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54 **Hydraulic tappet.**

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EP-A- 0 224 666
EP-A- 0 334 064
EP-A- 0 355 360
DE-A- 1 808 000
DE-A- 3 805 002

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Description

The present invention refers to an internal combustion engine having a hydraulic tappet able to prevent any air bubbles which may be present in oil arriving from a lubricating circuit and made to circulate in an outer reservoir, from reaching an inner reservoir and possibly the high pressure chamber, since gases tend to exert an unsteady or prejudicial effect on the supply of oil to the inner reservoir and thence to the high pressure chamber, and therefore also on the compensation of play in the tappet, particularly when the internal combustion engine is restarted after a period of rest.

Hydraulic tappets basically comprise a first element, or outer part engaging a driving cam, an outer reservoir where the oil is first collected, and a second element, or inner part, telescopically moving inside the first element and in contact with the stem of one of the valves of the internal combustion engine. An inner reservoir and a high pressure chamber of variable capacity are formed by the telescopic sliding of the second element within the first element, such high pressure chamber communicating with the inner reservoir by means of a check or ball-valve. The invention is conceived for generally overhead cam drives, where bubbles tend to rise to the parts in the region driven by the cam.

One of the drawbacks of this type of tappet is the fact that the oil reaching first the outer reservoir and then the inner reservoir and the high pressure chamber may contain air bubbles so that there is less oil than needed in the high pressure chamber especially when the engine is restarted and therefore play of the tappet cannot be fully adjusted.

In order to minimise the drawback of gas, e.g. air bubbles in the oil reaching the high pressure chamber, provision is made in prior proposals for a duct drawing in oil from the bottom of the outer reservoir where there is minimum or no air since air tends to rise. Such a duct is usually complicated and costly to make, but the invention aims at improving this kind of duct.

This object is achieved, according to the invention, by an oil tappet according to claims 1 and 2.

DE-A-1 808 000 discloses in Fig 1 a duct 15 for drawing in fluid from the bottom of an outer reservoir 14, but provides, both as described and illustrated, no real inner or central reservoir. Instead, there is at least one annular duct 16 used to collect fluid en route to the high pressure chamber. Furthermore, no help is given to removing air from the fluid reaching this duct 16, because there is no possible escape path for air en route to this working chamber 5. This reference DE-A-1 808 000 makes clear that the Fig 2 embodiment thereof removes air in fluid directed downwards to a second reservoir, but now the advantage of Fig 1 thereof, namely of feed from the bottom of the outer

reservoir, has been lost; also a sharp right-angled change of direction is no longer provided.

Fig 1 as the state of the art, is desirably improved on, in order to draw fluid from the bottom of the outer reservoir, and then to feed it to a higher point in an inner reservoir, so that the direction of its passage onwards to a high pressure working zone, can be relatively downward.

EP-A-224 666 provides an abrupt change of direction in a feed from the bottom of an outer reservoir, but failed to appreciate the advantages of introducing the fluid to the top of an outer reservoir and of monobloc construction of a collar with the housing of the tappet.

By the feed system of EP-A-334 064, belonging to the prior art as an earlier application according to Article 54 (3) EPC, the passage into an inner reservoir is downward, with consequent tendency to drive air bubbles downward, too. Moreover no air-separating abutment is provided in the flow path at this passage.

The state of the art DE-A-1 808 000 is characterized by the inventions of Claims 1 and 2, of which first and second embodiments are described below.

In order to overcome these drawbacks, the present invention, in a first embodiment, features an inclined duct extending from the outside of the inner wall of the outer reservoir towards the inside, and also extending in an upwards direction to a higher point in the inner reservoir, obtained by mechanical working on the known inner annular collar provided in the outer part to separate the outer reservoir from the inner reservoir. This can be obtained by boring a hole in an element projecting from the collar, e.g. using a drill which is introduced from the bottom of the outer part, such introduction being enabled by the fact that the channel forming the outer labyrinth-shaped reservoir is open at the bottom for the mechanical working and is only closed later, after such duct has been made, by addition of an annular base.

According to another embodiment of the present invention, the duct provided in the collar which is positioned between the labyrinth and the receiving seat for the inner reservoir is obtained by making suitable grooves and rebates, for instance by milling, in said inner collar. There is thus provided an L-shaped channel, being a closed portion in the form of a right-angle in co-operation with an insert able to close the bottom of the reservoir as in the first embodiment of the invention, wherein a vertical cylindrical element of the insert fits into the receiving cavity for the telescopically moving inner part and thus can form a vertical guiding wall for the inner part which slides inside the outer one. The vertical cylindrical element thus performs two important functions.

The present invention will now be described in detail with reference to the attached drawings wherein:

Figs 1 and 2 show respectively a vertical cross-

section and an underneath plan view of the outer part of the tappet, according to a first embodiment of the invention; and

Figs 3 and 4 show a vertical cross-section and an underneath plan view of a second embodiment of the invention.

There is known a hydraulic tappet comprising an inner part and an outer part. Between these parts there are defined an outer reservoir, an inner reservoir and a high pressure chamber, respectively. The oil from the lubrication circuit enters the outer reservoir via an inlet and then moves into the inner reservoir flowing through suitable openings. Subsequently, the oil moves into the high pressure chamber as the result of the relative movement of the telescopically moving parts.

The oil flowing from the lubrication circuit to the outer reservoir tends to contain air bubbles which would prejudice the compensating function of the tappet if the bubbles flowed into the inner reservoir and thence into the high pressure chamber. In order to avoid this drawback, the oil in the outer reservoir is transferred to the inner one via a duct which preferably draws it directly from the bottom of the outer reservoir. Since any air bubbles in the oil tend to rise upwards in the outer reservoir, the duct inlet will contain reduced or no air contact. However, this concept has been difficult to put into practice, and the present invention aims to practise it in an easy and economical way.

According to one form of embodiment of the invention (Figs 1 and 2), the outer part 10 of the hydraulic tappet consists of a monoblock provided with an inwardly and upwardly extending inlet duct 12 through which the oil from the lubrication circuit of the internal combustion engine enters. The oil then arrives in the upper region of an outer reservoir 14 and flows through a minimum of 180° along a circular path 16 formed between an outer wall 18 and an inner collar 20 which are integral with the outer part monobloc, and reaches a position on the right hand side as viewed, which side is indicated at 22 in Figs 1 and 2. In a position opposite that of the oil inlet duct 12, the collar 20 provides an abutment 24, which is drilled or other mechanically worked to obtain an upwardly and inwardly inclined duct 26. This working is made possible by the fact that the bottom of the outer annular reservoir comprises an insert 28 consisting of an annular diaphragm which is not present for the working, being mounted only after the inclined duct 26 has been formed. Therefore, before positioning insert 28, it has been made possible for the tip of a drill to be inserted from below in the appropriately inclined direction of the axis 30 of duct 26, in order to enable production of such duct by boring or drilling in an easy and economical way. As shown in Fig 1, the inlet of duct 26 is in the lower part of the outer chamber portion 22 and the outlet of duct 26 is located in the upper

part of a cavity 32 destined to receive the parts intended to form the inner reservoir and the high pressure chamber and intended also to engage the valve stem in a manner compensated for lost motion. By this means, duct 26 enables oil to be drawn in with minimum or zero air bubbles even after long standing before a start-up of the engine. After the inclined duct 26 has been formed, the bottom of the outer reservoir is closed by insert of said annular diaphragm 28, which is made in any suitable material. The inner cylindrical surfaces 36 and 34 of collar 20 define respectively a receiving cavity and a guide for the known telescopically moving parts (not shown) of the hydraulic tappet which form the inner reservoir and the high pressure chamber in known manner.

According to the second embodiment of the invention (Figs 3 and 4) which aims also to achieve the same result, e.g. reduce (air) bubbles reaching the inner reservoir, the function of oil conveying duct 26 of the first embodiment is provided by formation by mechanical working for example by milling, of a vertical groove 38 in the wall of a collar 20 likewise formed as a monobloc with outer part 20 and outer wall 18 and inlet channel 12, said collar 20 generally dividing outer and inner reservoirs 14 and 32. The collar 20 separates an outer reservoir labyrinth 22 from a cavity which receives the telescoping part forming the abutment with the valve stem, the inner reservoir and the high pressure chamber. A radial groove 40 is provided e.g. milled in the lower edge of the collar 20. The grooves 38 and 40 generally perpendicular to each other, together with a preferably metal insert 42 which consists of an upper and axially extending cylindrical sleeve 44 and an annular and radially extending lower flange 46, form a duct, which has a closed portion in the general form of a right-angle, i.e. shaped as a "L", which duct communicates with and draws oil from the bottom of the outer reservoir. The external periphery of the flange 46 is suitably secured to the internal vertical surface 48 of the outer wall 18 of the outer part 10, whereas the external surface of the sleeve 44 fits snugly into the internal bore or cavity formed on the internal surface of collar 20. Therefore, the inner surface of sleeve 44 acts as a guide for the usual telescopically moving parts of the hydraulic tappet.

Claims

1. An oil tappet comprising an outer part (10) for contact with a driving cam, and an inner part for contact with the stem of a valve of an internal combustion engine, said inner part arranged to slide inside the outer part, the two parts together forming an outer reservoir (14,16,22) in which fluid is introduced into a top region (14) thereof, a circular passage (16) extending for at least 180°,

an inner fluid space and a high pressure chamber which can receive fluid from the inner fluid space via a non-return valve, wherein the outer part (10) of the tappet is integrated as a monobloc with an inner annular collar (20) and an outer wall (18), said inner annular collar (20) being generally concentric with the outer wall (18), the base of the outer reservoir (14,16,22) is provided by an insert (28) which comprises an annular diaphragm secured to the inner surface of the outer wall (18) of the outer part (10), and a communication between the said passage (16) of the outer reservoir and the inner fluid space involves an abrupt change of direction and is from an area (22) of the outer reservoir at a low position generally adjacent the base thereof and generally diametrically opposite the oil inlet (12) of the outer reservoir (14), which is achieved by a region (26) of mechanical working on said inner annular collar (20); characterized in that

the communication between the outer reservoir and the inner fluid space is made via a duct (26) provided by an oblique channel (26) mechanically worked in the annular collar (20), this channel (26) extending inwardly and upwardly from said low position in the outer reservoir at the circumferential location where there is an abutment (24), the preparation of such channel having being carried out before the annular diaphragm (28) is mounted.

2. An oil tappet comprising an outer part (10) for contact with a driving cam, and an inner part for contact with the stem of a valve of an internal combustion engine, said inner part arranged to slide inside the outer part, the two parts together forming an outer reservoir (14,16,22) in which fluid is introduced into a top region (14) thereof, a circular passage (16) extending for at least 180°, an inner fluid space and a high pressure chamber which can receive fluid from the inner fluid space via a non-return valve, wherein the outer part (10) of the tappet is integrated as a mono-bloc with an inner annular collar (20) and an outer wall (18), said inner annular collar (20) being generally concentric with the outer wall (18), the base (46) of the outer reservoir (14,16,22) is provided by an insert (42) by reason of an annular diaphragm portion (46) abutting the inner surface of the outer wall (18) of the outer part (10), and a communication between the said passage (16) of the outer reservoir and the inner fluid space involves an abrupt change of direction and is from an area (22) of the outer reservoir at a low position generally adjacent the base thereof and generally diametrically opposite the oil inlet (12) of the outer reservoir (14), which is achieved by a region (38,40) of mechanical working on said inner an-

nular collar (20); characterized in that

the communication between the outer reservoir and the inner fluid space is made via generally axial and radial grooves (38,40); in which,

the insert (42) has a cylindrical sleeve portion (44) which projects axially from the annular base portion (46), wherein said sleeve (44) acts as a guide for the telescopically moving parts of the hydraulic tappet and whereby

the generally axial groove (38) and the generally radial groove (40), together with the cylindrical sleeve (44) and with the annular base portion (46) of the metal insert (42), together form the fluid communication from the base of the outer reservoir, via a generally right-angled change in direction being said abrupt change, to a higher point of the receiving cavity for reaching the parts forming the inner reservoir and the high pressure chamber.

Patentansprüche

1. Ein Ölstößel, der ein Außenteil (10) zum Kontakt mit einem Antriebsnocken und ein Innenteil zum Kontakt mit dem Schaft eines Ventils einer internen Verbrennungsmaschine aufweist, wobei das Innenteil so angeordnet ist, daß es in dem Außenteil gleitet, die zwei Teile zusammen ein äußeres Reservoir (14, 16, 22) bilden, in das Strömungsmittel in eine obere Region (14) desselben eingeführt wird, ein kreisförmiger Durchlaß (16), sich um mindestens 180° erstreckt, und ein innerer Strömungsmittelraum und eine Hochdruckkammer vorgesehen sind, die Strömungsmittel von dem inneren Strömungsmittelraum erhalten kann, und zwar über ein Einwegventil (Nicht-Rückkehrventil), und wobei ferner das Außenteil (10) des Stößels als ein Monoblock mit einem inneren ringförmigen Kragen (20) und einer Außenwand (18) integriert ist, der innere ringförmige Kragen (20) im allgemeinen konzentrisch mit der Außenwand (18) verläuft, die Basis des äußeren Reservoirs (14, 16, 22) durch einen Einsatz (28) vorgesehen ist, der eine ringförmige Membran befestigt an der Innenoberfläche der Außenwand (18) des Außenteils (10) aufweist, und wobei schließlich eine Verbindung zwischen dem Durchlaß (16) des äußeren Reservoirs und des inneren Strömungsmittelraums eine abrupte Richtungsänderung aufweist, und von einem Bereich (22) des äußeren Reservoirs an einer niedrigen Position im allgemeinen benachbart zu dessen Basis und im allgemeinen diametral gegenüber dem Öleinlaß (12) des äußeren Reservoirs (14) verläuft,

was erreicht wird durch einen Bereich (26) mechanischer Bearbeitung an dem inneren ringförmigen Kragen (20);

dadurch **gekennzeichnet**, daß die Verbindung zwischen dem äußeren Reservoir und dem inneren Strömungsmittelraum über eine Leitung (26) hergestellt ist, die vorgesehen ist durch einen schrägen Kanal (26), der mechanisch eingearbeitet ist in den Kragen (20), wobei dieser Kanal (26) sich nach innen und nach oben erstreckt, und zwar von der niedrigen Position in dem äußeren Reservoir an der umfangsmäßigen Stelle, wo einen Anschlag (24) ist, wobei die Herstellung dieses Kanals durchgeführt wird, bevor die ringförmige Membran (28) angebracht wird.

2. Ein Ölstößel der ein Außenteil (10) zum Kontakt mit einem Antriebsnocken, und ein Innenteil zum Kontakt mit dem Schaft eines Ventils einer internen Verbrennungsmaschine aufweist, wobei das Innenteil so angeordnet ist, daß es in dem Außenteil gleitet, die zwei Teile zusammen ein äußeres Reservoir (14, 16, 22) bilden, in das Strömungsmittel in eine obere Region (14) eingeführt wird, ein kreisförmiger Durchlaß (60) sich um mindestens 180° erstreckt, und ein innerer Strömungsmittelraum und eine Hochdruckkammer vorgesehen sind, die Strömungsmittel von dem inneren Strömungsmittelraum aufnehmen kann, und zwar über ein Einweg- oder Nicht-Rückkehrventil, und wobei ferner das Außenteil (10) des Stößels als ein Monoblock mit einem inneren ringförmigen Kragen (20) und einer Außenwand (18) integriert ist, der innere ringförmige Kragen (20) im allgemeinen konzentrisch mit der Außenwand (18) verläuft, die Basis (46) des äußeren Behälters (14, 16, 22), ist vorgesehen durch einen Einsatz (42) durch einen ringförmigen Membranteil (46), der an der Innenoberfläche der Außenwand (18) des Außenteils (10) anstößt, und wobei eine Verbindung zwischen dem Durchlaß (16) des äußeren Reservoirs und dem inneren Strömungsmittelraum eine abrupte Richtungsänderung aufweist, und ausgeht von einem Bereich (22) des äußeren Reservoirs an einer niedrigen Stelle im allgemeinen benachbart zur Basis desselben und im allgemeinen diametral entgegengesetzt dem Öleinlaß (12) des äußeren Reservoirs (14), wobei dies erreicht wird durch einen Bereich (38, 40) einer mechanischen Bearbeitung des inneren ringförmigen Kragens (20);
dadurch **gekennzeichnet**, daß:
die Verbindung zwischen dem äußeren Reservoir und dem inneren Strömungsmittelraum hergestellt ist über im allgemeinen axiale und radiale Nuten (38, 40);
wobei

der Einsatz (42) einen zylindrischen Hülseenteil (44) besitzt, der axial von dem ringförmigen Basisteil hervorspringt, wobei die Hülse (44) als eine Führung für die sich teleskopartig bewegend Teile des hydraulischen Stößels dienen, und wobei

die im allgemeinen axiale Nut (38) und die im allgemeinen radiale Nut (40) zusammen mit der zylindrischen Hülse (44) und mit dem ringförmigen Basisteil (46) des Metalleinsatzes (42) zusammen die Strömungsmittelverbindung bilden, und zwar von der Basis des äußeren Reservoirs über eine im allgemeinen rechtwinklige die erwähnte abrupte Änderung bildende Richtungsänderung, zu einem höheren Punkt des Aufnahmehohlraums zum Erreichen der Teile, die das innere Reservoir und die Hochdruckkammer bilden.

Revendications

1. Un poussoir à huile comprenant une partie extérieure (10) venant en contact avec une came de commande et une partie intérieure venant en contact avec la tige d'une soupape d'un moteur à combustion interne, ladite partie intérieure étant conçue pour coulisser à l'intérieur de la partie extérieure, les deux parties formant ensemble un réservoir extérieur (14, 16, 22) où le liquide est introduit dans une région supérieure (14) dudit réservoir, un conduit (16) suivant un trajet circulaire s'étendant au moins sur 180°, un espace intérieur où passe le liquide et une chambre à haute pression qui peut recevoir du liquide venant dudit espace intérieur à travers une soupape de retenue, dans lequel la partie extérieure (10) du poussoir fait partie d'un ensemble monobloc avec un collet annulaire intérieur (20) et une paroi extérieure (18), ledit collet annulaire intérieur (20) étant d'une manière générale concentrique avec la paroi extérieure (18), la base du réservoir extérieur (14, 16, 22) est constituée par un diaphragme annulaire fixé à la surface intérieure de la paroi extérieure (18) de la partie extérieure (10) et une communication entre ledit trajet (16) du réservoir extérieur et le volume intérieur occupé par le liquide entraîne un changement brusque de direction, à partir d'une zone (22) du réservoir extérieur, d'une position basse généralement adjacente à la partie inférieure de ladite zone, et, dans l'ensemble diamétralement, opposée à l'arrivée de l'huile (12) dans le réservoir extérieur (14), et obtenue avec une région (26) d'usinage mécanique dudit collet annulaire (20) caractérisé par le fait

que la communication entre le réservoir extérieur et l'espace intérieur occupé par le liquide est réalisé au moyen d'un conduit (26) consti-

tué par un canal oblique (26) usiné mécaniquement dans le collet annulaire (20), ledit canal (26) s'étendant vers l'intérieur et vers le haut à partir de ladite position basse dans le réservoir extérieur et située circonférentiellement au point où est prévue une saillie (24), la préparation dudit canal ayant été effectuée avant la mise en place du diaphragme annulaire (28).

2. Un poussoir à huile comprenant une partie extérieure (10) venant en contact avec une came de commande, et une partie intérieure venant en contact avec la tige d'une soupape d'un moteur à combustion interne, ladite partie intérieure étant conçue pour coulisser à l'intérieur de la partie extérieure, les deux parties formant ensemble un réservoir extérieur (14, 16, 22) dans lequel le liquide est introduit dans une région supérieure (14) dudit réservoir, un chenal (16) suivant un trajet circulaire, s'étendant au moins sur 180°, un espace intérieur où passe le liquide et une chambre à haute pression qui peut recevoir du liquide venant dudit espace intérieur à travers une soupape de retenue, dans lequel la partie extérieure (10) du poussoir fait partie d'un ensemble monobloc avec un collet annulaire intérieur (20), ledit collet intérieur étant d'une manière générale concentrique avec la paroi extérieure (18), la base (46) du réservoir extérieur (14, 16, 22) est constituée par une pièce emboîtée (42) avec une partie diaphragme annulaire (46) ajustée à la surface intérieure de la paroi extérieure (18) de la partie extérieure (10), et une communication entre ledit chenal (16) du réservoir extérieur et l'espace intérieur occupé par le liquide entraîne un changement brusque de direction, à partir d'une zone (22) du réservoir extérieur, d'une position basse généralement adjacente à la partie inférieure de ladite zone, et dans l'ensemble, diamétralement opposée à l'arrivée de l'huile (12) dans le réservoir extérieur (14) qui est réalisée avec un usinage mécanique dans une région (38, 40) dudit collet annulaire intérieur (20), caractérisé par le fait
 - que la communication entre le réservoir extérieur et l'espace intérieur occupé par le liquide est réalisée au moyen de rainures d'orientation générale radiale et axiale (38, 40) dans lesquelles,
 - la pièce emboîtée (42) a une partie manchon cylindrique (44) qui s'élève axialement à partir de la partie base annulaire (46), ledit manchon (44) faisant fonction de guide pour les parties du poussoir hydraulique qui se déplacent télescopiquement, quant à
 - la rainure de direction générale axiale (38) et la rainure de direction générale radiale (40), ensemble avec le manchon cylindrique (44) et la

partie base annulaire (46) de la pièce emboîtée métallique (42), elles forment ensemble le trajet de passage du liquide, de la base du réservoir extérieur, à un point plus élevé de la cavité réceptrice, en passant par un changement de direction de configuration générale en angle droit, dit changement brusque de direction, pour atteindre les parties qui constituent le réservoir intérieur et la chambre à haute pression.

Fig. 1

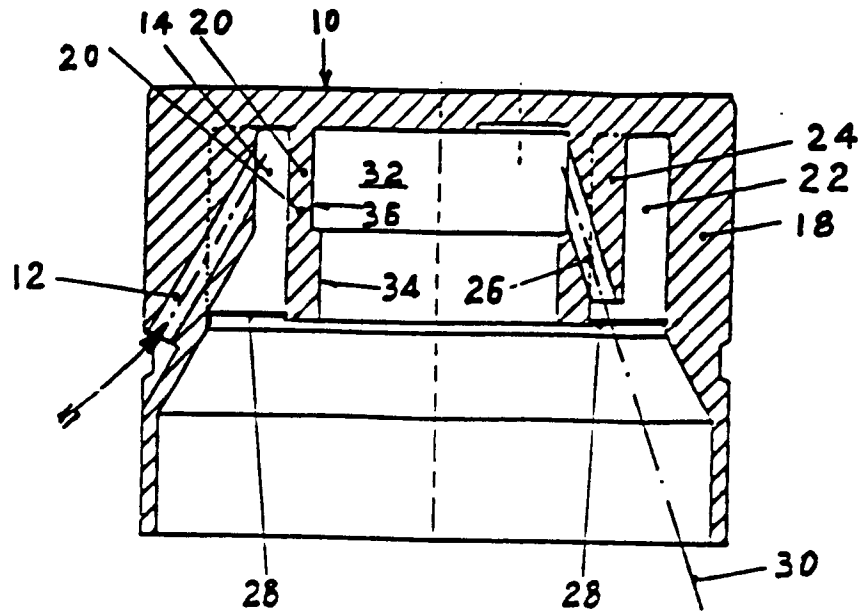


Fig. 2

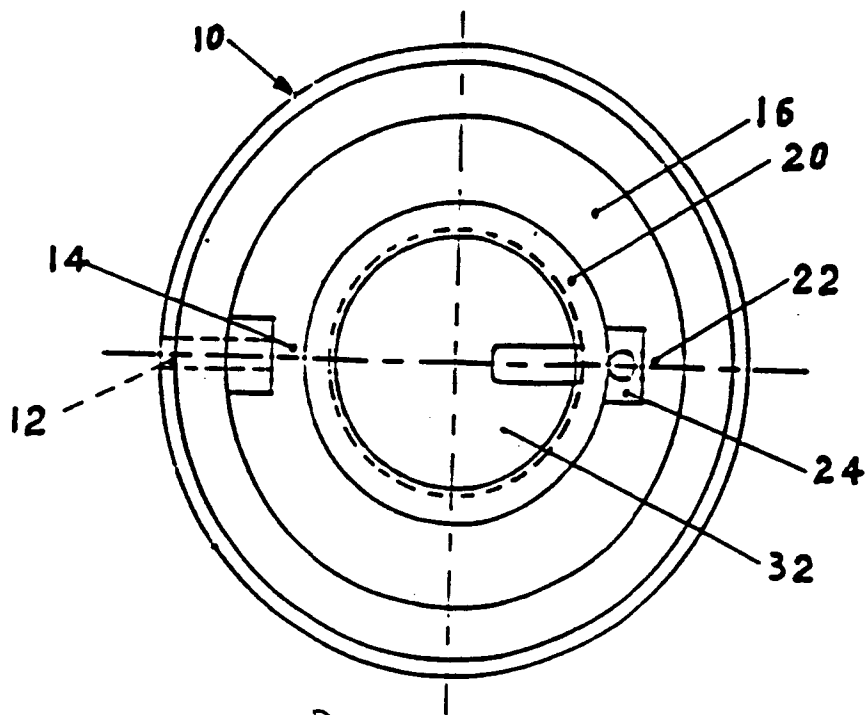


Fig.3

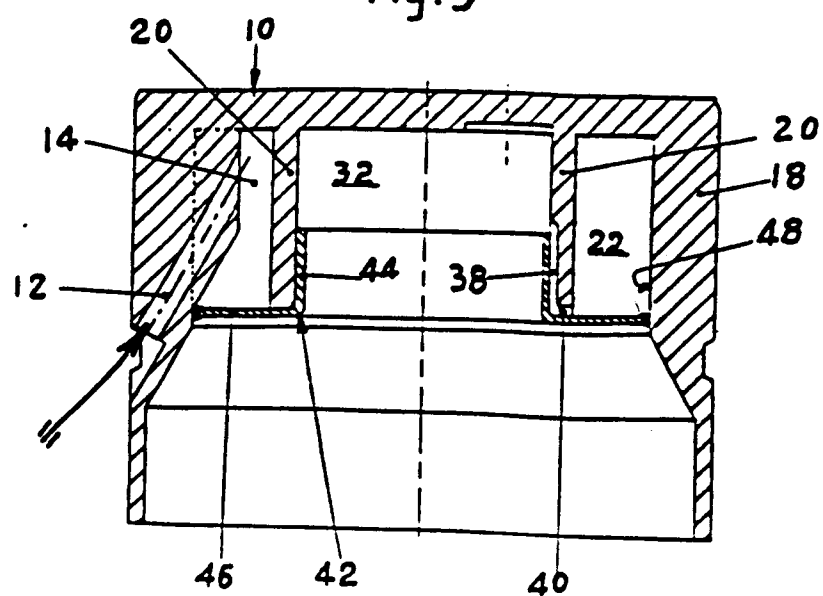


Fig. 4

