the ball by the action of gravity to its open position. The retainer 28 is in the form of a tubular sheet metal member extending around the ball in coaxial relationship to the piston. The upper end of the tubular member is turned radially outwardly to provide a flange 31 engageable with the end of the piston and also engaged by the upper end of spring 29, the latter having its lower end seated on the bottom 15 of the cylinder. The coil spring 29 is held under compression between flange 31 and wall 15, and is of sufficient strength to hold the retainer 28 in place on the piston throughout the movement of the latter. The piston has a tubular extension 31' which extends beneath it and which surrounds the port 24, and this extension is closely received in the tubular retainer 28 to center it. The coil spring 29 also tends to maintain the piston in the extended position, illustrated in Figure 1, relative to the cylinder during normal operation of the tappet but is not of sufficient strength to prevent movement of the piston to its collapsed or leak-down position in which the lower end of the piston rests on shoulder 23 when operation of the piston is discontinued.

The ball 27 is held in assembled relationship with the retainer 28 by a cross bar 32 which has its opposite ends integrally connected to diametrically opposite sides of the tubular portion of the retainer at its lower edge. The bar is as narrow as consistent with good stamping practice and, in any case, does not restrict the flow of oil through the retainer. The free flow of oil through the retainer 28 is important because it assists in filling the space below the piston in the leak-down position of the tappet and also exposes a greater area of the ball to the oil in said space to assure instantaneous closing of the ball. Also, the axial spacing between the bar 32 and seat 30 is accurately predetermined with respect to the diameter of the ball. In practice, the bar 32 is located to afford a predetermined maximum clearance between the seat and ball in the open position of the latter.

Oil from the lubricating system of the engine is supplied to the hydraulic tappet assembly 11 by a passage 34 in the engine part 10 and ports 35 extending through the adjacent wall of the cylinder 12 intermediate the ends of the latter. The intake sides of ports 35 open into an annular groove 36 formed in the outer surface of the cylinder wall and the discharge sides open into an annular groove 37 formed in the outer surface of the piston wall. The annular groove 36 is of sufficient width to register with the supply passage 34 throughout the stroke of the cylinder within the bore 14 in the engine part 10. In the normal operation of the tappet assembly, the groove 37 communicates with chamber 25 in the piston through ports 38 formed in the adjacent wall of the piston and the width of groove 37 is sufficient to register with ports 38 throughout the full stroke of the piston relative to the cylinder.

The hydraulic tappet assembly is shown in Figure 1 in its normal operating or extended position in which the bottom of the piston is spaced above shoulder 23 and a column of oil is provided between the lower end of the piston and the bottom wall 15 of the cylinder. This column of oil takes up the clearance between push rod 17 and the engine valve mechanism affording quiet operation of the valve mechanism. The ports 35 and 38 provide a relatively unrestricted flow of oil into the chamber 25. Oil admitted to the chamber 25 is maintained in the latter until the pressure below piston 13 drops sufficiently to enable movement of the ball 27 away from its seat 30, whereupon oil from chamber 25 flows through port 24 and into the adjusting chamber 22 below the piston. Thus, when the engine is cold, an ample supply of oil is delivered to chamber 25 within the piston upon starting of the engine and this oil is readily available to quickly replenish the adjusting chamber 22. Therefore, there is no apparent lost motion of the parts and objectionable clearance in the engine valve operating mechanism is avoided.

Under normal operating conditions, that is, when the engine is warm, it is desirable to restrict the flow of oil from passage 34 into chamber 25 in order to avoid building up excessive pressures within chamber 25. The restriction in the flow of oil to chamber 25 is accomplished by the split bimetal band 39 which is disposed in the groove 37. This band, when the engine is cold, assumes the position shown in Figures 1 and 2 in which it loosely encircles the ports 38 in the piston but does not close any of them. The band is formed of an inner strip 40 and an outer strip 41 which are coextensive but which have different coefficients of expansion. When heated, the bimetal band will contract due to the different coefficients of expansion of the two strips making up the band. When normal engine operating temperature is reached, the band will contract under the influence of the heat to a point where it tightly embraces the base of channel 37 to close the ports 38 which it overlies. The length of the band 39 is such that it will overlie and close all but one of the ports 38 when thus contracted. If it is in a different rotative position from that shown in Figure 2, the ends of the band may expose portions of two adjacent ports, but the portions of the ports exposed will add up to approximately the area of one port. Accordingly, when the predetermined minimum temperature is reached, that is, when the temperature of the engine reaches normal operating temperature, the heat responsive band 39 will effectively close all but one of the ports 38 to thereby highly restrict the flow of oil into chamber 25 and thereby avoid any excessive buildup of pressure therewithin. The ends of the band have rounded edges, as shown in Figure 3, since sharp edges would have a tendency to catch in the ports 35.

Under some circumstances, it becomes necessary or desirable to remove the piston from the cylinder. This is not always an easy thing to do particularly where the tappet assembly has been in use for some time and there has been an opportunity for a residue from the oil to accumulate on the internal surfaces of the cylinder. This difficulty is overcome by forming the upper portion of the cylinder, indicated at 42 with an enlarged diameter. Thus, any residue on the walls of the cylinder above the shoulder 43 will not interfere with the removal of the piston through the open upper end of the latter.

As a further means for preventing the accumulation of a residue from the oil on the internal walls of the cylinder, an oil retainer 44 is provided. At this point, it might also be mentioned that when the piston is in the collapsed or leak-down position for any extended period, it is possible for the internal walls of the cylinder to develop a film of residue even below shoulder 43 and

thus interfere with the movement of the piston to its extended position during normal operation of the tappet assembly. The oil retainer 44 comprises an annular metal strip 45 which is L-shaped in cross section and which seats upon the shoulder 46 which separates the enlarged diameter portion 42 from the upper end portion 47 of still greater diameter. The retainer 44 also includes a ring 48 of flexible resilient deformable rubber-like material such as neoprene. The outer periphery of the ring is suitably bonded to the metal strip 45.

The cap 18 of the piston is formed with a tubular sleeve 49 which extends upwardly and which loosely surrounds the push rod 17. The sleeve 49 loosely surrounds the push rod so as not to interfere with the normal angular motion of the push rod during the operation of the tappet assembly. The sleeve 49 is closely received within the ring 48 and, in fact, the inner margin of the ring has a tight yielding engagement with the sleeve. The ring 48 is formed with a plurality of circumferentially spaced splits 50 which extend radially outwardly from the inner margin thereof to increase the flexibility of the ring. The retainer 45 is held in position on the shoulder 46 by a removable split snap ring 51 located in an annular groove in the upper end portion 47 of the internal surface of the cylinder.

It will thus be seen that any oil within the cylinder above the piston will be retained and prevented from splashing out of the upper end of the cylinder by the oil retainer 44. Oil will continuously leak past the piston from the adjusting chamber 22 upwardly to the space between the piston and the retainer during the normal operation of the engine and particularly when the engine is shut down and the pistons of certain tappets move to the leak-down position. Such oil will then be retained above the piston in a pool and will not splash out during operation of the tappet assembly. By thus retaining the oil in a pool above the piston, the solid particles that may be present in the oil will not precipitate out but rather will remain dissolved or in suspension in the oil.

It will be noted that the cap 18 is securely attached to the piston. Therefore, when there is any objectionable clearance in the valve operating mechanism the pressure of oil in chamber 25 within the piston will be applied against the ball 27 to open the latter and force oil into the adjusting chamber 22 to take up the clearance. It will be appreciated that if the cap 18 were not firmly attached to the piston, the clearance might be taken up by the pressure of oil raising the cap on the piston without opening the valve 27 to replenish the adjusting chamber 22. The purpose therefore of providing a fixed attachment between the cap and the piston will be readily apparent.

The vents 19 are normally closed by a washer 55 which loosely surrounds sleeve 49. A coil spring 56, encircles sleeve 49 and is compressed between the washer and the annular shoulder 57 on the sleeve, thus normally closing the vents to permit the action described in the preceding paragraph. However, the spring has a force predetermined to allow the washer to raise or open when the pressure in the piston chamber exceeds a certain maximum amount, this pressure acting on the washer through the vents 19. Thus, the washer is in effect a relief valve to relieve excessive pressure in the piston chamber through vents 19.

Referring now to Figure 6, a modification is shown. In this construction, the cylinder 12 has the portion 42 of increased internal diameter which extends from the shoulder 43 entirely to the top of the cylinder. The oil retainer is in the form of a frusto-conical metal ring 70 and the outer periphery of the ring is secured in place in an annular groove 72 with a press fit. The internal diameter of the cylinder below the groove is somewhat greater than that above the groove to provide an upwardly facing shoulder. Then when pressure is applied against the retainer in a downward direction, the retainer will spread out or flatten slightly to engage its periphery in the groove with a press fit. The ring is thus firmly secured in place and makes unnecessary the provision of a snap ring, such as that indicated at 51 in Figure 1. The oil retainer 70 loosely surrounds the tubular extension or sleeve 49 to retain oil above the piston.

Figures 7 and 8 show another thermostatic control in which the piston is formed with a second annular groove 80 on the inner surface which communicates with the ports 38. The bimetal band 39' is like the bimetal band 39 except that it is of a smaller diameter, expands instead of contracts when heated, and is located loosely within the groove 80. When the engine is cold, the band 39' assumes the position shown in which it extends along the ports 38 but does not close them. When the engine assumes normal operating temperature, the heat is sufficient to cause the band to expand into a position in which it presses against the base of the groove 80 and overlies and closes all but one of the ports 38. The band 39' thus assures a highly restricted flow of oil into chamber 25 during the normal operation of the tappet assembly, but also makes provision for a greatly increased flow of oil to the chamber 25 when the engine is cold. In this construction, there is no danger of the edges of the band catching in the ports 35 during axial movement of the piston relative to the cylinder. Otherwise, the Figure 7–8 construction may be like the Figure 1–5 construction with or without the Figure 6 modification.

Figures 9 and 10 show still another thermostatic control in which the inlet passage 34 is threaded and threadedly receives the plug 100. Plug 100 is formed with the enlarged threaded portion 101 at one end, the portion 102 of smaller diameter at the other end and the intermediate portion 103 of still smaller diameter. The plug 100 has a central passage 104 which extends from the large end past the intermediate portion 103, and the intermediate portion is formed with a plurality of circumferentially spaced ports 105 which extend from the radially outer surface thereof to the central passage 104. A bimetal band 39'' is provided which is like the bimetal band 39 except that it is somewhat smaller in diameter. When the engine is cold, the band 39'' assumes the position shown in Figures 9 and 10 in which it loosely surrounds the intermediate portion of the plug but is confined axially between the end portions. The band 39'' thus does not restrict the flow of oil through ports 105 so that a relatively large volume of oil is supplied to the chamber 25 when the engine is cold. However, when the engine reaches normal operating temperature, the heat is sufficient to contract the band 39'' tightly around the intermediate portion 103 and the length of the band is such that it will close all but one of the ports 105. Thus, under normal operating conditions, a highly restricted flow is permitted to chamber 25 thereby avoiding an excessive buildup of pressure within chamber 25. Otherwise, the Figure 9–10 construction may be like the Figure 1–5 construction with or without the Figure 6 modification.

What I claim as my invention is:

1. A hydraulic tappet assembly comprising a cylinder having one end closed and having a chamber at the closed end thereof, a piston slidably supported in said cylinder and having a chamber therein communicating with the chamber in said cylinder through a port in the end of said piston adjacent the closed end of said cylinder, valve means controlling communication through said port, an inlet port in one side of said cylinder, porting through said piston arranged to connect said inlet port to the chamber in said piston in all positions of said piston relative to said cylinder, and heat responsive means operative to reduce the flow of hydraulic fluid into the chamber in said piston when the temperature of said tappet assembly rises to a predetermined minimum.

2. A hydraulic tappet assembly comprising a cylinder having one end closed and having a chamber at the

closed end thereof, a piston slidably supported in said cylinder and having a chamber therein communicating with the chamber in said cylinder through a port in the end of said piston adjacent the closed end of said cylinder, valve means controlling communication through said port, an inlet port in one side of said cylinder, porting through said piston arranged to connect said inlet port to the chamber in said piston in all positions of said piston relative to said cylinder, heat responsive means operative to reduce the flow of hydraulic fluid into the chamber in said piston when the temperature of said tappet assembly rises to a predetermined minimum, said heat responsive means comprising an element associated with said piston and adapted to partially close said porting when the temperature of said tappet assembly rises to a predetermined minimum.

3. A hydraulic tappet assembly comprising a cylinder having one end closed and having a chamber at the closed end thereof, a piston slidably supported in said cylinder and having a chamber therein communicating with the chamber in said cylinder through a port in the end of said piston adjacent the closed end of said cylinder, valve means controlling communication through said port, an inlet port in one side of said cylinder, porting through said piston arranged to connect said inlet port to the chamber in said piston in all positions of said piston relative to said cylinder, heat responsive means operative to reduce the flow of hydraulic fluid into the chamber in said piston when the temperature of said tappet assembly rises to a predetermined minimum, said heat responsive means comprising a bimetal strip composed of metal having different co-efficients of expansion.

4. A hydraulic tappet assembly comprising a cylinder having one end closed and having a chamber at the closed end thereof, a piston slidably supported in said cylinder and having a chamber therein communicating with the chamber in said cylinder through a port in the end of said piston adjacent the closed end of said cylinder, valve means controlling communication through said port, an inlet port in one side of said cylinder, porting through said piston arranged to connect said inlet port to the chamber in said piston in all positions of said piston relative to said cylinder, heat responsive means operative to reduce the flow of hydraulic fluid into the chamber in said piston when the temperature of said tappet assembly rises to a predetermined minimum, said heat responsive means comprising a bimetal strip carried by said piston adjacent said porting, said strip normally loosely overlying said porting and adapted to warp and partially close said porting when the temperature of said tappet assembly rises to a predetermined minimum, the metals of which said strip is composed having different co-efficients of expansion.

5. A hydraulic valve tappet assembly as defined in claim 4 in which said porting is arranged annularly, and said bimetal strip is a split band.

6. A hydraulic tappet assembly comprising a cylinder having one end closed and having a chamber at the closed end thereof, a piston slidably supported in said cylinder and having a chamber therein communicating with the chamber in said cylinder through a port in the end of said piston adjacent the closed end of said cylinder, valve means controlling communication through said port, an inlet port in one side of said cylinder, porting through said piston arranged to connect said inlet port to the chamber in said piston in all positions of said piston relative to said cylinder, an annular channel in the radially outer surface of said piston into which said porting opens, and heat responsive means operative to reduce the flow of hydraulic fluid into the chamber in said piston when the temperature of said tappet assembly reaches a predetermined minimum, said heat responsive means comprising a split bimetal band in said channel normally loosely overlying said porting and adapted to warp and partially close said porting when the temperature of said

tappet assembly rises to a predetermined minimum, the metals of which said strip is composed having different co-efficients of expansion.

7. A hydraulic tappet assembly as defined in claim 6, in which the ends of said band have rounded corners to prevent said corners from catching on said inlet ports.

8. A hydraulic tappet assembly comprising a cylinder having one end closed and having a chamber at the closed end thereof, a piston slidably supported in said cylinder and having a chamber therein communicating with the chamber in said cylinder through a port in the end of said piston adjacent the closed end of said cylinder, valve means controlling communication through said port, an inlet port in one side of said cylinder, porting through said piston arranged to connect said inlet port to the chamber in said piston in all positions of said piston relative to said cylinder, an annular channel in the wall of the chamber in said piston into which said porting opens, and heat responsive means operative to reduce the flow of hydraulic fluid into the chamber in said piston when the temperature of said tappet assembly reaches a predetermined minimum, said heat responsive means comprising a split bimetal band in said channel normally loosely overlying said porting and adapted to warp and partially close said porting when the temperature of said tappet assembly rises to a predetermined minimum, the metals of which said strip is composed having different coefficients of expansion.

9. A hydraulic tappet assembly comprising a cylinder having one end closed and having a chamber at the closed end thereof, a piston slidably supported in said cylinder and having a chamber therein communicating with the chamber in said cylinder through a port in the end of said piston adjacent the closed end of said cylinder, valve means controlling communication through said port, an inlet port in one side of said cylinder, porting through said piston arranged to connect said inlet port to the chamber in said piston in all positions of said piston relative to said cylinder, and heat responsive means operative to reduce the flow of hydraulic fluid into the chamber in said piston when the temperature of said tappet assembly rises to a predetermined minimum, means providing a passage for delivering hydraulic fluid to said inlet port, porting for connecting said passage to a source of supply of hydraulic fluid, said heat responsive means comprising an element adapted to partially close the last-mentioned porting when the temperautre of said tappet assembly rises to a predetermined minimum.

10. A hydraulic valve tappet assembly as defined in claim 9, said element comprising a bimetal strip the metals of which have different coefficients of expansion.

11. A hydraulic valve tappet assembly as defined in claim 10 in which said last-mentioned porting is arranged annularly, and said bimetal strip is a split band partially overlying said last-mentioned porting and adapted to warp and tightly cover part of said last-mentioned porting when the temperature of said tappet assembly rises to the aforesaid predetermined minimum.

12. A hydraulic tappet assembly comprising a cylinder having a closed end and having a chamber at the closed end thereof, a piston supported in said cylinder for sliding movement from a collapsed position adjacent the closed end of said cylinder to an extended position more remote from said closed end, said piston having a chamber therein communicating with the chamber in said cylinder through a port in the end of said piston adjacent the closed end of said cylinder, valve means controlling communication through said port, and means for preventing the escape of hydraulic fluid from said cylinder and thereby preventing the formation on the internal surface of said cylinder of a film of hydraulic fluid residue, including a retainer secured to said cylinder within the same, said retainer extending across said cylinder beyond the extended position of said piston to preclude interference therewith, a push rod extending into said oppo-

site end of said cylinder for engagement with said piston, said retainer having an opening receiving said push rod, and said piston having a sleeve surrounding said push rod and closely received in the opening in said retainer for movement relative thereto.

13. A hydraulic valve tappet assembly as defined in claim 12 in which said retainer comprises a ring of flexible rubber-like material the radially inner margin of which has a sliding sealing engagement with said sleeve.

14. A hydraulic valve tappet assembly as defined in claim 13 in which said ring has a plurality of circumferentially spaced slits extending radially outwardly from the inner margin thereof.

15. A hydraulic valve tappet assembly comprising a cylinder having a closed end and having a chamber at the closed end thereof, a piston supported in said cylinder for sliding movement from a collapsed position adjacent the closed end of said cylinder to an extended position more remote from said closed end, said piston having a chamber therein communicating with the chamber in said cylinder through a port in the end of said piston adjacent the closed end of said cylinder, valve means controlling communication through said port, said piston having a close sliding fit in said cylinder between said extended and collapsed positions, said cylinder, having an enlarged inside diameter which extends from the opposite end of said cylinder to a point between the positions that the adjacent end of said piston assumes in the extended and collapsed positions of said piston to facilitate the removal of said piston from said cylinder through the opposite end of the latter despite the possible presence of a film of hydraulic fluid residue on the portion of the internal surface of said cylinder of enlarged inside diameter, and means for preventing the escape of hydraulic fluid from said cylinder and thereby preventing the formation on the internal surface of said cylinder of a film of hydraulic fluid residue, including a retainer secured to said cylinder within the same, said retainer extending across said cylinder beyond the extended position of said piston to preclude interference therewith.

16. A hydraulic valve tappet assembly as defined in claim 15 in which the portion of the internal surface of said cylinder of enlarged diameter has an annular shoulder on which said retainer seats, and a snap ring removably carried in an annular groove in the aforesaid portion of the internal surface of said cylinder at the side of said retainer opposite said piston and clamping said retainer against said shoulder.

17. A hydraulic valve tappet assembly as defined in claim 16 including a push rod extending into said opposite end of said cylinder for engagement with said piston, said retainer having a central opening receiving said push rod, said piston having a sleeve surrounding said push rod and closely received in the opening in said retainer for movement relative thereto.

18. A hydraulic valve tappet as defined in claim 17 in which said retainer comprises a ring of flexible rubber-like material the radially inner margin of which has a sliding sealing engagement with said sleeve, said ring having a plurality of circumferentially spaced slits extending radially outwardly from the inner margin thereof.

19. A hydraulic valve tappet assembly as defined in claim 15 in which the portion of the internal surface of said cylinder of enlarged diameter has an annular groove, and in which said retainer has its periphery secured in place in said groove with a press fit, said retainer being in form of a metal ring and serving also as a means for holding said piston in assembled relation with said cylinder.

20. A hydraulic valve tappet assembly as defined in claim 19 including a push rod extending into said opposite end of said cylinder for engagement with said piston, said retainer having a central opening receiving said push rod, said piston having a sleeve surrounding said push rod and closely received in said central opening for movement relative thereto.

21. A hydraulic tappet assembly comprising a cylinder having a chamber at one end thereof, a piston slidably supported in said cylinder, passageway means to said chamber for the admission of hydraulic fluid thereinto, and heat responsive means operative to reduce the flow of hydraulic fluid into said chamber through said passageway means when the temperature of said tappet assembly rises to a predetermined minimum.

22. A hydraulic tappet assembly comprising a cylinder having a closed end and having a chamber at the closed end thereof, a piston supported in said cylinder for sliding movement from a collapsed position adjacent the closed end of said cylinder to an extended position more remote from said closed end, said piston having a close sliding fit in said cylinder between said extended and collapsed positions, said cylinder having an enlarged inside diameter which extends from the opposite end of said cylinder toward and beyond the adjacent end of said piston in the extended position of the latter to facilitate the removal of said piston from said cylinder through said opposite end of the latter despite the possible presence of a film of hydraulic fluid residue on the portion of the internal surface of said cylinder of enlarged inside diameter.

23. A hydraulic tappet assembly comprising a cylinder having a closed end and having a chamber at the closed end thereof, a piston supported in said cylinder for sliding movement from a collapsed position adjacent the closed end of said cylinder to an extended position more remote from said closed end, said piston having a chamber therein communicating with the chamber in said cylinder through a port in the end of said piston adjacent the closed end of said cylinder, valve means controlling communication through said port, said piston having a close sliding fit in said cylinder between said extended and collapsed positions, said cylinder having an enlarged inside diameter which extends from the opposite end of said cylinder to a point between the positions that the adjacent end of said piston assumes in the extended and collapsed positions of said piston to facilitate the removal of said piston from said cylinder through said opposite end thereof despite the possible presence of a film of hydraulic fluid residue on the portion of the internal surface of said cylinder of enlarged diameter.

24. A hydraulic tappet assembly comprising a cylinder having a closed end and having a chamber at the closed end thereof, a piston supported in said cylinder for sliding movement from a collapsed position adjacent the closed end of said cylinder to an extended position more remote from said closed end, said piston having a chamber therein communicating with the chamber in said cylinder through a port in the end of said piston adjacent the closed end of said cylinder, valve means controlling communication through said port, and means for preventing the escape of hydraulic fluid from said cylinder and thereby preventing the formation on the internal surface of said cylinder of a film of hydraulic fluid residue, including a retainer secured to said cylinder within the same, said retainer extending across said cylinder beyond the extended position of said piston to preclude interference therewith, said piston having an extension of reduced cross-section, and said retainer having an opening closely receiving said extension for movement of the latter relative thereto.

25. A hydraulic tappet assembly comprising a cylinder having a closed end and having a chamber at the closed end thereof, a piston supported in said cylinder for sliding movement from a collapsed position adjacent the closed end of said cylinder to an extended position more remote from said closed end, said piston having a chamber therein communicating with the chamber in said cylinder through a port in the end of said piston adjacent the closed end of said cylinder, valve means

controlling communication through said port, and means for preventing the escape of hydraulic fluid from said cylinder and thereby preventing the formation on the internal surface of said cylinder of a film of hydraulic fluid residue, including a retainer secured to said cylinder within the same, said retainer extending across said cylinder beyond the extended position of said piston to preclude interference therewith, said cylinder having an internal annular groove in which the periphery of said retainer is secured in place with a press fit, said retainer

being in the form of a metal ring adapted to receive a push rod, said retainer also serving as a means for holding said piston in assembled relation with said cylinder.

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