May 1, 1956 K. L. HULSING 2,743,712

PUSH ROD AND RETURN SPRING MOUNTING THEREON

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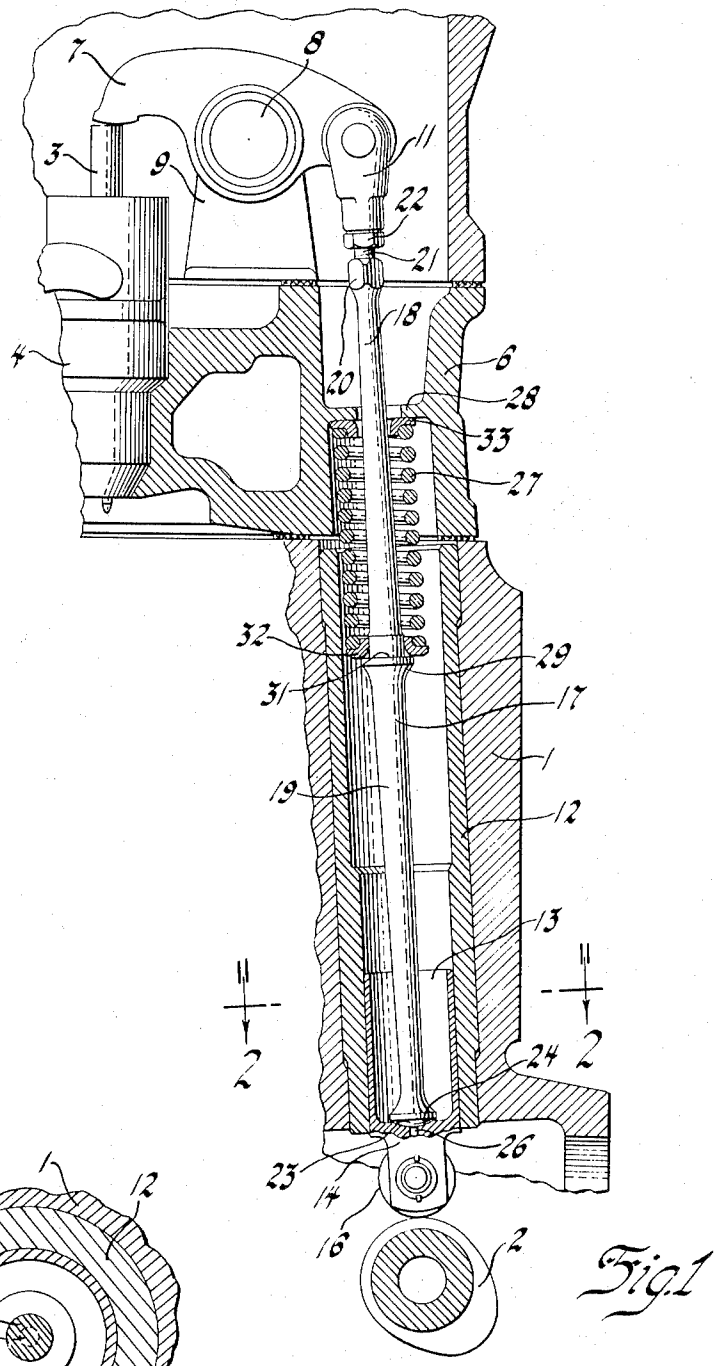


Fig. 1

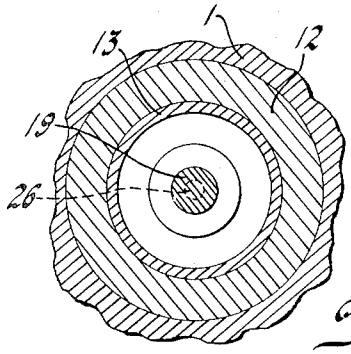


Fig. 2

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PUSH ROD AND RETURN SPRING MOUNTING THEREON

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1 Claim. (Cl. 123—90)

This invention relates to motion translating mechanisms such as are employed for operating fuel injector plungers, poppet valves, etc. of internal combustion engines, and particularly to an improved construction for a push rod and return spring mounting means.

It is well known that a rigid column when loaded in compression has a tendency to buckle and this tendency is particularly pronounced in columns having their ends pivotally supported, such as is the case with conventional engine push rods. Also, the greater the effective length of the column, or the distance between the points of load application thereon, the greater is the tendency toward buckling. In internal combustion engines and the like designed to operate at high speeds, the weight of the push rod is also an important consideration since the forces of its own inertia contribute materially to the applied load.

It is, therefore, one of the objects of this invention to provide an improved design of push rod having the transverse sectional configuration of its shank so proportioned that a uniform stress is obtained throughout its length, resulting in the lightest weight rod for a given axial loading.

A further object of the invention is to provide such a rod together with return spring means therefor in which the force of the spring is transmitted to the rod at a section intermediate and remote from the rod ends, thereby further reducing the necessary weight of the rod and its tendency to buckle in operation, and having the further advantage of providing a more compact assembly of push rod and return spring.

These and other objects are accomplished by means now to be described illustrating a preferred embodiment of the invention, having reference to the attached drawing, wherein:

Figure 1 shows a portion of an internal combustion engine with parts broken away and in section with my improved push rod and spring mounting incorporated therein.

Figure 2 is a sectional view taken on line 2—2 of Figure 1.

Referring to the drawing in detail, the numeral 1 designates the engine cylinder block and crankcase structure in which is suitably mounted a driving member in the form of a cam 2 for operating a driven member such as a plunger 3 of a fuel injector 4 mounted in the cylinder head 6. To transmit the motion of the cam 2 to the plunger 3 there is provided the usual double armed rocker 7 which is arranged to oscillate about an axis provided by the rocker shaft 8 which is supported on a rocker shaft pedestal 9 secured to the cylinder head 6. One arm of the rocker 7 bears against the upper end of the driven plunger 3, and pivotally connected to the opposite arm of the rocker 7 is a link 11 which extends toward the cam 2. Riding on the cam 2 and suitably guided for reciprocable movement, as by the bushing 12 fitted in the cylinder block 1, is a cam follower which in the particular form shown has an upwardly open cup-shape portion 13 from the bottom or end wall of which depends an extension 14 carrying a roller 16 in contact with the operating surface of the cam. Thrustably interconnecting the link 11 and the cam follower is my improved push rod 17.

This push rod has oppositely tapered integral upper and lower sections 18 and 19 having their largest diameters adjacent each other at a distance approximately midway between the extreme ends of the push rod. The tapered upper section 18 is rigidly connected to the link 11 as by an externally threaded stud portion 21 formed integrally with the rod and threaded into the lower end of the link 11. A jam nut 22 on the stud portion 21 is preferably provided to lock the push rod against turning axially of the link 11, and wrench flats 20 are provided on the upper section 18 below the stud portion 21 to facilitate its assembly and disassembly with the link 11, as well as adjustment of the over-all clearance or lash between the plunger 3 and the cam 2.

The lower tapered section 19 of the push rod is thrustably and pivotally conected at its lower end to the cam follower. This connection may be formed, as shown, by providing the lower end of the push rod section 19 with a ball like face 23 which sockets in a correspondingly shaped depression 24 provided in the bottom or end wall of the follower cup portion 13. A small passage 26 leading downward from the center of this depression 24 serves to conduct engine lubricating oil which may collect in the cup 13 to the shaft of the roller 16.

Urging the push rod 17 downwardly to maintain the follower in contact with the cam and the rocker 7 away from the injector plunger 3 is a push rod return spring 27. One end of the spring 27 is retained by a stationary abutment such as the internal flange 28 provided in the push rod opening through the cylinder head 6, and the other end of the spring is retained by an abutment 29 on the push rod. The latter abutment, in accordance with the invention, is located intermediately of the oppositely tapered upper and lower sections 18 and 19. This abutment 29 may be formed, as shown, as an integral enlargement of the push rod diameter to provide a shoulder 31 against which is seated a spring washer 32. A similar spring washer 33 is shown seated against the flange 28 of the cylinder head 6.

By reason of the push rod having its ends oppositely tapered, with the large ends of the tapered sections in adjacent relation, the stiffness of the rod under axial loads is very greatly increased. Hence with rotation of the cam 2 and resultant reciprocal movement of the cam follower, rotation is imparted to the rocker 7 with less tendency of the push rod to buckle than is the case with conventional push rods whose shanks are of substantially constant cross-section throughout their length. Also, by mounting the push rod return spring on the rod at a section approximately midway between the ends of the shank, a substantial reduction in length of the rod subjected to the spring load is effected, resulting in a further lessening of a tendency of the rod to buckle in operation. It will likewise also be appreciated that by lessening the tendency of the push rod to buckle under a given axial loading the weight of the push rod may be substantially reduced. Conversely, with a push rod of given weight, the maximum reciprocating speed to which it may be subjected may be substantially increased by applying the tapered design and spring mounting arrangement of my invention.

It will be appreciated that various minor modification may be made without departing from the spirit and scope of the invention as defined in the appended claim.

I claim:

In a valve actuating mechanism for an internal combustion engine having a cylinder head and a rocker

mounted thereon, said cylinder head including a push rod opening therein and a stationary spring retaining abutment located in said opening above the bottom of said cylinder head, a push rod passing through said opening and operatively connected to said rocker, said push rod having opposite end portions and a shank portion extending between the opposite end portions, said shank portion being oppositely tapered from an enlarged section midway the shank ends, a shoulder formed on the enlarged shank section, and a spring seated at one end against said abutment and at the other end against said shoulder yieldably opposing movement of said push rod toward said rocker.

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