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W. M. ANDERSON.
VALVE ACTUATING ROD FOR INTERNAL COMBUSTION ENGINES.
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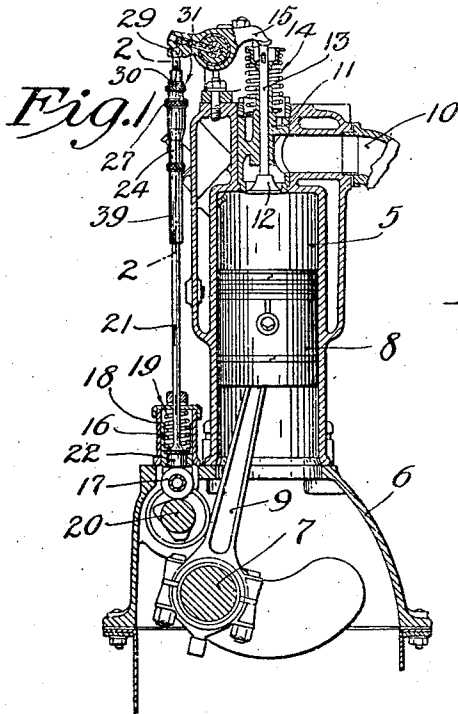


Fig. 2

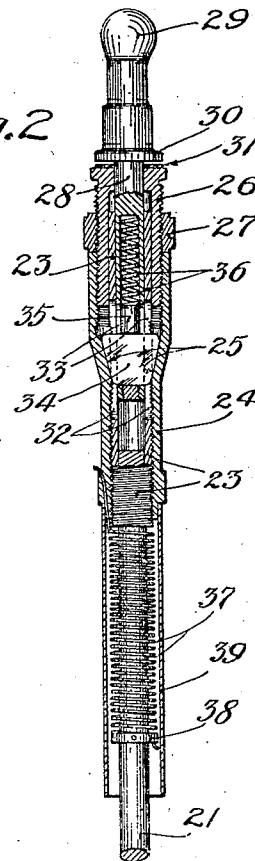


Fig. 3

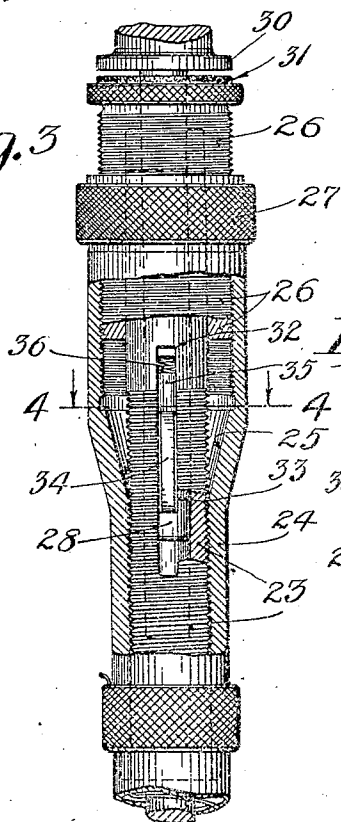
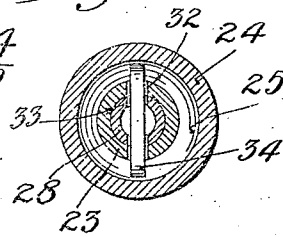


Fig. 4



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UNITED STATES PATENT OFFICE.

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VALVE-ACTUATING ROD FOR INTERNAL-COMBUSTION ENGINES.

Application filed May 7, 1921. Serial No. 467,526.

To all whom it may concern:

Be it known that I, WILLIAM M. ANDERSON, a citizen of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in Valve-Actuating Rods for Internal-Combustion Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My present invention has for its object to provide a simple and efficient automatically adjustable valve-actuating rod for internal combustion engines, and to such ends, generally stated, the invention consists of the novel devices and combinations of devices hereinafter described and defined in the claims.

This improved rod, while capable of more general use, is especially designed for and will be found particularly adapted to engines of the overhead valve type, wherein long rods are interposed between the cam shaft and the rocker arms, that directly act upon the valve.

One of the causes of noise in modern internal combustion engines is due to play between the valve rod and the rockers or similar valve-actuating elements, and this pounding action is not only objectionable because of the noise produced, but because of the increased wear and decreased efficiency caused thereby. These defects are especially noticeable in engines of the overhead valve type.

My invention provides an automatically extensible valve rod or push rod that is entirely mechanical in its operation, that will automatically extend itself to take up all play between the cam shaft and valve, that will, under no circumstance, prevent proper seating of the valve, and which, moreover, will automatically compensate for or take care of those changing conditions caused by expansion and contraction when the engine heats up and cools off. This last noted function is one of the most difficult features to accomplish and one that has rendered many attempts to accomplish the results herein enumerated hitherto impossible.

A commercial form of the improved rod is illustrated in the accompanying drawings, wherein like characters indicate like parts throughout the several views.

Referring to the drawings:

Fig. 1 is a vertical section showing one of the improved valve rods applied to an engine of the overhead valve type;

Fig. 2 is a section through the rod taken approximately on the line 2—2 of Fig. 1, showing the same on a much larger scale than in Fig. 1, some parts being shown in full and some being broken away;

Fig. 3 is a fragmentary view showing a portion of the rod partly in elevation and partly in section; and

Fig. 4 is a section on the line 4—4 of Fig. 3.

The parts of the engine may be briefly noted as follows:

The numeral 5 indicates the engine cylinder; 6 the crank shaft casing, 7 the crank shaft, 8 the piston, 9 the connecting rod, 10 the exhaust port, 11 the valve cage, 12 the exhaust valve, 13 the exhaust valve stem, 14 the valve spring, 15 the rocker arm, 16 the valve lifter equipped with a cam roller 17, 18 the valve lifter guide, 19 the valve lifter spring, and 20 the cam shaft, all of which parts may be assumed to be those of a well known overhead valve type of engine, such, for example, as found in use in the well known Buick automobile.

The term "push rod" will be hereinafter used in a broad sense to include any kind of a valve-actuating rod, which, by end movement or thrust or otherwise, will open a valve. The push rod, is herein illustrated, is applied in the customary place between the valve lifter 16 and the rocker arm 15, and it comprises a main rod 21, which, at its lower end, has a head 22 seated in the valve lifter 16 and pressed downward by the spring 19.

Shrunk onto or otherwise rigidly secured to the upper end of the rod 21 is a tubular externally threaded rod extension 23. Working with threaded engagement on the threaded portion of this tubular rod extension 23 is a sleeve 24, the intermediate portion of which is expanded to form an internal cone surface 25, and the upper portion of which is expanded to afford clearance between the same and the upper portion of the rod extension 23. The expanded upper portion of the sleeve 24 is internally threaded and is engaged by the external threads of a sleeve extension 26 that is adjustably locked to said sleeve 24 by a lock nut 27. The upper portion of the rod ex-

tension 23 is threadless and works telescopically within the sleeve extension 26.

Working slidably through the upper end or head of the sleeve extension 26, and in the tubular rod extension 23, is a rod section 28 that is axially aligned with the rod 21 and is axially adjustable in respect thereto. This rod section 28, at its upper end, has a spherical head 29 seated in the outer end of the rocker arm 15 in the usual way. Above the sleeve extension 26, the rod section 28 has an outstanding stop flange 30 spaced from the opposing upper end or stopping surface of the sleeve extension 26. If desired, a washer 31, of wood fibre or the like, may be placed around the rod 28 in the gap formed between the stop flange 30 and the stop surface of the sleeve extension 26, but this washer should not completely close said gap.

The rod extension 23 has longitudinal slots 32 and the lower end portion of the rod section 28 has a longitudinal slot 33. A flat tapered key or wedge element 34 is placed in the slots 32 and 33 and is engageable with the fractional cone surface 25 of the sleeve 24. The numeral 35 indicates a short plunger placed within an axial seat formed in the rod section 28 and extended to form a seat for a small coiled spring 36. This coiled spring 36, acting through the plunger 35, keeps the wedge key 34 seated against the uncut lower end of the rod section 28.

The numeral 37 indicates a coiled torsion spring that surrounds the rod 21, is anchored at its upper end to the lower end of the sleeve 24, and, at its lower end, is anchored to the rod 21, as shown, directly to a collar 38 on said rod, (see Fig. 2). The numeral 39 designates a light tube that surrounds the torsion spring 37, forming a housing therefor, and is secured to the lower end of the sleeve 24.

Operation.

In first applying the rod, as shown in Fig. 1, the sleeve extension 26 will be screwed into the sleeve 24 until just the right gap, see Fig. 2, is left between the washer 31 and the striking shoulder 30 of the upper rod section 29, and then the nut 27 is tightened to lock the elements 24 and 26 together. The spring 36 and plunger 35, pressing against the wedge 34, will keep the same pressed against the lower portion of the slot 33 in the rod extension 23, and the torsion spring 37 will keep the conical surface 25 engaged with the wedge 34. The spring 36 is of sufficient tension to produce a friction between the wedge and conical surface 25 to lock the sleeve 24 against rotation, but the tension of said spring 36 is not sufficient to overcome the valve spring 14 and, hence, closing of the valve 12 is always insured.

When the cam acts on the rod, the spring

36 will yield, permitting the shoulder 30 to strike the washer 31; (if said washer were not provided, said shoulder 30 would strike the upper end of the sleeve extension 26), and then said rod becomes an unyielding element and will positively open the valve 12 against the tension of its spring 14.

If wear should take place, then, under endwise motion of the rod, the rod section 28 would move slightly outward, thereby increasing the gap between the washer 31 and shoulder 30. This moves the wedge 34 slightly away from the conical surface 25 and thereupon, immediately, the torsion spring 37 rotates the sleeve 24 in a direction to cause the same to extend the length of the rod and again engage the conical surface 25 with said wedge. In practice, of course, the above described movements will not be considerable in extent, but rather infinitesimal and will take place whenever the slightest wear occurs, so that, in practice, or use, a predetermined gap between the washer 31 and shoulder 30 will always be maintained. This gap does not, therefore, vary as the rod is extended, but may be set for any desired amount of clearance required by adjustment of the rod extension 26 in respect to the sleeve extension 24.

The purpose of the gap above noted is to prevent interference with seating of the valve due to expansion and contraction. Without the gap, the rod would be automatically extended, but if the rod should contract when cold, the torsion spring 37 would act to take up the slack produced and then, when the engine is hot, said rod would be extended or expanded by the increasing temperature and would frequently unseat the valve or at least interfere with the tight closing thereof. With the gap, however, whenever expansion of the rod by heat would otherwise tend to unseat the valve, the spring 36 will yield under the greater force of the valve spring 14 and will permit the valve to properly seat. Obviously, the wedge 34 and conical surface 25 co-operate as a friction clutch to hold the internally threaded sleeve 24 against rotation as long as the said wedge is pressed even by very light spring force into engagement with said cone surface.

Normally, the spring 36 will hold said wedge 34 in frictional contact with said cone surface 25, and the lower portion of the rod section 28 will be slightly out of engagement with the lower edge of said wedge. When, however, wear produces play in excess of the predetermined gap between the shoulder 30 and washer 31, the lower portion of said rod section 28 will engage said wedge 34 and release the same from the cone surface 25. This permits the torsion spring 37 to rotate the sleeve 24 so as to take up all play in excess of said predetermined gap.

but as soon as said play is taken up to such extent, the spring 36 will become active to prevent further extension of the composite rod. Thus, the predetermined gap is maintained to the desired extent, say to the extent of four one-thousandths of an inch, and all other play is automatically taken up in the rod.

The gap noted may, therefore, be made only sufficient to take care of expansion and contraction. It has now been observed that the wedge 34 will move out of engagement with the conical friction surface 35 and permit the spring 37 to rotate the sleeve 24 only when play between the parts has permitted the rod section 28 to move outward in the sleeve extension 26, but under all movements produced by expansion and contraction due to varying temperature, the spring 36 keeps the cam 34 in frictional contact with the surface 25 and prevents rotation of the sleeve 24.

From the description given and the statements made, the principles of construction and operation involved in this extensible rod are thought to have been made clear and that it therefore becomes obvious that the invention is capable of a large range of modification.

What I claim is:

1. A valve actuating device comprising extensible sections with co-operating stops on said sections, and a friction clutch operative to follow up and maintain the extending movements of said sections.

2. A valve actuating device comprising extensible sections with co-operating stops on said sections, a friction clutch operative to follow up and maintain the extending movements of said sections, and a yielding element normally maintaining a gap between the stops of said sections.

3. A valve actuating device comprising extensible sections with co-operating stops on said sections, a friction clutch operative to follow up and maintain the extending movements of said sections, and a yielding element normally maintaining a gap between the stops of said sections, and which yielding element reacts on said clutch and holds the same set until the one section is moved in respect to the other in a direction to extend said device.

4. A valve actuating push rod comprising rod sections, the one rod section having a yieldingly pressed wedge and the other rod section having an adjustable sleeve with a clutch surface co-operating with said wedge.

5. A valve actuating push rod comprising rod sections, the one rod section having a yieldingly pressed wedge and the other rod section having an adjustable sleeve with a clutch surface co-operating with said wedge, and the one rod section having a limited contracting movement in respect to the other.

6. A valve actuating push rod comprising rod sections, the one rod section having a yieldingly pressed wedge and the other rod section having an adjustable sleeve with a clutch surface co-operating with said wedge, and the one rod section having a limited contracting movement in respect to the other, said sleeve having a threaded adjustable sleeve extension, said sleeve extension and the other rod section having opposing striking surfaces normally separated to afford a gap.

7. A valve actuating push rod comprising two aligned rod sections, the first having a sleeve working with threaded engagement thereon, a spring tending to rotate said sleeve in a direction to extend the length of the rod and said sleeve having a conical internal clutch surface, a wedge co-operating with said conical clutch surface and seated in said second rod section for axial movement, and a spring seated in said second rod section and normally pressing said wedge into contact with said conical clutch surface.

8. A valve actuating push rod comprising two aligned rod sections, the first having a sleeve working with threaded engagement thereon, a spring tending to rotate said sleeve in a direction to extend the length of the rod and said sleeve having a conical internal clutch surface, a wedge co-operating with said conical clutch surface and seated in said second rod section for axial movement, a spring seated in said second rod section and normally pressing said wedge into contact with said conical clutch surface, and normally separated gap-forming stops connected to the two rod sections and adapted to be engaged under compression of the spring in said second rod section.

9. A valve actuating push rod comprising two aligned rod sections, the first having a sleeve working with threaded engagement thereon, a spring tending to rotate said sleeve in a direction to extend the length of the rod and said sleeve having a conical internal clutch surface, a wedge co-operating with said conical clutch surface and seated in said second rod section for axial movement, a spring seated in said second rod section and normally pressing said wedge into contact with said conical clutch surface, and a sleeve extension having threaded engagement with said sleeve, said sleeve extension and said second rod section having normally separated gap-forming surfaces adapted to be engaged by compression of the spring in said second rod section.

10. In an internal combustion engine, the combination with a valve and a valve-actuating cam, of a cam-operated valve actuating push rod interposed between said cam and valve and comprising rod-forming elements, a clutch normally holding said rod

elements against extending movements, said rod elements having co-operating gap-forming stop surfaces, and a spring incorporated in said push rod normally holding said clutch set and tending to maintain said gap.

11. In an internal combustion engine, the combination with a valve and a valve-actuating cam, of a cam-operated valve actuating push rod interposed between said cam and valve and comprising rod-forming elements, a clutch normally holding said rod elements against extending movements, said rod elements having co-operating gap-forming stop surfaces, a spring incorporated in said push rod normally holding said clutch set and tending to maintain said gap, and a spring operative to extend the rod elements as far as permitted by said clutch.

12. In an internal combustion engine, the combination with a valve and a valve-actuating cam, of a cam-operated valve actuating push rod interposed between said cam and valve and comprising rod-forming elements, a clutch normally holding said rod elements against extending movements, said rod

elements having co-operating gap-forming stop surfaces, and a spring incorporated in said push rod normally holding said clutch set and tending to maintain said gap, the spring in said rod having less tension than that required to open said valve.

13. An extensible valve actuating rod having co-operating stop surfaces, a yielding device operative to normally maintain a predetermined gap between said stop surfaces, and an automatic device operative to take up all play in excess of said predetermined gap.

14. In an engine, the combination with a valve and a cam, of a valve-actuating connection including an extensible valve actuating rod having co-operating stop surfaces, a yielding device operative to normally maintain a predetermined gap between said stop surfaces, and an automatic device operative to take up all play in the valve-actuating connection in excess of said predetermined gap.

In testimony whereof I affix my signature.

WILLIAM M. ANDERSON.