

April 2, 1929.

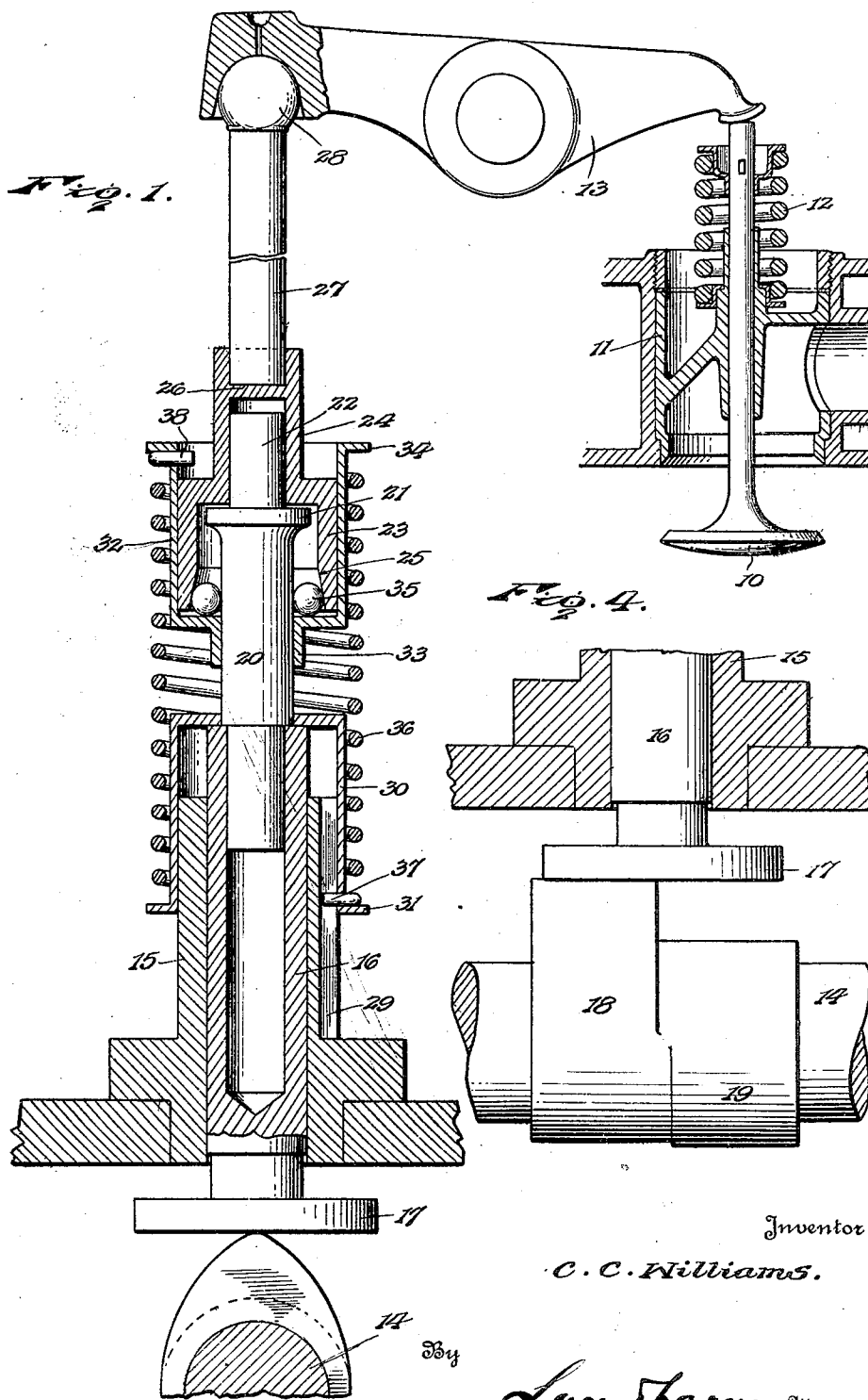
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1,707,244

VALVE ACTUATING MECHANISM

Filed Nov. 26, 1924

3 Sheets-Sheet 1



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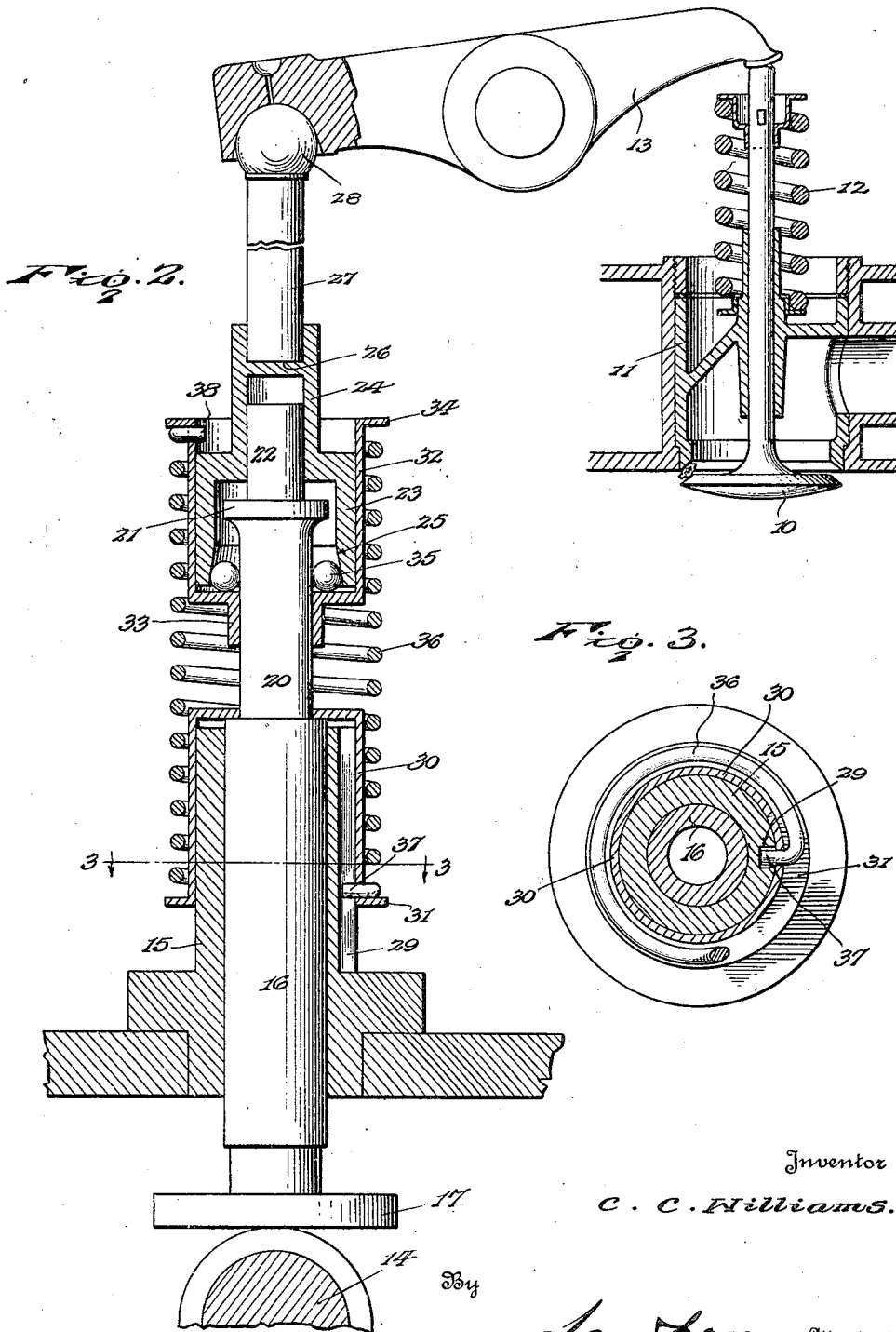
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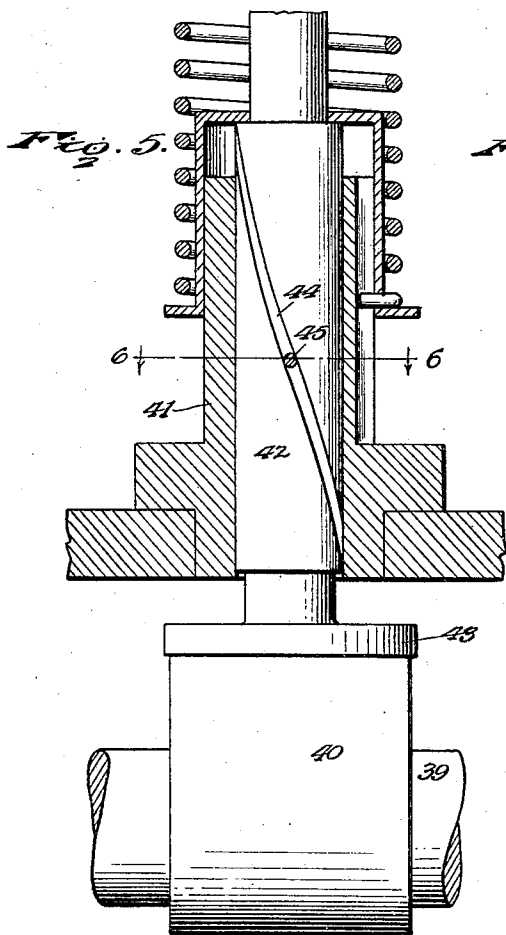


Fig. 6.

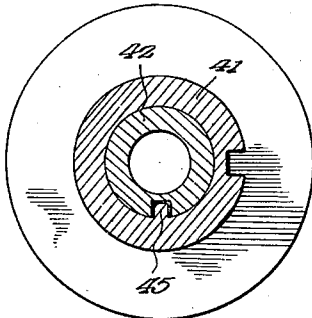
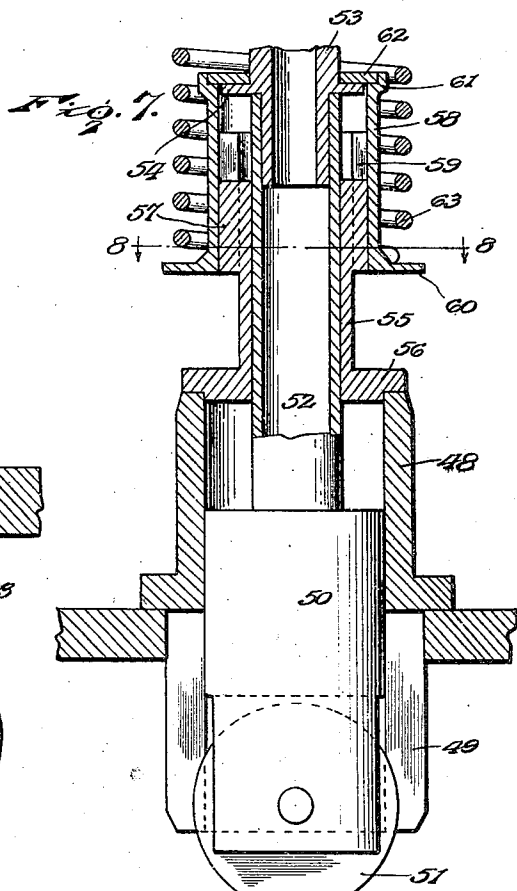
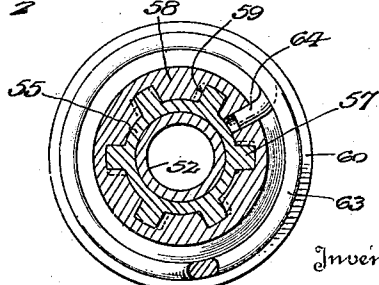


Fig. 8.



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UNITED STATES PATENT OFFICE.

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VALVE-ACTUATING MECHANISM.

Application filed November 26, 1924. Serial No. 752,400.

This invention relates to an improved valve actuating mechanism for internal combustion engines and seeks, among other objects, to provide a mechanism which will be free from the usual noise of overhead valve mechanisms as now in use, and which will also be free from the usual tendency of conventional overhead valve mechanisms to quickly get out of adjustment.

The invention seeks, as a further object, to provide a valve mechanism which will automatically function to take up all undue looseness between the parts but will not hamper the proper movement of the valves.

A further object of the invention is to provide a mechanism embodying a push rod which will, should a valve be prevented from seating, automatically expand to take up lost motion, and which will, when the valve is permitted to seat, automatically contract to its proper length to permit the valve to have its full travel to closed position.

And the invention seeks, as a still further object, to provide a valve mechanism wherein the valve will be opened slightly less than its full throw so that as a consequence, the valve will close before the tappet reaches the end of its down stroke whereby the push rod may freely expand to keep out lost motion and noise.

Other and incidental objects will appear hereinafter.

In the accompanying drawings:

Figure 1 is a vertical sectional view showing my improved valve actuating mechanism in connection with a conventional overhead valve.

Figure 2 is a view similar to Figure 1, but showing the push rod of the mechanism expanded.

Figure 3 is a transverse sectional view on the line 3—3 of Figure 2, looking in the direction of the arrows.

Figure 4 is a detail elevation particularly showing the cam employed for actuating the tappet of the mechanism.

Figure 5 is a fragmentary vertical sectional view showing a slight modification of the invention.

Figure 6 is a transverse sectional view on the line 6—6 of Figure 5, looking in the direction of the arrows.

Figure 7 is a fragmentary vertical sectional view showing a further slight modification of the invention.

Figure 8 is a transverse sectional view on

the line 8—8 of Figure 7, looking in the direction indicated by the arrows.

Referring now more particularly to the drawings, I have, for convenience, shown my improved valve actuating mechanism in connection with a conventional overhead valve 10. Slidably mounting the valve is the usual cage 11 and coacting between the valve and cage is a spring 12 normally holding the valve closed. A conventional rocker is indicated at 13 while a cam shaft is indicated at 14.

In accordance with the present invention, I employ a tappet guide 15 which is rigidly fixed to the engine block above the cam shaft 14, and slidable through the guide is a tappet 16 provided at its lower end with a head 17. Formed on the cam shaft 14 to coact with said head is, as best shown in Figure 4, a cam having a high side 18 and a low side 19 which, as the cam shaft revolves, will alternately engage the tappet at opposite sides of its vertical axis for oscillating the tappet. The tappet is bored axially and rigidly fixed in the upper end of said bore is the lower section 20 of a push rod. Formed on said section is an enlarged annular shoulder 21 while at the upper end of the section is a reduced stud 22. Mounted upon the rod section 20 to surround the shoulder 21 is an inverted cylindrical clutch cup or member 23 having an upstanding sleeve 24 slidably fitting the stud 22 and, as will be observed, the cup is internally chamfered at its lower end to define a conical clutch face 25. Near the upper end of the sleeve 24 is a partition wall defining a socket 26 at the upper terminal of said sleeve, and fixed at its lower end in said socket is the upper section 27 of the push rod, which section is provided at its upper end with a ball head 28 to fit in the usual socket at the adjacent end of the rocker 13.

Formed in the tappet guide 15 at its outer side is a vertical slot 29 and slidably fitting over the guide to rest against the upper end of the tappet 16 is a spring seat or cap 30 provided at its lower end with an annular flange 31. Slidably fitting over the clutch cup 23 is a similar spring seat or cap 32 provided at its lower end with a sleeve 33 slidably fitting the rod section 20 while at its upper end said seat is formed with an annular flange 34. Resting upon the bottom of the seat 32 within the lower end of the clutch cup is a series of clutch

balls 35 surrounding the rod section 20 to coact between the said section and the clutch face 25 of the cup 23. Freely surrounding the spring seats 30 and 32 to coact therebetween is a spring 36, the lower end of which bears against the flange 31 of the former seat while the upper end of the spring bears against the flange 34 of the latter seat. The free end of the lower convolution of the spring is bent to define an inwardly directed terminal 37 which extends through an opening in the seat 30 and is slidably accommodated in the slot 29 of the tappet guide 15 while the upper convolution of the spring is bent at its free end to form a similar terminal 38 extending through an opening in the seat 32 above the clutch cup 23. Thus, the terminal 37 of the spring will coact with the tappet guide 15 for locking the spring seat 30 as well as the spring against rotation so that the spring will, in turn, function, through the medium of the terminal 38 at the upper end thereof, to lock the spring seat 32 against rotation. At the same time, the spring will bear downwardly against the spring seat 30 for holding the tappet 16 constantly in contact with its actuating cam and will also constantly tend to shift the seat 32 upwardly along the rod section 20 and hold the series of balls 35 in contact with said rod section and the clutch face 25 of the cup 23. However, as will be perceived, the spring may freely move vertically as a unit with the rise and fall of the tappet 16.

Assuming now that the tappet 16 is raised, the up-thrust on the rod section 20 will cause the clutch balls 35 to jam between said rod section and the clutch face 25 of the cup 23 to thus provide a rigid connection between the sections 20 and 27 of the push rod so that the thrust of the tappet will be directly communicated to the rocker 13 for opening the valve 10. However, attention is directed to the fact that when the valve is opened, the valve spring 12 is, of course, brought under increased tension while, as the tappet is raised and lowered, the tappet will be turned slightly, as previously explained, to impart a corresponding turning movement to said rod section 20. Turning of the rod section 20 will cause the balls 35 to roll and, due to the increased downward pressure exerted on the balls by the increased tension of the valve spring, the balls will be caused to roll downwardly, substantially in a spiral path, around the rod section. The push rod will, therefore, be caused to contract or, in other words, will be shortened a corresponding amount, say a few thousandths of an inch, so that the valve will not be fully opened by a like amount of its travel. Therefore, when the tappet 16 is lowered, the valve

will seat slightly before the tappet reaches the end of its down stroke. As soon as the valve seats and the pressure of the valve spring against the rocker is relieved, the spring 36 will expand for raising the spring seat 32 and accordingly lifting the balls 35 and clutch cup 23 along the rod section 20 so that the ball head 28 of the rod section 27 will be pressed into the socket of the rocker 13. Thus, the push rod will automatically expand to keep out all noise as well as all unnecessary play between the parts. Should the valve be prevented from seating, as by the lodgement of a piece of carbon on the valve seat, as shown in Figure 2, it is obvious that the push rod will expand to take up the lost motion which would otherwise occur between the push rod and rocker as well as between the rocker and the valve. Furthermore, when the grain of carbon is dislodged, the push rod will, as will be clear in view of the foregoing, automatically contract a corresponding amount. Compensation for any variation in the closing travel of the valve will thus be automatically made while at no time will any undue looseness be present to cause wear or rattling. The shoulder 21 on the rod section 20 is, of course, provided to coact with the balls 35 for limiting the spring seat 32 in its upward travel.

In Figures 5 and 6 of the drawings, I have illustrated a slight modification of the invention embodying a slightly different means for rotating the tappet. A cam shaft is conventionally indicated at 39 and a conventional cam on the shaft at 40. In this modified structure, I employ a tappet guide 41 which is fixed to the engine block and slidable through the guide is a tappet 42 provided at its lower end with a head 43 to coact with the cam 40. Formed in the tappet is a helical slot 44 and formed on the tappet guide 41 or otherwise fixed thereto is a stud or key 45 slidably engaging in said slot. Thus, the tappet will be oscillated as the tappet rises and falls. Otherwise, this modified structure is identical with the preferred form of the invention.

In Figure 7 of the drawings, I have illustrated a further modification of the invention wherein, instead of rotating the tappet, as shown in Figure 5, the spring seats of the push rod are rotated. A conventional cam shaft is indicated at 46 and one of the cams thereon at 47. Rigidly fixed to the engine block above the cam is a tappet guide 48 provided at its lower end with vertical slots 49, and slidable in the guide is a tappet 50 journaled on a roller 51 to coact with the cam. The roller is slidably received in the slots 49 and thus coacts with the tappet guide for locking the tappet against turning movement. Upstanding from the tappet is a

tubular stem 52 and rigidly fixed to the upper end of said stem is the lower section 53 of the push rod. The rod section 53 is substantially identical with the rod section 20 as illustrated in connection with the preferred embodiment of the invention with the exception that the rod section 53 is provided at its lower end with an annular flange 54 overhanging the upper end edge of the stem 52 to rest thereagainst. Slidably accommodating the stem is a sleeve 55 provided at its lower end with a flange 56 rigidly fixed in the upper end of the tappet guide 48, and formed on said sleeve at its upper end is, as particularly shown in Figure 8, a plurality of radial ribs or keys 57 which are inclined spirally of the sleeve. Slidably fitting over the sleeve is a spring seat 58 which is formed with spiral slots 59 slidably accommodating the ribs 57 of the sleeve and projecting from the lower end of said seat is an annular flange 60. At its upper end, the sleeve is offset, as indicated at 61, and rigidly fixed in the offset portion of the sleeve is a ring 62 loosely surrounding the rod section 53 to coact with the flange 54 of said section. Fitting over the seat 58 to rest against the flange 60 is a spring 63 like the spring 36 of the preferred embodiment of the invention and provided with a terminal 64 engaged in an opening in the wall of the seat. Thus, as the spring seat 58 is raised and lowered by the tappet 50, said seat will through the medium of the ribs 57 and slots 59, be oscillated, so that the spring 63 will be turned about its axis with the seat. Otherwise, this modified structure is identical with the preferred form of the invention and, as will be seen, the spring 63 will, upon being oscillated, turn the spring seat at the upper end of said spring so that the clutch balls of the device will be rotated relative to the rod section 53 for effecting contraction of the push rod, the rod section 53 being held against rotation by the tappet.

Having thus described the invention, what I claim is:

1. In a valve actuating mechanism, the combination with a cam and valve, of means including a push rod interposed between the cam and valve for actuating the valve by the cam, means for automatically expanding the rod, and means for automatically rotating one of the parts for contracting the rod.

2. In a valve actuating mechanism, a push rod, means constantly tending to expand the rod, means rigidly resisting the contraction of the rod, and means for rotating one of the parts to cause retrograde movement of said second mentioned means whereby to automatically contract the rod.

3. In a valve actuating mechanism, a push rod, means constantly tending to expand the rod, a clutch rigidly resisting the contrac-

tion of the rod, and means for rotating one of the parts to cause retrograde movement of said clutch whereby to automatically contract the rod.

4. In a valve actuating mechanism, a tappet, a rod section carried thereby, a clutch member slidable on said rod section, a spring tending to shift the clutch member in one direction, a plurality of balls coacting between the clutch member and said rod section for resisting movement of the clutch member in the opposite direction, and means for substantially releasing said balls automatically whereby to effect movement of the clutch member in the latter direction.

5. In a valve actuating mechanism, a tappet, a rod section carried thereby, a clutch member slidable on said section, a spring tending to shift the clutch member in one direction, a plurality of balls coacting between the clutch member and said rod section for resisting movement of the clutch member in the opposite direction, and means for rotating one of the parts to cause retrograde movement of said balls along the rod section whereby to effect movement of the clutch member in the latter direction.

6. In a valve actuating mechanism, a tappet, a rod section carried thereby, a spring seat sustained by the tappet, a clutch member slidable on said rod section, a spring seat fitting over said clutch member, a plurality of balls sustained by the latter spring seat to coact between said clutch member and said rod section for resisting movement of the clutch member in one direction, and a spring coacting between said spring seats for automatically shifting the clutch member in the opposite direction.

7. In a valve actuating mechanism, a tappet, a rod section carried thereby, a spring seat sustained by the tappet, a clutch member slidable on said rod section, a spring seat fitting over said clutch member, a plurality of balls sustained by the latter spring seat to coact between said clutch member and said rod section for resisting movement of the clutch member in one direction, a spring coacting between said spring seats for automatically shifting the clutch member in the opposite direction, and means for rotating one of the parts and causing retrograde movement of said balls along said rod section whereby to effect movement of the clutch member in the former direction.

8. In a valve actuating mechanism, a tappet, a rod section carried thereby, a spring seat resting against the tappet, a clutch member slidable on said rod section, a spring seat fitting over said clutch member, a plurality of balls sustained by the latter spring seat to coact between the clutch member and said rod section for resisting movement of the clutch member in one direction, a spring coacting between said spring seats for auto-

5 matically shifting the clutch member in the opposite direction, means locking one of the parts against rotation, and means for turning another of said parts and causing retrograde movement of the balls along said rod section whereby to effect movement of the clutch member in the former direction.

9. The combination with a clutch member, of supporting means, a plurality of clutch elements coacting between said means and said member for rigidly resisting axial movement of said member in one direction, and means whereby one of the parts may be rotated to cause retrograde movement of said clutch elements along said supporting means and effect axial movement of the clutch member in said direction.

10. The combination with a clutch member, of means slidably supporting said member, a plurality of clutch elements coacting between said means and said member for rigidly resisting movement of the member along said means, and means whereby one of the parts may be rotated to cause retrograde movement of said clutch elements along said supporting means and effect movement of the clutch member.

11. The combination with coacting rod sections, of means interposed between said sections for rigidly resisting axial movement of one section toward the other, and means for rotating one of the parts whereby to shift said means and effect movement of said rod section.

35 12. In a valve actuating mechanism, a tappet, a push rod operable thereby and including a rod section fixed to the tappet, means tending to expand the rod, and means

for rotating the tappet and turning said rod section for contracting the rod.

13. In a valve actuating mechanism, a tappet, a fixed guide for the tappet having a longitudinal slot therein, a rod section carried by the tappet, a spring seat resting against said tappet, a clutch member slid- 45 able on said rod section, a spring seat fitting over said clutch member, a plurality of balls sustained by the latter spring seat to coact with the clutch member and said rod section for resisting movement of the clutch mem- 50 ber in one direction, a spring interposed between said spring seats for automatically shifting the clutch member in the opposite direction and provided at one end with a terminal slidably engaging in said slot and 55 at its opposite end with a terminal engaging said second mentioned spring seat for locking said second mentioned spring seat against rotation, and a cam for actuating the tappet and provided with portions to alter- 60 nately engage the tappet at opposite sides of its longitudinal axis for rotating the tappet and turning said rod section to cause retrograde movement of the balls along said rod section and effect movement of the 65 clutch member in the former direction.

14. In valve actuating mechanism, means for automatically increasing the effective length of said mechanism, and means rigidly resisting decrease in the effective length of 70 said mechanism, one of the parts being rotatable for rendering said resisting means ineffective whereby to permit contraction of said mechanism.

In testimony whereof I affix my signature.

CALVIN C. WILLIAMS. [L. S.]