July 5, 1932. A. O. ABBOTT, JR 1,865,998

VALVE OPERATING ASSEMBLY

Filed Oct. 23, 1929

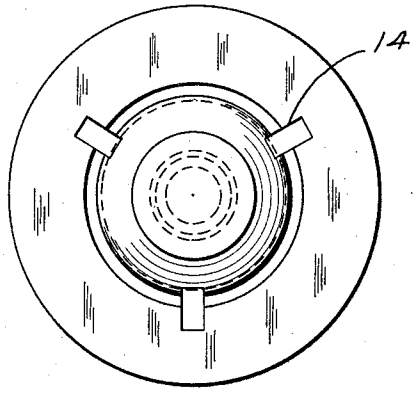


Fig. 4.

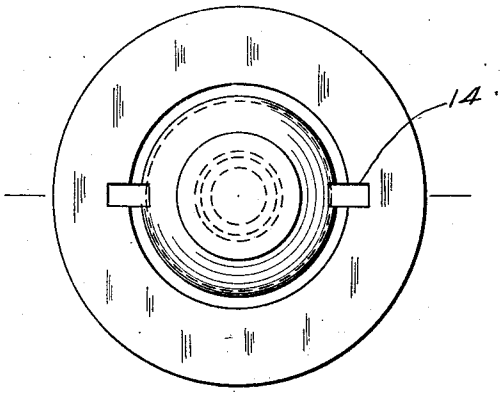


Fig. 1.

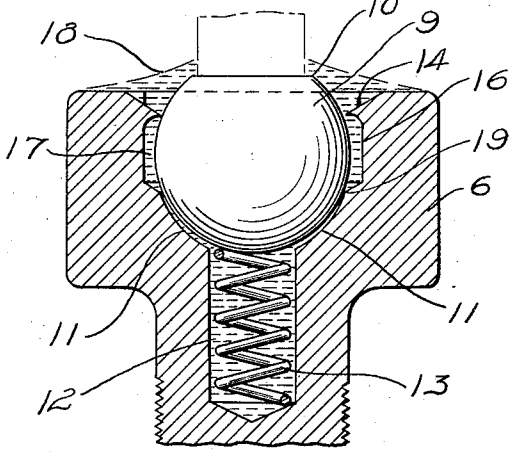


Fig. 2.

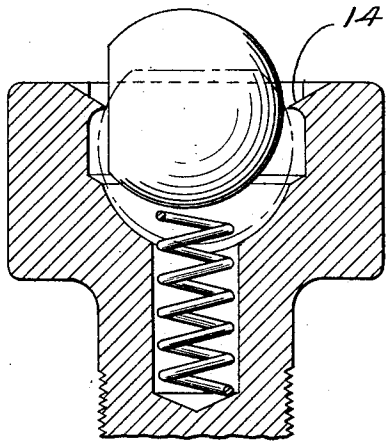


Fig. 3.

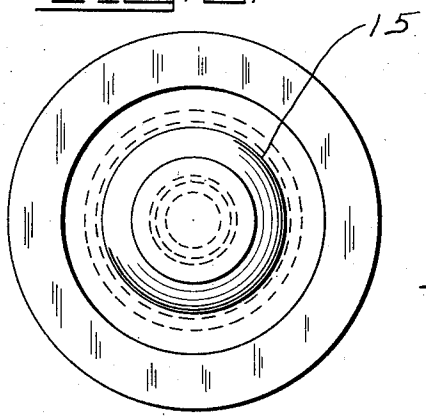


Fig. 6.

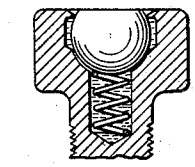


Fig. 5.

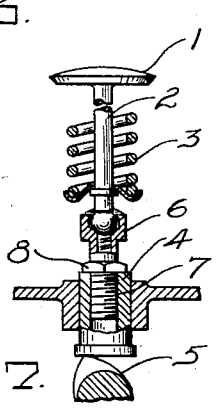


Fig. 7.

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UNITED STATES PATENT OFFICE

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VALVE OPERATING ASSEMBLY

Application filed October 23, 1929. Serial No. 401,658.

This invention has to do with a poppet valve operating construction such as the poppet valves so extensively used in internal combustion engines.

More particularly, the invention is directed towards the provision of a construction designed to minimize the so-called tappet noise which accompanies poppet valves. In this regard the present invention contemplates a construction which embodies the general principles disclosed in my patent application Serial No. 287,194, filed June 21, 1928. The present invention is directed to the provision of an assembled unit embodying, in the main, a ball and socket assembly which can be handled and installed as a unit, thus to facilitate assembling, repairing, replacing, adjusting, or other handling operations, and making it unnecessary to handle the several pieces of the assembly individually.

In the accompanying drawing:

Fig. 1 is a top plan view of a ball and socket assembly as contemplated by the present invention.

Fig. 2 is a vertical section of the same and also illustrating how the same functions in the presence of oil.

Fig. 3 illustrates the method of assembly or disassembly.

Fig. 4 is a top plan view illustrating a modified form.

Fig. 5 is a sectional view of the modified form.

Fig. 6 is a top plan view of a further modified form.

Fig. 7 is an assembly view with some parts in section and others cut, in illustration of a poppet valve and its operating mechanism.

In the application above mentioned there is described and claimed a construction for poppet valve operation which embodies a ball and socket installed in the valve assembly in such a manner that the usual clearance between the valve stem and the tappet takes place between the ball and its socket. Oil is present and enters the space between the ball and socket so that when the ball and socket are forced towards each other in valve lifting operation there is an oil cushion which deadens the noise of the two spaced parts striking each other. The details of the operation need not be gone into further in the present case for the above brief description will suffice herein.

By referring to Fig. 7 a conventional poppet valve is illustrated at 1 having a stem 2 and the valve is acted upon by a spring 3 in such a manner as to seat the valve on a valve seat (not shown). A push rod is shown at 4 which is acted upon by an open cam 5 and associated with the push rod is a valve tappet member 6 preferably arranged for adjustment relative to the push rod as by means of a screw threaded connection therewith as shown in 7 and the employment of a lock nut 8.

This valve tappet member, as will be seen by reference to Fig. 2, is shaped to provide a socket for the reception of a ball member 9 preferably having a flat surface 10 which is hereinafter referred to as a flat-sided ball. The valve stem 2 in the completed assembly contacts with the flat side of the ball.

The ball and socket construction is such that these two members may be mounted together in an assembly and handled and installed as such. The socket member comprises what may be termed a socket proper having curved walls 11 against which the ball is adapted to seat. Also a depression or well 12 may be provided for the reception of a spring 13 arranged to act upon the ball. The walls of the socket member are designed so that the ball may be retained therein and prevented from falling out of the socket when the same is being handled prior to assembly into an engine. For example, the ball may be urged out of the socket by the spring 13, or else even without the spring it would not remain in the socket without holding means. Accordingly, the walls of the socket may be and preferably are designed to extend above the center line of the ball and claws or projections are punched or peened over, the same being illustrated at 14, for the purpose of holding the ball in place. As shown in Fig. 1 two claws may be utilized and positioned oppositely; the distance between the claws is less than the diameter of the ball, and ac-

cordingly, as illustrated in Fig. 2, the ball, in its normal position, cannot get out of the socket member. An advantageous construction, which is also thought to be preferred is to provide the ball so that the dimension across the ball taken from its flat side is less than the distance between the claws. Accordingly, the assembly may be put together as illustrated in Fig. 3 by turning the ball sidewise, thus permitting the ball to enter the socket whereupon it is given a rotary movement to position the flat side upwardly.

In this manner the entire assembly comprising the socket, the spring and the ball, may be made up by the manufacturer and shipped as such to the users, such as automobile manufacturers, and also installed as such. Two or more claws may be utilized and as illustrated in Fig. 4 there are three equally spaced around the periphery edge of the socket. In this form some modification is necessary in order to get the ball in and out of the socket and as shown in Fig. 5, the ball has its flat located closer to its center line in order that its short dimension will be such as to clear the claws.

A further modification is shown in Fig. 6 wherein the entire edge of the socket is turned over as at 15; this may be done by a spinning operation. In this form however, when the assembly is once constructed it cannot be disassembled and in fact the parts must be assembled before the edge is turned over, whereas in the other forms embodying the claws each part including the socket may be in finished form and assembly later made. Further, replacements of any one element in the assembly cannot be accomplished in this form as is can with the others where either the socket, the ball, or the spring may be replaced.

The socket member is designed so as to not follow the curvature of the ball above its center line and to accomplish this the same may be counter-bored as at 16. This provides a pocket 17. The purpose of this will be understood when the reference is made to the operation of the construction.

In a poppet valve assembly in an engine there is a clearance between the valve stem and the valve tappet during the dwell period of the cam and while the valve is seated. This clearance varies in different engines but as a rule the clearance runs around .006 to .008 of an inch. Inasmuch as this clearance is to take place between the ball and the socket it is necessary that the prongs 14 and/or the spun-over edge 15 be positioned so that the clearance between the same on the ball when the ball is seated in its socket is sufficient to take care of this clearance. An advantageous manner of doing this is to allow a clearance between the ball and the prongs or edge 15, when the ball is seated, which will permit the ball to move away from its seat a sufficient distance to take care of any valve tappet clearance. By doing this a sufficient clearance is provided to take care of all of the desired clearance in valve construction whether small or great. For example the construction may permit the ball and seat to separate as much as .02.

In making the assembly, the proper clearance may be had by the use of a suitable gauge disposed between the valve stem and the flat on the ball and adjusting the valve tappet member 6 accordingly.

In the operation of this construction, a quantity of oil becomes associated with the ball and socket. Engines of various types are lubricated in different manners, as by oil vapors, positive oil pumping action, splash system, gravity flow system, or a combination of these, and oil will collect much after the manner illustrated in Fig. 2 and indeed it is found that there will be a deposit of oil as illustrated at 18 which will more or less pile up on the top of the socket member. During the dwell period of the cam, the clearance takes place between the ball and socket as illustrated in Fig. 2 with the flat side of the ball remaining in contact with the valve stem. The spring 13 insures this operation although the spring is not absolutely necessary for this purpose because the flat side of the ball and the stem will tend to adhere to each other even without the spring due to the oil collection. At this time some of the oil flows into the socket, and as the cam lifts the push rod the ball and socket are brought together but are cushioned by a film of oil. There is a tendency then to force the oil out of the socket proper, but this is somewhat restricted due to the fact that the clearance at the point referenced 19 is less than the clearance near the bottom of the socket proper and the ball, and accordingly, a cushion action is assured on account of the egress of the oil being retarded. Accordingly, as the ball and socket repeatedly move toward and away from each other there is an inflow and outflow of oil. The fact that the several parts are made up into a unit assembly by extending the walls of the socket member up above the center line of the ball does not interfere with the flow of oil as the same readily passes through the pocket 17. With the type shown in Fig. 6 wherein the entire edge of the socket member is spun-over there will be a restriction between the ball and this spun-over edge which will affect the in-and-out flow of the oil deposited on the top of the socket member. However, where the clearance between the ball 9 and its seat 11 is not required to be great and provision is made for a relatively greater clearance by the arrangement of the edge of the spun-over part 15 relative to the ball, a flow of oil adequate for providing the cushion effect can be had. In this regard

the pocket 17 may act as a reservoir for supplying the oil for in-and-out flow.

The assembly shown in Fig. 7 is one designed for use in the so-called L-head engine. Some engines employ over-head valves in which event it may be necessary to associate the ball and socket with the valve stem instead of the push rod, but this is merely a reversal of points. The invention is intended to cover the same.

The construction which forms what is termed herein the pocket 17 may vary. The pocket 17 need not necessarily be counterbored below the center line of the ball. On the other hand the walls of the so-called pocket may rise from the center line of the ball without practically a counter-bore; thus the diameter of the pocket above the center line may be substantially equal to the diameter of the ball, or say .002 or .003 of an inch greater than the same. In any event a space is provided above the center line of the ball to permit it to move upwardly into this space and this is what is termed the pocket.

I claim:

1. In a ball and socket assembly adapted for use with valve operating mechanism, a socket, a flat sided ball therein, projections extending from the edge of the socket for holding the ball in the socket, the dimension of the ball diametrically from its flat side being less than the distance between the projections whereby to permit placement and removal of the ball into and out of the socket when the same is turned with its flat portion adjacent a projection and to permit the ball to be retained in the socket when turned with its flat side upwardly as regards the projections.

2. In a ball and socket assembly adapted for use with valve operating mechanism comprising a socket member having a ball seat, a coil spring projecting through the seat, means adjacent the edge of the socket projecting inwardly thereof, a flat sided ball movable in the socket with its flat side adjacent a projection which has a diameter greater than the distance between the projections whereby the socket, ball, and spring are held assembled by the projections when the flat side of the ball is positioned away from a projection.

3. The combination in a poppet valve mechanism wherein there is a poppet valve member and an actuating member for successively moving the valve and wherein a clearance space is provided between the valve member and actuating member between movements of the valve, a ball and socket construction comprising a socket associated with one of the members, a ball associated with the other member, means for holding the ball in the socket but permitting relative movement between the ball and socket which is greater than the clearance effective between the valve member and actuating member whereby said clearance may take place between the ball and socket.

4. For use in poppet valve mechanism in which there is a poppet valve member and a valve actuating member arranged for clearance between the valve member and actuating member between successive valve movements by the actuating member, a socket adapted to be connected to one of said members, a flat sided ball in the socket adapted to engage the other of said members with its flat side when the actuating member acts through the socket and ball for actuating the valve, and means on the socket for normally holding the ball within the socket, said socket having a seat therein for the ball, said holding means being arranged so as to permit the ball to move off its seat in the socket with the relative movement between the ball and socket greater than the clearance between the valve member and actuating mmber whereby said clearance in the operation of the parts may take place entirely between the ball and its seat in the socket.

In testimony whereof I affix my signature.

ADRIAN O. ABBOTT, JR.