F. F. KISHLINE.

THRUST JOINT.

APPLICATION FILED SEPT. 18, 1920.

1,404,444. Patented Jan. 24, 1922.

Fig. 1

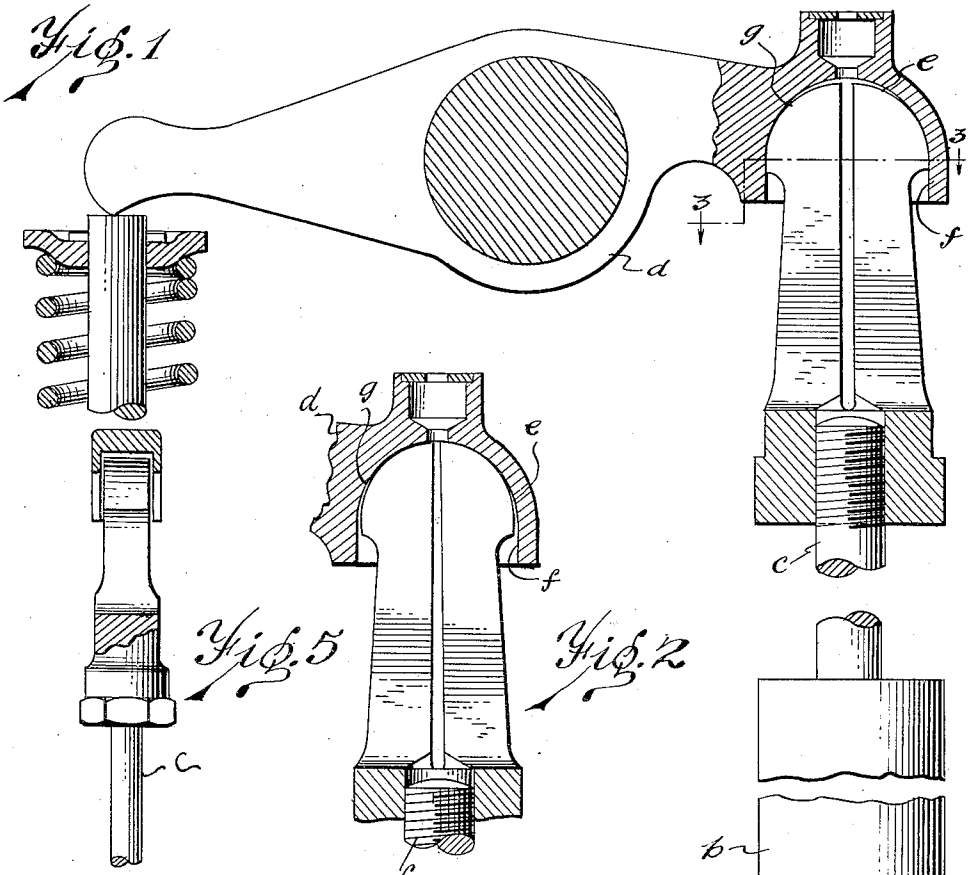


Fig. 5

Fig. 2

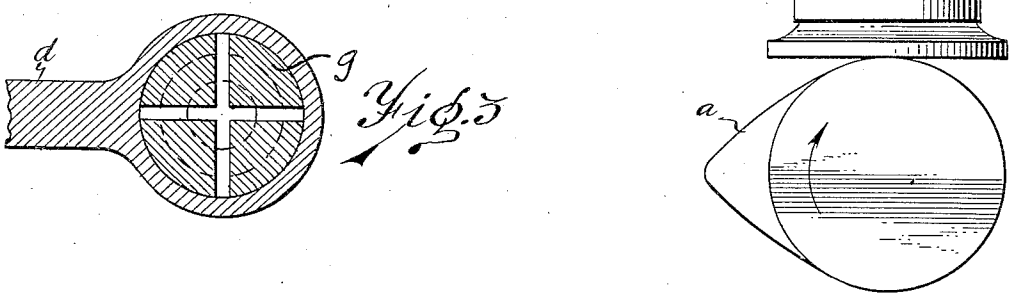


Fig. 3

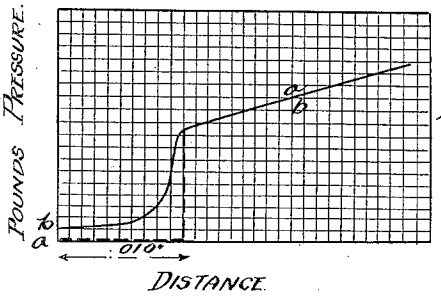


Fig. 4

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FLOYD F. KISHLINE, OF EVANSVILLE, INDIANA, ASSIGNOR OF ONE-HALF TO ERNEST E. WEMP, OF EVANSVILLE, INDIANA.

THRUST JOINT.

1,404,444. Specification of Letters Patent. Patented Jan. 24, 1922.

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To all whom it may concern:

Be it known that I, FLOYD F. KISHLINE, a citizen of the United States, residing at Evansville, in the county of Vanderburgh and State of Indiana, have invented certain new and useful Improvements in Thrust Joints, of which the following is a specification.

This invention relates to a thrust joint where ordinarily some clearance is required between the thrusting member and the thrust member. It is especially applicable to a valve construction on internal combustion motors. It is customary to leave considerable clearance, in the neighborhood of 10/1000ths of an inch, when cold, between the valve stem and the tappet, or in overhead valves between the tappet rod and the rocker arm. This clearance, as is well known, results in annoying noises.

It is the object of the present invention to provide a thrust connection which is especially adaptable for overhead valves but which may be used with almost any valve construction or any place where a thrust joint with clearance is required. This thrust joint is practically noiseless by reason of gradually increasing the resistance from the beginning of the movement of the tappet rod until the rod comes into non-yielding thrust relation with the rocker arm. This will more fully appear in the description following.

In the drawings,—

Fig. 1 shows an example of the thrust joint used in connection with an overhead rocker arm of an internal combustion engine.

Fig. 2 is a view showing the condition of the parts of the thrust joint when the rocker arm is under movement.

Fig. 3 is a section on the line 3—3 of Fig. 1.

Fig. 4 is a chart illustrating roughly the difference in action between an ordinary tappet rod and rocker arm and my thrust joint.

Fig. 5 is a section showing a modified form of joint.

a designates the cam; *b* the tappet; and *c* the tappet rod, which is broadly the thrusting member, while the rocker arm *d* is the thrust member provided with a spherical socket *e* having a cylindrical opening *f* thereinto. The tappet rod head is very similar to the tappet rod heads now in construction except instead of being a member with a solid spherical end it is split part way down by two cross slots into four segments *g*. The end of this thrust head is spherical but of slightly greater diameter when not under stress than the diameter of the spherical socket *e*. This means that the segments are put under a slight initial strain or constriction.

Comparing Figs. 1 and 2, it will be seen that as the thrusting head is actuated by the cam, the line of contact between the thrusting head and the socket wall travels from the point at the side of the socket, as shown in Fig. 1, to the top of the sockets, as shown in Fig. 2, and the segmental portions of the thrusting head are slightly constricted upon each other as clearly indicated in Fig. 2. The strength of the valve spring is greater than the resistance of the segmental portions of the split sleeve thrusting head. Consequently the valve is not opened until the point of contact travels to the top of the thrusting head. Thereupon a non-yielding thrust line is established between the thrusting head and the rocker arm. A continued movement of the thrusting head then lifts the rocker arm and opens the valve.

Instead of a free movement of the thrusting head through the range of clearance and then a sudden striking of the rocker arm, the thrusting head of my improvement is always in contact with the rocker arm or thrust member and as the thrusting member moves through what is ordinarily the range of clearance, it simply has a sliding frictional engagement with the sides of the wall of the socket with a gradually increasing resistance until the line of contact travels to the top of the thrusting head, whereupon an unyielding connection is established between the thrusting head and the rocker arm. This is shown graphically and roughly in Fig. 4, wherein the units in a vertical direction represent pounds of pressure and the units in a horizontal direction represent thousandths of an inch in distance. The difference in action between the ordinary thrust connection and my thrust joint, within the 10/1000ths of an inch ordinarily allowed as clearance, is here clearly shown. The dotted line *a* represents the action of the ordinary tappet rod and rocker arm. *b* illustrates the

action of my thrust joint. It will be seen by reference to the dotted line *a* that the tappet rod head travels through 10/1000ths of an inch without meeting any pressure at all. When it reaches the limit of the clearance it suddenly meets the entire resistance of the valve spring, of course, with the usual clatter accompanying such valve action.

With my improved thrust joint the thrust head is always under some initial resistance, depending upon the amount the diameter of the spherical head exceeds the socket diameter. As the point of contact travels along the spherical surface of the wall socket, this resistance is gradually but slightly increased until near the end of the range of clearance it begins to gradually rise until it meets the valve spring resistance. Instead of a striking hammer-like blow delivered to the rocker arm, there is a gradually increasing resistance or rubbing contact which avoids the objectionable noise present in almost all thrust connections having clearance.

I have not attempted to enumerate all the places that such a joint would be available. It will be obvious that it could be used almost anywhere where a thrust connection with clearance is used.

The joint shown in Fig. 5 is a modified form which uses a part-cylindrical head for the thrusting member and a part-cylindrical socket for the thrust member. The principle of operation is substantially the same as with the spherical head and socket members.

What I claim is:

1. A thrust joint, having in combination, a thrust member provided with a socket, and a thrusting member provided with a thrusting head yieldable transversely but rigid longitudinally, said thrusting head having initially a contact line near the mouth of the socket that gradually travels towards the bottom of the socket as the clearance is taken up during the movement of the thrusting head.

2. A thrust joint, having in combination, a thrust member provided with a socket having sloping walls, and a thrusting member provided with a thrusting head which can be yieldingly constricted transversely but is rigid in the direction of the line of thrust, said thrusting head being adapted to engage the sloping walls of the socket to gradually constrict the thrusting head in taking up the clearance as the thrusting head makes its initial movement.

3. A thrust joint, comprising a thrust member having a socket provided with sloping walls and a thrusting member provided with a thrusting head split into segments, the ends of which are adapted to engage the sloping walls of the socket to gradually constrict the segments upon one another in taking up the clearance in the initial movement of the thrusting member.

4. A thrust joint, having in combination, a thrust member and a thrusting member provided with a thrusting head having a spherical end split into segments, said thrust member provided with a spherical socket, the spherical ends of the segments arranged to engage the spherical ends of the socket to gradually constrict the segments one upon the other in initially taking up the clearance between the thrusting head and the thrust member.

5. A thrust joint, having in combination, a thrust member and a thrusting member, one of said members being provided with sloping walls and the other said member adapted to be flexible transversely but rigid in the direction of thrust and to engage the sloping walls of the first said member to provide a gradually increasing resistance as the clearance in the direction of thrust is taken up between the two members.

6. A thrust joint, having in combination, a thrust member and a thrusting member, one of said members being provided with sloping walls and adapted to be flexible transversely but rigid in the direction of thrust, the other said member being adapted to engage the sloping walls of the first said member to provide a gradually increasing resistance as the clearance in the direction of thrust is taken up between the two members.

In testimony whereof I affix my signature.

FLOYD F. KISHLINE.