

Feb. 4, 1958

G. D. LINE
HYDRAULIC TAPPET

2,821,970

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2 Sheets-Sheet 1

Fig. 1

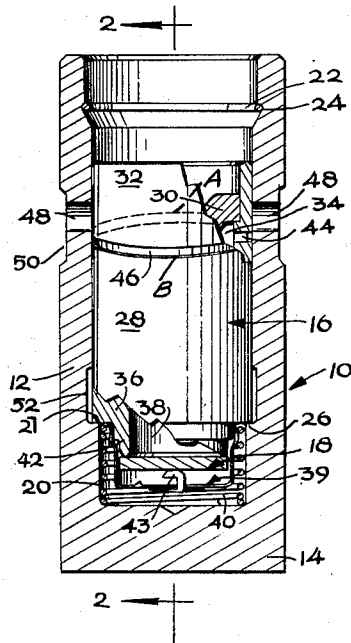
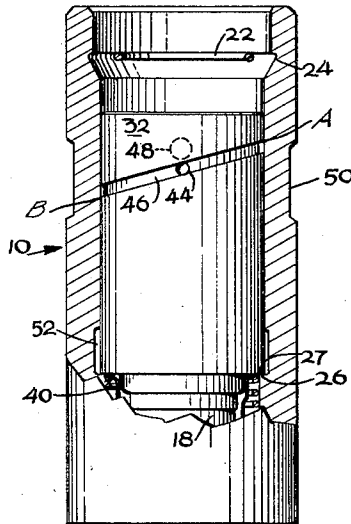


Fig. 2

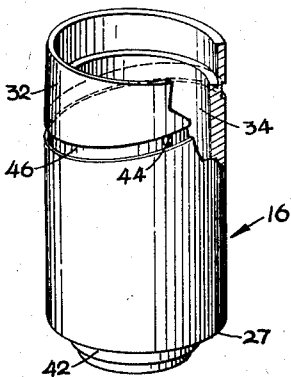


Fig. 3

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Fig. 4

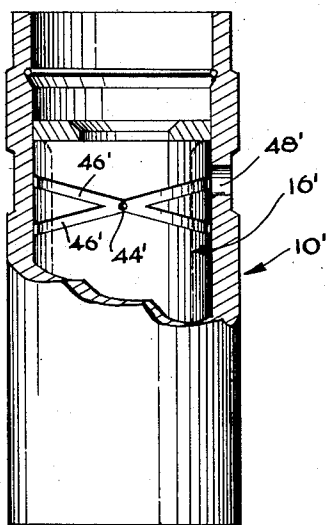


Fig. 5

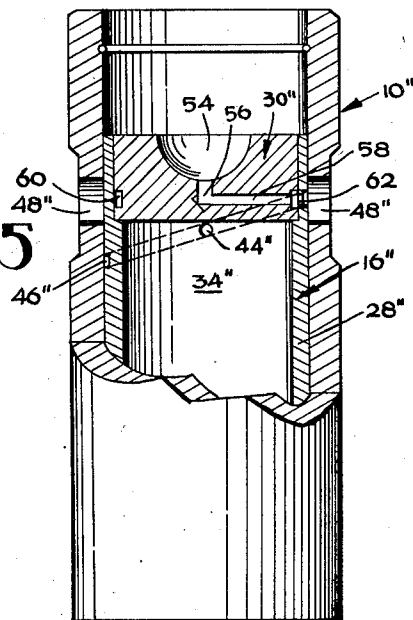
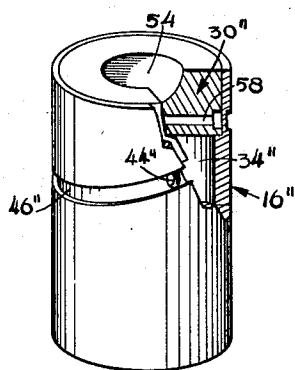


Fig. 6

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HYDRAULIC TAPPET

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19 Claims. (Cl. 123—90)

This invention relates to tappets and more particularly to hydraulic tappets for internal combustion engines.

Broadly the invention comprehends the provision of a hydraulic tappet or lifter of the full hydraulic fluid registration type, for use in a valve gear system of internal combustion engines, which incorporates structure for minimizing hydraulic fluid drainage from the tappet during periods when the engine incorporating said tappet is shutdown, for providing a wiping of varnish deposits from the cooperative surfaces of the body and plunger of the tappet and for providing a maximum available supply of fluid in the plunger.

Full hydraulic fluid registration type hydraulic tappets heretofore devised have had shortcomings in the structure thereof due in part to the fact that because of the particular arrangement of fluid flow communication therethrough, from a source of fluid under pressure, a limited fluid supply is provided in the plunger and a ready drainage of the fluid from said tappet is possible when an engine, incorporating said tappet, is shutdown. Drainage results in noisy starts of the engine when it is again placed in operation after a period when it is shutdown. The presently devised tappet, through the provision of preferably a narrow angular or elliptical annular groove, that is a groove of substantially uniform channel width having an axial extent of communication much greater than its channel width, as part of the plunger or cylinder body construction for the tappet together with appropriate ports in the plunger and body, has materially improved the operating characteristics of tappets of the full hydraulic fluid registration type particularly as relates to drainage and plunger fluid supply.

Among the principal objects of the invention is the provision of a hydraulic tappet of the full fluid registration type, having a narrow elliptical groove on either the external surface of the plunger or internal surface of the body thereof, that;

- a. Is of simple and economical construction;
- b. Eliminates the necessity of providing cooperating annular grooves on the body and plunger of the tappet;
- c. Because of the high and low points of the grooves and with rotation between the plunger and body a wiping free of varnish deposits from the cooperating surfaces of the body and plunger is achieved;
- d. Will shear off varnish deposits, when the plunger bottoms in the body, even though rotation does not occur during a condition of shutdown;
- e. Permits of the placing of the fluid cooperation port in the plunger at the high point therein thus increasing the available supply of fluid in the plunger;
- f. Provides for the communication of supply fluid to the plunger for tappet operation and to the socket of the tappet for subsequent supply to the mechanism of the valve gear system; and,
- g. Provides for communication thereof with appropriate ports in the plunger and body for all operative positions

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of relative angular and axial movement between the plunger and body.

Other objects and advantages of the invention will appear from the following description taken in connection with the drawings forming a part of the specification, and in which:

Fig. 1 is a vertical cross-sectional partly broken away view of a hydraulic tappet, embodying the invention;

Fig. 2 is a cross-sectional view taken substantially along lines 2—2 of Fig. 1;

Fig. 3 is a perspective partly broken away view of the plunger of the tappet shown by Fig. 1;

Fig. 4 is a vertical cross-sectional partly broken away view of a modified form of tappet embodying the basic invention disclosed by Figs. 1 through 3;

Fig. 5 is a vertical cross-sectional partly broken away view of a further modified form of tappet embodying the basic invention hereof; and,

Fig. 6 is a perspective partly broken away view of the plunger of Fig. 5.

This invention was devised primarily for the purpose of providing a novel fluid flow communication construction through the body and plunger of an internal combustion engine hydraulic tappet of the full fluid registration type such as to minimize drainage of the fluid from the tappet when the engine in which employed is shutdown. By the provision of preferably a narrow elliptical groove, that is an annular groove disposed substantially in a plane, angularly disposed to a plane perpendicular to the axis of the tappet, arranged on either the external surface of the plunger or internal surface of the body, the communication through the plunger to the interior of the tappet, for all positions of relative angular movement between the tappet, plunger and body and limited relative axial movement therebetween, is confined to a narrow passageway and at the highest point possible so as to increase an available fluid supply in the plunger. The form of grooving herein provided additionally is very effective to remove varnish deposits which might occur upon the cooperating surfaces of the body and plunger.

The provision of an annular groove as herein devised permits of a simple arrangement for the supplying of fluid through the plunger to a push rod and overhead valve operating mechanism adapted to be operatively associated with the tappet. This is possible by communicating with the elliptical groove at a point remote from the communication through the plunger with the interior of the tappet.

Referring to the drawings for more specific details of the invention 10 represents a hydraulic tappet for incorporation in a valve gear system for internal combustion engines between a cam, not shown, and pushrod, not shown.

The tappet 10 comprises basically a hollow cylindrical body 12 closed at one end 14, a plunger 16 reciprocable in the hollow of the body, a flat check valve 18 supported for engagement with one end of the plunger and a spring 20, arranged in the hollow of the body, axially biasing the plunger outwardly thereof.

A spring clip 22 is appropriately held in an annular groove 24, on the internal peripheral wall of the body 12, for limiting the outward axial movement of the plunger whereas a shoulder 26 formed on the internal periphery of the body is adapted to be engaged by a shoulder 27 on the external periphery of the plunger to limit its opposite axial extent of movement relative to the body.

The plunger 16 consists of two parts, a sleeve member 28 and a cap member 30 appropriately arranged on one end 32 of the sleeve and providing a reservoir or low pressure chamber 34 internally therebetween.

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The end 36 of the sleeve opposite end 32 thereof provides a fluid port or passage 38, communicating with chamber 34 and a high pressure chamber 40 provided between the end 36 of sleeve member 28 and the closed end 14 of the body, adapted to be controlled by flat check valve 18. A combination cage and valve spring structure 39 fixedly mounted on a reduced extension 42 of plunger 16 serves to confine the movement of valve 18 therein as well as normally hold said valve on its seat on the plunger to control port 38. Spring portion 43 of structure 39 is stamped therefrom of spiral form and thus provides openings through the structure to permit communication therethrough with the chamber 40.

Fluid reservoir 34 provided centrally of sleeve member 28 has communication exteriorly thereof by way of port 38 at end 32 thereof and a port 44 provided in the wall thereof. Port 44 is the means by which hydraulic fluid is supplied to the tappet for the operation thereof wherein a relatively narrow, elliptical or angular annular groove 46, on the outer periphery of the sleeve, is connected therewith. Groove 46, as noted from Figs. 1 through 3 of the drawings, lies angularly to a plane arranged perpendicular to the axis of the tappet with its furthest remote axial limits, that is points A and B being substantially circumferentially 180° apart on the outer periphery of the plunger, the purpose of which will hereinafter appear.

A pair of diametrically opposite ports 48 arranged in the wall of body 12 provide communication between the groove 46 and an annular groove 50 arranged on the outer peripheral surface of the body whereby as hydraulic fluid is supplied to groove 50 it can pass in a continuous path through ports 48, groove 46 and port 44 to reservoir 34.

By reason of the provision of groove 46 a confined continuous path or passage for hydraulic fluid is maintained between ports 48 in body 12 and port 44 in plunger 16 for all limits of relative axial and angular movement between the plunger and body. Furthermore because of the angular disposition of groove 46 on the plunger, port 44 is arranged at approximately the highest point of communication possible between the exterior of the plunger and the chamber 34 thus providing a maximum fluid supply in the plunger chamber 34. With the provision of solely one port 44 in plunger 16 communicating by way of the narrow channel confines of groove 46 with port 48 a minimizing of the drainage of the fluid from the tappet is possible under shutdown conditions of an engine in which employed, thereby minimizing the possibility of noisy starts when said engine is placed back in operation.

Due to the wide axial zone covered by groove 46, rotation which normally occurs in operation between the plunger and the body serves to wipe free varnish deposits which might accumulate on the interior surface of body 12. Furthermore, because of the narrowness of groove 46, even though no rotation occurs between the plunger and body during periods of engine shutdown, the plunger will bottom and serve to shear off varnish deposits from the body.

Plunger 16 is bottomed as shown in Figs. 1 and 2 when shoulder 27 of the plunger axially abuts shoulder 26 provided on the interior of the body adjacent an annular groove 52 provided therein.

It will be quite obvious in viewing Figs. 1 through 3 that groove 46 could be equally as well applied to the internal surface of body 12 instead of the external surface of plunger 16 and serve a like efficient purpose.

Fig. 4 illustrates a modified form of tappet 10¹ from that shown in Figs. 1 and 2 wherein a plunger 16¹ is provided on its external surface with a pair of criss-crossed communicating grooves 46¹ with the provision of a port 44¹ through the wall of the plunger at one crossing point of the grooves 46¹. Grooves 46¹ are provided communication to the exterior of the tappet by way of a single

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port 48¹ provided through the wall of body 12¹. Grooves 46¹, port 44¹ and port 48¹ serve a like purpose as the comparable structure of Figs. 1 and 2.

Fig. 5 illustrates a modified form of tappet 10¹¹ from that of Figs. 1 and 2 wherein plunger 16¹¹ includes a sleeve member 28¹¹ and a cap member 30¹¹. Cap member 30¹¹ includes a socket 54 adapted to receive a push rod, not shown, therein, intercommunicating passages 56 and 58 providing communication passageway between socket 54 and an annular groove 60 arranged in the external surface of cap member 30¹¹. Groove 60 is in turn in communication with a port 62 provided in the wall of plunger 16¹¹ and port 62 is in turn in communication with an elliptical groove 46¹¹ provided on the external surface of plunger 16¹¹. Groove 46¹¹ communicates with a chamber 34¹¹ centrally of the plunger by way of a port 44¹¹ and exteriorly of the tappet by way of ports 48¹¹ in the wall of body 12¹¹. Groove 46¹¹ in addition to serving the purpose of providing fluid communication to chamber 34¹¹ from an external pressure source, not shown, by way of port 44¹¹, provides fluid communication to socket 54 by way of port 62, groove 60, passage 58 and passage 56. It is through the angular disposition of groove 46¹¹ on the plunger surface that is possible for it to serve a dual fluid supply communication to socket 54 and chamber 34¹¹ thus eliminating the necessity of an additional groove as is conventionally required.

Likewise as in the structure of Figs. 1 and 2, groove 46¹¹ could equally as well be arranged on the internal surface of body 12¹¹ instead of on the external surface of plunger 16¹¹.

Although the grooves 46, 46¹ and 46¹¹ are disclosed in the specific form of elliptical or angular grooves, it is readily conceivable that numerous modifications thereof could be devised to serve an identical purpose. Accordingly, it is the basic concept hereof, as expressed by the appended claims, that the grooves be of substantially uniform channel width and be so arranged on the plunger or body of such cooperating mechanism as to provide for communication therewith over an axial distance appreciably greater in dimension than the channel width of the groove.

What I claim is:

1. A hydraulic tappet comprising a hollow body having an open end and a closed end, and a plunger reciprocable in said body and providing a thrust transmitting fluid chamber between one end thereof and the closed end of said body, said plunger and body having an annular groove, of substantially uniform width, between cooperating peripheral surfaces thereof extending over an axial extent of said plunger greater than the width of the groove, said plunger and body having several ports in the cooperating wall surfaces thereof registrable with the groove providing for continuous communication between the chamber and the exterior of said body through the ports and groove for predetermined limited relative axial movement and for all positions of relative angular movement between said plunger and body.

2. A thrust transmitting mechanism comprising a hollow cylinder member having an open end and a closed end, and a plunger member reciprocable in said hollow member and providing therebetween with said hollow member a thrust transmitting fluid chamber, one of said members having an annular groove in a peripheral wall surface thereof, cooperating with a peripheral wall surface of the other member, said groove having an annular portion thereof disposed axially closer to one axial end of said member, in which arranged, than another annular portion thereof circumferentially spaced therefrom, said members having ports through the walls thereof registrable with the groove, providing, with the groove, continuous communication between the chamber and the exterior of the body irrespective of relative angular and limited axial movement between the plunger and body.

3. A tappet according to claim 1 wherein means are

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provided for limiting relative axial movement between said plunger and body.

4. A tappet according to claim 3 wherein the axial distance between one axial end limit of the groove and the opposite axial end limit of the groove is greater than the limited relative axial movement between said body and plunger.

5. A tappet according to claim 1 wherein the groove is substantially elliptical.

6. A tappet according to claim 1 wherein the groove lies substantially in a plane offset angularly to a plane perpendicular to the axis of said plunger and body.

7. A tappet according to claim 1 wherein the groove is arranged in the external peripheral surface of said plunger, and wherein the ports include one port in said plunger registrable with the groove and a pair of circumferentially spaced ports in said body registrable with the groove.

8. A tappet according to claim 7 wherein the axis of the ports in said body be substantially in a plane perpendicular to the axis of said body and circumferentially spaced substantially diametrically opposite one another and wherein the opposite axial extremities of the groove are circumferentially spaced substantially 180° apart.

9. A mechanism according to claim 8 wherein the groove is of substantially uniform width throughout its annulus and lies substantially uniformly angularly to a plane perpendicular to the axis of said body and plunger, wherein the groove is arranged on the external peripheral surface of the plunger and wherein the ports comprise, a port in said plunger registrable with the groove and having communication with the chamber and a pair of diametrically opposite ports through the wall of said body registrable with the groove and adapted to have communication with a supply of fluid externally of said body.

10. A mechanism according to claim 2 wherein means are provided for limiting the relative axial movement between said plunger and body, and wherein said annular portions of the groove are axially spaced apart a distance substantially equal to the limit of relative axial movement between said plunger and body and circumferentially spaced apart substantially 180°, such as to provide continuous communication between the ports and groove for all positions of relative axial and rotative movement between said plunger and body.

11. A thrust transmitting mechanism comprising a hollow body having an open end, and a plunger reciprocable in said body and providing therebetween with said body a thrust transmitting fluid chamber, said plunger and body having a continuous circumferential substantially uniform width groove arranged between cooperating peripheral surfaces thereof with one axial extremity of the groove being axially spaced to one side of a plane perpendicular to the axis of said plunger and body and an opposite

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axial extremity of the groove being axially spaced to the opposite side of the plane from the first axial extremity of the groove by a distance greater than the width of the groove, said axial extremities of the groove being circumferentially spaced substantially 180° from one another, and said plunger and body having a combined plurality of ports in their peripheral surfaces registrable with the groove.

12. A mechanism according to claim 11 wherein means are provided for limiting the relative axial movement between said plunger and body, and wherein the groove has communication with the ports for all positions of relative axial and rotative movement between said plunger and body.

13. A mechanism according to claim 12 wherein the groove is arranged in the external peripheral surface of said plunger angularly uniformly disposed to a plane perpendicular to the axis of said plunger, and wherein one of the ports is in said plunger registrable with the groove.

14. A mechanism according to claim 13 wherein a pair of the ports are in said body diametrically opposite one another and registrable with the groove.

15. A mechanism according to claim 13 wherein a second continuous circumferential groove is provided in the external peripheral surface of said plunger arranged in angular crossing relation and communication to the first groove and of substantially like angular disposition as the first groove.

16. A mechanism according to claim 13 wherein said plunger has passageway means therein registrable with the groove and providing communication between an end of said plunger opposite from the thrust transmitting chamber end thereof and the groove.

17. A mechanism according to claim 16 wherein said plunger includes a socket member secured in one end thereof having the passageway means therethrough, and wherein another port is provided in the plunger providing communication between the groove and the passageway means.

18. A mechanism according to claim 17 wherein a pair of the ports are arranged diametrically opposite one another in the body registrable with the groove.

19. A mechanism according to claim 15 wherein said body has a port therein registrable with one of the grooves.

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