June 24, 1941. R. H. DAISLEY 2,247,278

VALVE TAPPET

Original Filed May 4, 1938

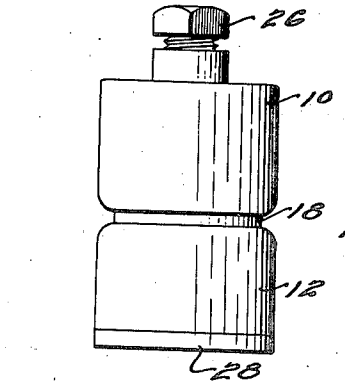


FIG. 1.

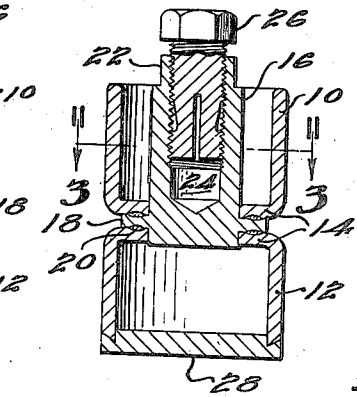


FIG. 2.

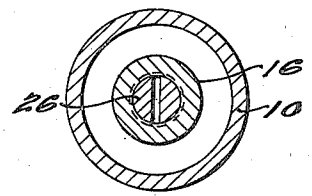


FIG. 2.

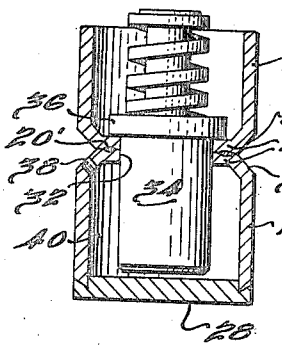


FIG. 4.

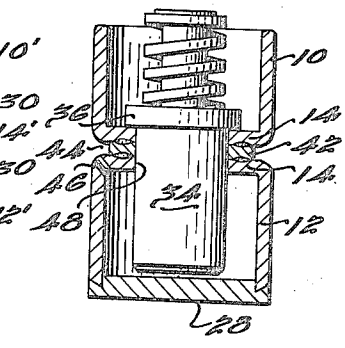


FIG. 5.

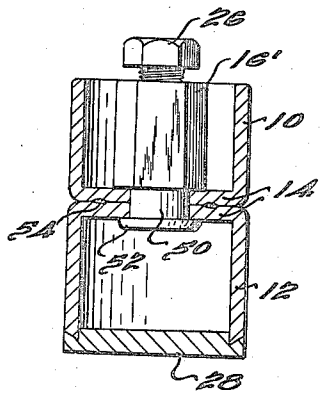


FIG. 6.

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2,247,278

VALVE TAPPET

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Continuation of application Serial No. 206,072, May 4, 1938. This application March 16, 1940, Serial No. 324,440

12 Claims. (Cl. 123—90)

This invention relates to valve tappets for internal combustion engines and particularly to a valve tappet of the so-called barrel type, the principal object being the provision of a highly efficient tappet of this general type that is extremely economical to manufacture. The present application is a continuation of my application for Letters Patent of the United States on the same subject filed May 4, 1938 and serially numbered 206,072.

Objects of the invention include the provision of a valve tappet the main body portion of which is formed principally by a pair of tubular sheet metal members secured together in end-to-end relationship; the provision of a valve tappet of the type described the main body of which comprises a pair of hollow cylindrical members having radially inwardly directed flanges or wall portions at one end thereof, the flanged ends or wall portions of the members being arranged in opposed relationship; the provision of a tappet as above described in which the inwardly turned flanges or walls cooperate to provide a support for a valve clearance adjusting mechanism; the provision of a barrel type valve tappet comprising a pair of cup-shaped members arranged in aligned relation with the bottoms of the cups opposed to one another and being formed for reception of a valve clearance adjusting mechanism or the like, the open end of one of the cups being closed by an end member providing a cam contact face for the tappet; the provision of a barrel type valve tappet comprising a pair of hollow cylindrical tubes each of which is provided with a radially inwardly directed flange at one end thereof, the tubes being arranged with the flanged ends in opposed relationship with an intermediate member therebetween fixed to the flanges of both of said members whereby to secure them into an integral structure and the open end of one of the tubes being closed by a cam contact member; the provision of a structure as above described in which the intermediate member and the cam contact end member cooperate with one of the tubular members to form a hermetically sealed chamber, and the provision of a valve tappet as above described that is simple in construction, efficient in operation and economical to manufacture.

The above being among the objects of the present invention the same consists in certain novel features of construction, combinations of parts and step or steps of operations to be hereinafter described with reference to the accompanying drawing, and then claimed, having the above and other objects in view.

In the accompanying drawing which illustrates suitable embodiments of the present invention and in which like numerals refer to like parts throughout the several different views,

Fig. 1 is a side elevational view of a valve tappet constructed in accordance with the present invention;

Fig. 2 is a vertical sectional view taken axially through the valve tappet shown in Fig. 1;

Fig. 3 is a transverse sectional view taken on the line 3—3 of Fig. 2; and,

Figs. 4, 5 and 6 are views similar to Fig. 2 but illustrating modified forms of construction.

Referring to the accompanying drawing and particularly to Figs. 1, 2 and 3, it will be noted that the main body portion of the tappet there shown is made up of a pair of hollow cylindrical members 10 and 12 each of which is provided with a radially inwardly turned flange or wall 14 at that end thereof opposed to the other member. The members 10 and 12 may also be described as cup-shaped members each having bottoms 14 arranged in opposed relationship. In any event the members 10 and 12 are axially aligned with each other and the inner marginal edges of the flanges or walls 14 bound, or the bottoms 14 are provided with, aligned circular openings which receive one end of a cylindrical post member 16, the post member 16 being provided with a peripheral annular flange 18 which is received between and which abuts against the opposed faces of the flanges or bottoms 14 and is preferably welded thereto as at 20. The post member 16 projects upwardly beyond the upper end of the member 10 where it is flattened off at diametrically opposite sides thereof as at 22 for providing wrench receiving faces. The post 16 is provided with a preferably blind central threaded hole 24 therein for reception of a suitable or conventional valve clearance adjusting screw 26. While any suitable or conventional type of adjusting screw 26 may be employed in conjunction with the present tappet, the screw 26 shown by way of illustration is that shown and claimed in United States Letters Patent No. 2,035,055, granted March 24, 1936 to Harold I. Dyer and owned by the assignee of the present invention, it being of a self-locking type eliminating the necessity of employing a lock nut in connection therewith.

The lower end of the member 12 is closed by an end member 28 suitably welded thereto and providing an axially flat surface for engagement with the usual valve operating cam of an internal combustion engine.

With the construction as thus far described it will be recognized by those skilled in the art that the tappet will be extremely economical to manufacture in that the members 10 and 12 may be formed from sheet metal by a stamping operation although they may be machined out of a solid bar as upon a screw machine if desired. Where formed from stampings they are not of sufficient length to require annealing as an interme-

diate step in the succession of drawing operations is required to form them in accordance with conventional practices. The post member 16 may be formed by a simple screw machine operation and the end member 28 may be formed either in a screw machine or by simply stamping the same out of sheet material. The parts 10 and 12 being supported at their adjacent ends they may be made of relatively light construction and yet the completed article will be extremely rigid. Particularly where the members 10 and 12 are formed from sheet metal it will be apparent that the article will be extremely economical to manufacture as compared to conventional constructions.

The extrenal peripheral surfaces of the members 10 and 12 in service cooperate with a suitable bore in an internal combustion engine to guide the tappet in its reciprocating movements and for this reason it is preferable that these surfaces be of a hardened character to better withstand the wear to which they are subjected to in service. The exposed face of the end member 28 is adapted to directly contact a valve operating cam of an internal combustion engine and have rubbing contact therewith and, accordingly, it is desirable that this surface be of an unusually hard nature.

There are two general methods which may be employed in the manufacture of the valve tappets thus described. According to one of these methods the members 10, 12 and 28 may all be formed of a steel having the characteristic of becoming hardened upon heating and quenching. According to the second method the members 10 and 12 and in some instances the member 28 may be formed of a steel which alone does not have the characteristic of becoming hardened upon heating and quenching but which, in order to obtain this characteristic, must first be carburized or otherwise surface hardened as by nitriding or the like.

In making the tappet according to the first method, inasmuch as the wear to which the members 10 and 12 are subjetced to in service is not nearly as severe as that to which the end member 28 will be subjected to, it is not necessary that the exterior surfaces of the members 10 and 12 be of extreme hardness, although they may be constructed to provide such hardness if desired. Ordinarily it will be suitable if the members 10 and 12 and particularly the wearing surfaces thereof have a hardness of approximately 40 Rockwell, Class C. Under such circumstances any suitable type of steel which upon being heated and quenched will provide such hardness will be satisfactory for use. One example of such steel is that known as S. A. E. #1035 having the following analysis.

Carbon	Manganese	Phosphorus	Sulphur	Balance
Percent 0.30–0.40	*Percent* 0.60–0.90	*Percent* [1] 0.045	*Percent* [1] 0.055	Principally iron.

[1] Maximum.

The end member 28 will preferably have a hardness of approximately 60 Rockwell, Class C or greater and while any steel which will provide such hardness upon heating and quenching will usually be found satisfactory, one example of a satisfactory steel for this use is here set out, it being commercially known as S. A. E. steel #52,100 and having the following analysis.

Carbon	Manganese	Phosphorus	Sulphur	Chromium	Balance
Percent 0.95–1.10	*Percent* 0.20–0.50	*Percent* [1] 0.030	*Percent* [1] 0.035	*Percent* 1.20–1.50	Principally iron.

[1] Maximum.

The post member 16 may be made from the same type of steel as the members 10 and 12 are formed from, namely steel of the general character of the S. A. E. steel #1035 above described, but ordinarily it will not be necessary that the post 16 be of a hardened nature and, accordingly, it will be satisfactory to form it from a steel which does not have the characteristic of becoming hardened upon heating and quenching, this primarily for the purpose of economy in manufacture. As an example of a suitable type of steel for the post 16 when it is not required to be of a hard nature, the analysis of S. A. E. steel #1020 is here set out.

Carbon	Manganese	Phosphorus	Sulphur	Balance
Percent 0.15–0.25	*Percent* 0.30–0.60	*Percent* [1] 0.045	*Percent* [1] 0.055	Principally iron.

[1] Maximum.

It will be understood that in manufacturing the tappet shown in Figs. 1, 2 and 3 according to the first method embodying the use of the materials above described, the members 10, 12, 16 and 28 are all independently formed and are later assembled and secured together. The preferred steps of operation include first assembling the members 10 and 12 in their respective desired locations on the post 16 and welding them in such position as at 20, preferably by a resistance welling operation. The end member 28 is then welded to the open end of the member 12 and it will be noted that this operation hermetically seals the chamber formed by the members 12, 16 and 28. The post member 16 at this stage of operation does not have threaded openings 24 formed therein but is left solid except in those instances where the post member is formed of a material which is hardenable upon heating and quenching in which case it will be necessary to form the opening 24 therein and to thread the walls thereof before the hardening step. With the parts thus assembled and welded together as above described, the entire assembly is heated to the required temperature and then quenched in order to harden the hardenable part thereof. After the hardening operation, where the post 16 has not previously been drilled and tapped the opening 24 will now be formed and threaded, the flats 22 milled, if not previously milled thereon, and the exterior surfaces of the members 10 and 12 and the operative face of the end member 28 suitably ground to bring them to a condition of desired finish.

It is not necessary that the opening 24 be a blind opening as shown but it is preferably blind for the reason that the interior of the chamber formed by the members 12, 16 and 28 is thus hermetically sealed so as to positively prevent the escape of any foreign material therefrom as well as the occurrence of any foreign material therein during the heating and quenching opera-

tion which tends to form scale on any exposed surfaces.

In accordance with the second described method of manufacturing the tappet shown in Figs. 1, 2 and 3 the members 10, 12 and 16 are formed from a steel that does not have the characteristic in and of itself of becoming hardened upon heating and quenching and in such case a steel such as the S. A. E. steel #1020 above described may be employed in the fabrication of the same. However, where the members 10 and 12 are drawn out of sheet metal it may be desirable to form them of a steel having a still lower carbon content, for instance, such as S. A. E. steel #1010 having the following analysis.

Carbon	Manganese	Phosphur	Sulphur	Balance
Percent 0.05–0.15	*Percent* 0.30–0.60	*Percent* [1] 0.045	*Percent* [1] 0.055	Principally iron.

[1] Maximum.

The end member 28 may be made from a hardenable steel such as the S. A. E. steel #52,100 above described or, where it is desired to use a case hardening steel for this member and yet one that will provide the desired surface hardness in the final product, a steel such as S. A. E. steel #3115 may be employed. S. A. E. steel #3115 has the following analysis.

Carbon	Manganese	Phosphorus	Sulphur	Nickel	Chromium	Balance
Percent 0.10–0.20	*Percent* 0.30–0.60	*Percent* [1] 0.040	*Percent* [1] 0.050	*Percent* 1.00–1.50	*Percent* 0.40–0.75	Principally iron.

[1] Maximum.

Where the end member 28 is formed of a hardenable steel, then in accordance with this second method of manufacture the members 10, 12 and 16 are welded together in the manner illustrated, the entire assembly is subjected to a suitable carbonizing operation such, for instance, as packing in bone black and heating, where the opening 24 has not previously been formed in the post 16 then the upper carbonized surface of the post 16 will be machined away, the end member 28 will be welded to the open end of the member 12, the entire assembly heated and quenched to harden the same, and then the opening 24 drilled and tapped. Nitriding or equivalent steps may be substituted for carburizing and quenching if desired. Where the end member 28 is to be formed of steel such as the S. A. E. steel #3115 above described, then it will be welded to the open end of the member 12 before the carbonizing step and its surface will be carburized with the remaining members during the carbonizing operation and, of course, will be hardened upon heating and quenching of the entire unit. Regardless of which method of manufacture is employed in the formation of the tappets shown the operations on both will be identical once the hardening operation has been completed. One feature that will be noted is that regardless of the composition of the various initially independently formed parts of the tappet, during the hardening operation the interior of the member 12 will be hermetically sealed during the hardening operation as well as in service.

In the modified form of construction illustrated in Fig. 4 the two tubular or cup-shaped members 10′ 12′ correspond with the members 10 and 12 previously described in all respects except that the cylindrical body portions thereof in this case are connected to the flanges or bottoms 14′ by a wall section 30 disposed at an angle of approximately 45° with respect to the axis of the tappet, the angular walls 30 of the cooperating members 10′ and 12′ serving to form a peripheral annular groove in the surface of the tappet approximately midway between its length. An end member 28 which may be identical in all respects to the end member 28 previously described is welded to the open end of the member 12′ as indicated. In the construction illustrated in Fig. 4 no post member such as the post member 16 previously described or its equivalent is employed, the flanges, walls or bottoms 14′ being directly welded together in this case as at 20′. The tappets thus far described may be made up of a material for each of its initially independently formed parts corresponding with the material stated for the corresponding parts of the tappet illustrated in the preceding figures.

In eliminating the post member 16 or its equivalent in the construction shown in Fig. 4 the tappet is thus provided with a co-axial cylindrical bore 32. This is provided for reception of a hydraulically actuated automatic valve clearance adjusting mechanism 34, and while in the broader aspects of the present invention the unit 34 may be of any conventional or suitable construction the particular unit 34 shown is described and claimed in the application for Letters Patent of the United States of Carl Voorhies for improvements in internal combustion engines, filed April 14, 1938, Serial No. 202,022, issued Nov. 7, 1939 as Patent No. 2,178,732. The unit 34 includes a cylindrical body portion having an integral flange 36 at its upper end, the flange 36 abutting against the upper face of the flange or bottom 14′ of the upper member 10′ thereby limiting movement of the unit 34 downwardly of the tappet and so as to space the lower end of the unit 34 a short distance above the upper face of the end member 28. In operation the groove formed between the angular walls 30 serves as a means for receiving a suitable source of lubricating oil under pressure which is transmitted thereby to a hole 38 drilled through the angular wall 30 of the lower body portion 12′ of the tappet so as to convey such lubricating oil into the chamber 40 formed between the inner walls of the body portion 12′ and the outer walls of the unit 34, such oil thus forming a reservoir of oil for use in the unit 34 during operation. The members 10′, 12′ and 28 in this form of construction may be made from the same materials as corresponding parts in the first described structure and may be assembled, hardened and otherwise subjected to the same general operations in its manufacture as described in connection with the construction shown in Figs. 1, 2 and 3. It will be appreciated by those skilled in the art that the form of tappet illustrated in Fig. 4 is extremely economical to manufacture, can be manufactured as an exceptionally light structure, yet amply strong for its intended use.

In the modified form of tappet shown in Fig. 5 the tappet is also adapted for reception of an automatic hydraulic valve adjusting unit 34 shown as identical to the unit 34 illustrated in Fig. 4. In the construction shown in Fig. 5 the same cup members 10 and 12 as employed in the construction in Figs. 1, 2 and 3 are also employed, but instead of securing the cup members 10 and 12 directly together as in the construction shown in Fig. 4, an annular spacer or washer-like member 42 is interposed between the flanges or bottoms 14 and is suitably welded thereto as indicated. The spacer member 42 is of less external diameter than the members 10 and 12 so as to form a groove 44, corresponding to the groove formed between the angular wall portions 30 in Fig. 4, for the same purpose, and a hole 46 corresponding to the hole 38 in Fig. 4 is drilled through the wall of the member 12 in communication with the groove 44. The inner marginal edges of the openings in the flanges or bottoms 14 and spacer member 42 cooperate to form a bore 48 for reception of the unit 34, the bore in this case being of greater axial dimensions than in the construction illustrated in Fig. 4. The spacer member 42 may be formed of the same material as the post 16 described in connection with the construction shown in Figs. 1, 2 and 3 and the members 10, 12 and 28 may be formed of materials corresponding to those first described for these parts and the entire assembly manufactured by following the same general steps of manufacture as described in connection with Figs. 1 to 3, inclusive.

In the construction shown in Fig. 6 the same members 10, 12 and 28 are employed as are employed in the construction illustrated in Figs. 1 to 3, inclusive, with the possible exception that in this case the flanges or bottoms 14 are preferably of a greater radial dimension so as to form a smaller central opening centrally thereof. The members 10 and 12 in this case are preferably secured in direct bottom to bottom relationship. The post member 16' in Fig. 6, corresponding to the post 16 described in connection with Figs. 1 to 3, inclusive, may be formed from hexagonal or other non-circular sectioned stock, drilled and tapped at one end for reception of an adjusting screw such as the adjusting screw 26 and at its opposite end formed to provide a projecting pin 50 of a diameter smaller than the post 16' and of such size as to be relatively closely received in the central openings of the flanges or bottoms 14, and that end of the pin 50 which projects into the interior of the lower member 12 is headed over as at 52 so as to clamp the flanges or bottoms 14 tightly together between the main body of the post 16 and the head 52. Ordinarily this heading over operation which serves to rivet the members 10 and 12 together will be sufficient to maintain the relative operative relationship between the members 10 and 12 but it may be found desirable as a matter of safeguard to further secure these members together as by welding, for instance as by a resistance welding operation as at 54.

In the construction shown in Fig. 6 the post 16' may, of course, be constructed of the same material as the post 16 previously described and the members 10, 12 and 28 may be formed of the same material as the members 10, 12 and 28 described in connection with Figs. 1 to 3, inclusive. Likewise these parts may be assembled together, carbonized if required, heated and quenched and otherwise constructed in the same general manner as the tappet illustrated in Figs. 1 to 3, inclusive.

Formal changes may be made in the specific embodiment of the invention described without departing from the spirit or substance of the broad invention, the scope of which is commensurate with the appended claims.

What I claim is:

1. A valve tappet comprising a pair of hollow cylindrical members, inwardly turned wall portions at one end of each of said members, said members being arranged in end to end relationship with the inwardly turned wall portions thereof adjacent and fixed with respect to each other, and an end member secured to and closing that end of one of the first mentioned members opposite the flanged end thereof.

2. A valve tappet comprising a pair of cup-shaped members the bottom wall of each of which is provided with an opening therethrough and fixed with respect to each other with said bottom walls in adjacent relationship, and a cam contact member secured at the open end of one of said cup-shaped members.

3. A valve tappet comprising, in combination, a pair of hollow cylindrical members, inwardly turned flanges at one end of each of said members, said members being arranged in end-to-end and aligned relationship with said flanges adjacent each other, means interposed between said flanged ends spacing said flanges, and a cam contact member fixed with respect to that end of one of said members opposite said flange thereon.

4. A valve tappet comprising, in combination, a pair of hollow cylindrical members arranged in aligned relationship, inwardly directed flanges on said members at adjacent ends thereof, means having a smaller external diameter than said members spacing said flanges whereby to form a peripheral groove intermediate the ends of said tappet, and a cam contact member fixed with respect to that end of one of said members opposite the flanged end thereof.

5. A valve tappet comprising, in combination, a pair of hollow cylindrical members arranged in aligned relationship, a radially inwardly directed flange at one end of each of said members, said flanges being arranged adjacent and fixed with respect to each other, each of said cylindrical members including a portion joining the main body portion thereof with its corresponding flange which portions on both of said members cooperate to form a peripheral groove in said tappet, and a cam contact member fixed with respect to that end of one of said cylindrical members opposite said flange thereon.

6. A valve tappet comprising, in combination, a pair of aligned hollow tubular members arranged in end-to-end relationship, an inwardly directed flange at one end of each of said members, said flanges being arranged in adjacent relationship, a post member centrally disposed with respect to one of said tubular members, said flanges being fixed with respect to said post member, and a cam contact fixed with respect to that end of one of said tubular members opposite said flange thereon.

7. A valve tappet comprising, in combination, a pair of aligned hollow tubular members, an inwardly directed flange at one end of each of said members, said flanges being arranged in adjacent relationship, a post member disposed centrally of one of said cylindrical members, a peripheral flange on said post member interposed

between said flanges on said tubular members and fixed with respect thereto, and a cam contact member secured to that end of one of said tubular members opposite said flange thereon.

8. A valve tappet comprising, in combination, a pair of axially aligned hollow cylindrical members, a radially inwardly directed flange on one end of each of said members, said members being arranged with the flanged ends thereof adjacent to each other, said cylindrical members being formed of a material having the charatceristic of becoming hardened upon heating and quenching, a post member disposed centrally of one of said cylindrical members and fixed with respect to said flanges, said post member being formed of a material having the characteristic of remaining machinable upon heating and quenching, and a cam contact member fixed with respect to that end of one of said cylindrical members opposite said flange thereon.

9. A valve tappet comprising, in combination, a pair of cup-shaped members having apertured bottom walls arranged in end-to-end relationship and with said bottom walls in adjacent relationship, an annular spacer having an opening therein of the same size as and aligned with the openings in said bottom walls interposed between said bottom walls and fixed thereto and serving to space said cup-shaped members with respect to one another, and a cam contact member fixed with respect to the open end of one of said cup-shaped members.

10. A valve tappet comprising a pair of hollow cylindrical members each having an inwardly directed end wall portion, said members being arranged in end-to-end relationship with the inwardly directed end wall portions thereof adjacent and fixed with respect to each other, and an end member secured to and closing that end of one of the first mentioned members opposite the inwardly directed end wall portion thereof.

11. A valve tappet comprising, in combination, a pair of hollow cylindrical members fixed together in end-to-end and concentric relationship, the outer surfaces of said members being of a relatively hard unmachinable nature and the inner portions thereof being of a relatively soft machinable nature, a radially inwardly directed wall portion fixed with respect to said members intermediate the ends thereof, and a cam contact member formed of a material having the characteristic of becoming hard throughout upon heating and quenching fixed to and closing that end of one of said cylindrical members opposite that end thereof which lies in opposed relation to the other of said cylindrical members.

12. A valve tappet comprising a pair of hollow cylindrical members fixed together in end-to-end and concentric relationship, an inwardly directed radial wall portion fixed with respect to both of said members adjacent the opposed ends thereof and an end member secured to and closing the outer end of one of said members.

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