Nov. 12, 1935. F. A. THAHELD 2,020,624

FUEL INJECTING MECHANISM

Filed Aug. 15, 1932 3 Sheets-Sheet 1

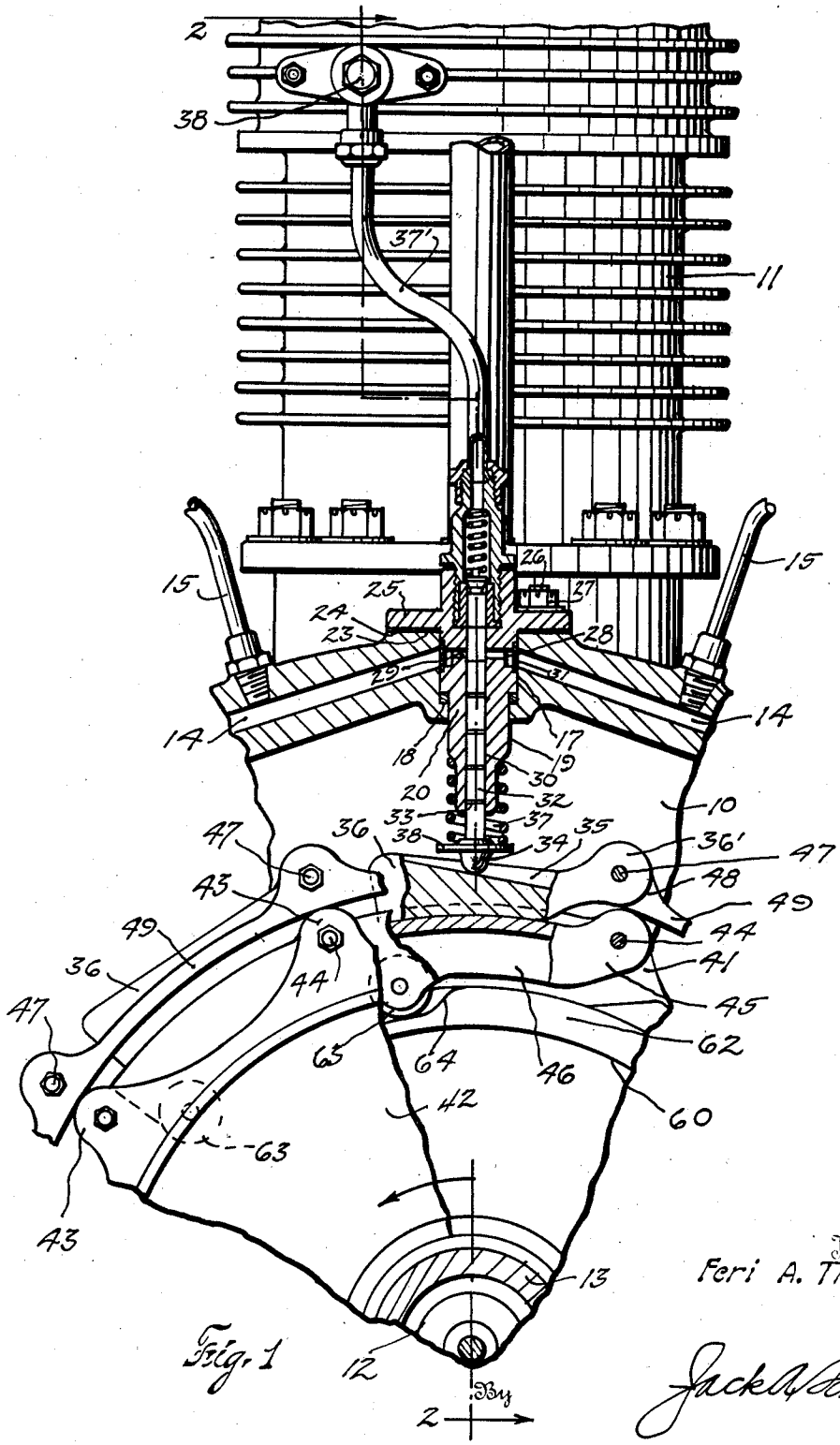


Fig. 1

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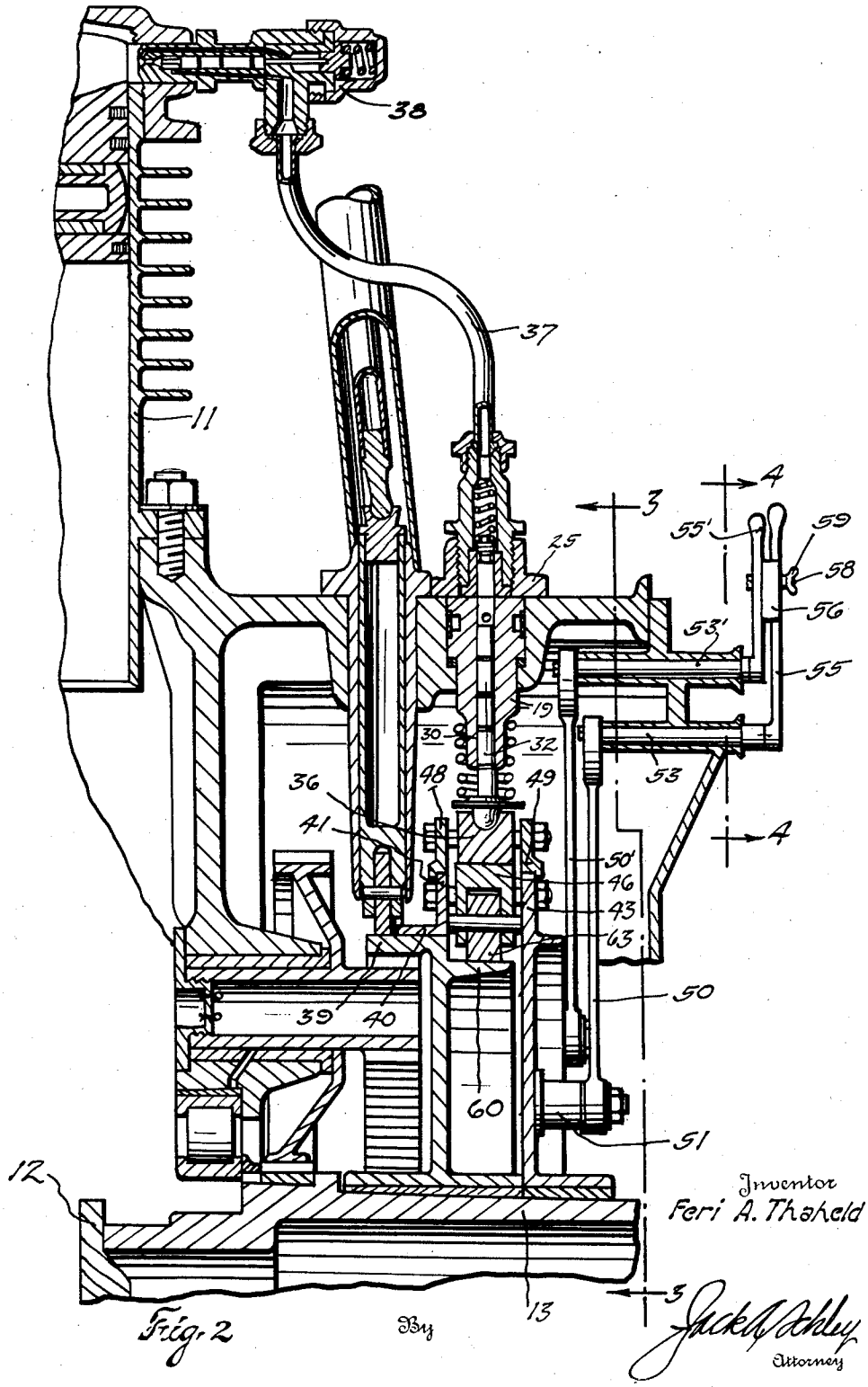


Fig. 2

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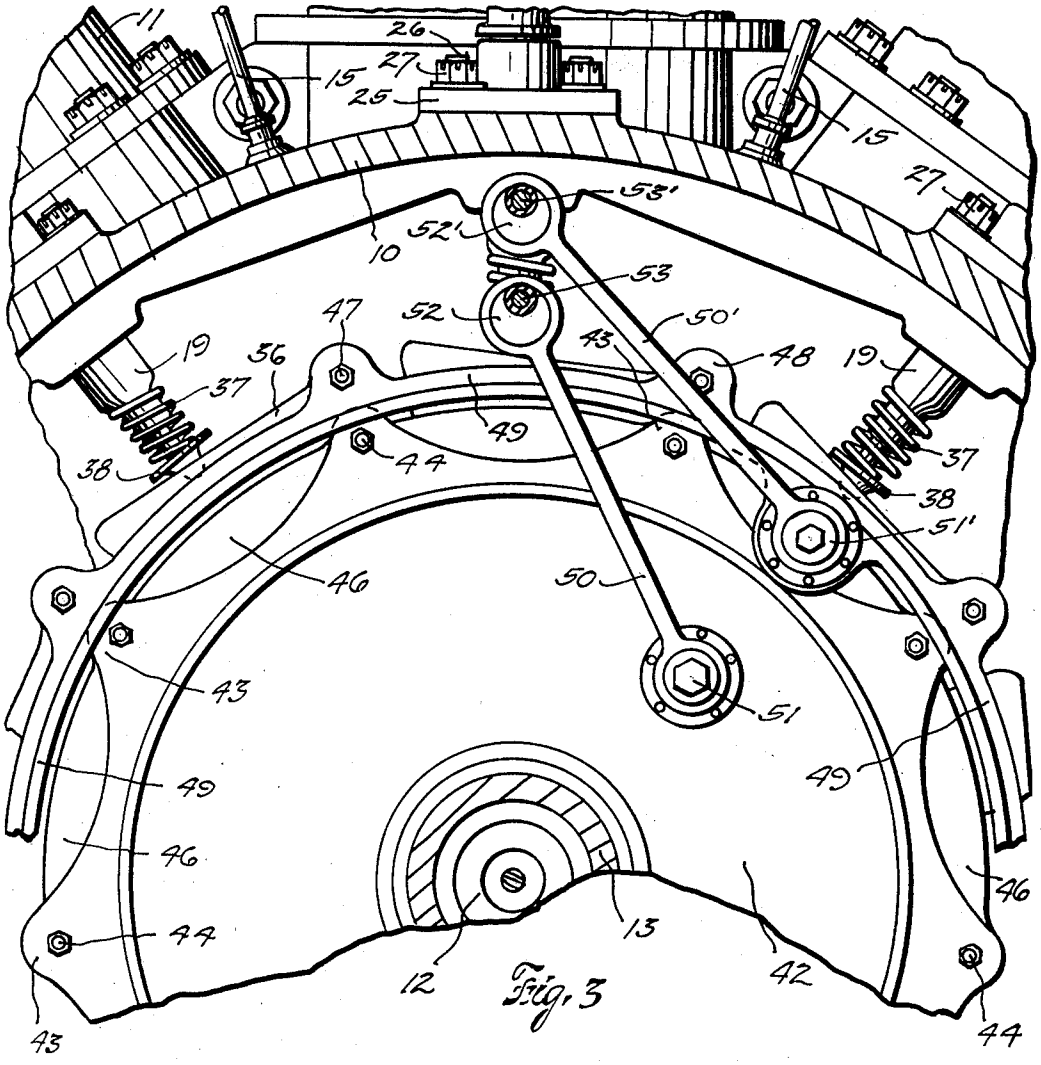


Fig. 3

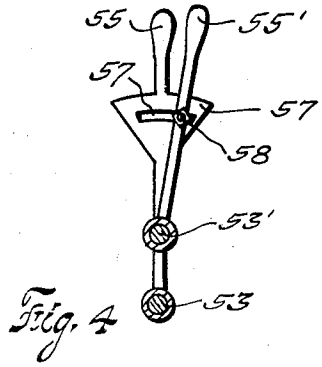


Fig. 4

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UNITED STATES PATENT OFFICE

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FUEL INJECTING MECHANISM

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Application August 15, 1932, Serial No. 628,822

2 Claims. (Cl. 123—139)

This invention relates to new and useful improvements in fuel injecting mechanisms.

This application is filed as an improvement over my copending application Serial No. 442,316, filed April 7, 1930. In my previous application the adjusting of the amount of fuel injected and the adjusting of the timing of the engine is accomplished by means of a single cam actuated lever. The single lever controls both adjustments and it is an impossibility to adjust one independently of the other.

One object of my invention is to provide improved means, whereby the amount of the fuel injected and the instant or point of injection with relation to the revolution of the crank shaft may be varied.

Another object of the invention is to provide means whereby the instant or point of the injection may be varied and the amount of the fuel injected may be varied, either in conjunction with the variation in the timing or independently thereof.

Another object of the invention is to provide an improved fuel injecting mechanism consisting of a pair of actuating levers, one riding upon the other, and arranged so that one lever will control the amount of fuel injected, and the other will control the timing of the engine, and means for adjusting the levers either simultaneously or independently of each other.

Still another object of the invention is to provide an improved fuel injecting mechanism including a pair of operating elements which may be secured together, whereby the operation of one will simultaneously operate the other, said elements being adapted to be operated independently of each other when the connection therebetween is broken.

A construction designed to carry out the invention will be hereinafter described together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings in which an example of the invention is shown, and wherein:

Figure 1 is a view, partly in elevation and partly in section, showing fuel injecting mechanism constructed in accordance with the invention,

Figure 2 is a vertical sectional view taken on the line 2—2 of Figure 1,

Figure 3 is a transverse vertical sectional view taken on the line 3—3 of Figure 2, and

Figure 4 is a detail of the hand control levers.

In the drawings the numeral 10 designates a portion of a crank case having a plurality of radial cylinders 11 mounted thereon. A crank shaft 12 is suitably mounted in the crank case and provided with a rear trunnion or extension 13. A fuel passage or line 14 is formed within the wall of the crank case and liquid fuel is supplied thereto by a pipe 15 from a booster pump (not shown), which receives fuel from a suitable source of storage.

Adjacent each cylinder 11 the crank case is provided with a cylindrical socket 17 having an annular seat 18 at its bottom. A pump 19 is provided for each socket and each pump includes a cylindrical barrel 20 seated in the socket through the bottom thereof into the crank case. The outer end of the socket is surrounded by a boss 23 having a flat surface for receiving a packing gasket 24, which is interposed between the boss and an outwardly directed flange 25, preferably made integral with the pump barrel. Stud bolts 26 fastened in the boss extend upwardly through the gasket and flange, and receive nuts 27 whereby the pump is fastened in place.

It will be noted that the passages 14 connect with the socket 17 below the packing 24. By this arrangement leaking of the fuel oil is reduced to a minimum and the use of exterior connections between the fuel line and the pump is avoided. The pump is conveniently and securely fastened in place and is readily removable when necessary.

An annular groove 28 formed in the head 21 of the pump provides a circular passage for the fuel fluid, whereby such fluid may pass around the pump, which removes any obstruction to the free flowing of the fluid through the fuel line 14. The head is provided with fuel ports 29 extending from the groove to the bore 30. A strainer 31 encircles the groove and prevents particles entering the pump from the fuel line.

A fuel plunger 32 having a close sliding fit in the bore 30 is provided throughout its length with a plurality of spaced annular grooves 33. Any fuel liquid which may seep between the plunger and the surface of the bore will collect in these grooves and serve both as a lubricant and as seal rings for the plunger. The outer end of the plunger is normally slightly inward of, or substantially flush with, the ports 29, as is best shown in Figure 1. The inner end of the plunger has a convex boss 34, which rides in a complementary groove 35 extending longitudinally on the upper side of an actuating lever 36. The boss is held in engagement with the lever by a coiled

spring 37 confined on the inner end of the barrel and engaging a flange 38 surrounding said boss.

When the lever 36 is lifted the plunger 32 will be displaced outwardly beyond the ports 29, and these ports will be closed at their inner ends until the plunger is returned. This will prevent back pressure air entering the ports 29 and finding its way into the fuel line 14 so long as said ports are covered. The charge of liquid is displaced outwardly by the plunger into a fuel tube 37' which is connected to the outer end of the pump 19. The other end of the tube is connected with an injector 38. As the details of the pump and injector form no particular part of the invention, it is not considered necessary to further describe the same. It is pointed out that the sizes and areas of the fuel supply elements are such that a single stroke of the pump plunger will displace sufficient fuel liquid from the pump to provide the desired fuel charge which will be discharged into the cylinder from the injector.

A cam disk 39 (Figure 2) is mounted on the crank shaft 12. A decompression ring 40 is rotatably confined on the outer periphery of the cam disk and is provided with spaced ears 41, one being provided for each lever. A control disk 42 is mounted on the cam shaft and carries a plurality of ears 43. The ears 41 and 43 are arranged in pairs and each pair carries a pivot bolt 44 on which an ear 45, at the rear end of a lever 46, is journaled. The upper side of the lever 46 is provided with a smooth surface and the lever 36 is slidable thereon. Each lever 36 has an ear 36' at its rear end journaled on a pivot bolt 47 supported in ears 48 of control rings 49, which are slidably mounted on the control disk 42 and decompression ring 40. It is pointed out that the contacting surfaces of the levers 36 and 46 are curved to arc concentric to the axis of the cam disk 39 so as to provide for easy adjustment.

The decompression ring 40 and the control disk and ring 42 and 49 respectively, being free to rotate, and the levers being attached thereto by the pivot bolts 44 and 47, it is obvious that by adjusting the disk 42, or the ring 49, the levers 36 and 46 are moved circumferentially either in a clockwise or a counter-clockwise direction, according to the direction said disk and ring are rotated. For rotating the disk 42, I have shown a very simple device (Figure 3) consisting of a link 50 pivotally connected to a bearing 51 secured on the disk 42. The upper end of the link encircles a disk 52, which is eccentrically mounted on a shaft 53 supported in the rear cover plate 54 (Figure 2) of the crank case 10. A hand lever 55 is secured on the outer end of the shaft, and by moving the lever the shaft is rotated, thereby rotating the eccentrically mounted disk 52 and either lifting or lowering the link 50, and rotating the control disk 42 in a clockwise or counter-clockwise direction.

For rotating the control ring 49, I provide another link 50' similar to the link 50, which is pivotally connected to a bearing 51' on said ring. The upper end of this link encircles a disk 52', which is also supported in the rear cover plate 54 above the shaft 53. A hand lever 55', fastened to the outer end of the shaft 53', is positioned adjacent the hand lever 55, and the adjustment of the disk 49 is accomplished in the same way as the adjustment of the disk 42.

The hand lever 55 carries a segment 56, which is provided with an arcuate slot 57. A bolt 58 secured to the lever passes through the slot and has a wing nut 59 on its outer end. By this arrangement the two levers can be secured together, and by operating either the control disk or ring, the other is adjusted accordingly. When it is desired to adjust one independently of the other, as will hereinafter be explained, the wing nut 59 is loosened to separate the hand levers 55 and 55'.

On the side of the cam disk 39, I form a cam ring 60 (Figures 1, 2, and 3). Lugs 62 are mounted on the periphery of this ring in the path of rollers 63 carried by the outer ends of the lever 46 and traveling on said periphery. Each lug, as is best shown in Figure 1, has an inclined approach 64. As the roller 63 rides up this approach its lever is lifted, thus lifting the lever 36 riding thereon, whereby the plunger 32 is thus displaced. When the roller reaches the upper surface of the lug it travels therealong, thus holding the plunger outwardly beyond the ports 29 during such travel. The upper surface of each lug 62 is long enough to hold the plunger outwardly until the injection of the fuel has been completed.

It will be seen that by adjusting the control ring 49 in a clockwise direction, each lever 36 will be moved under the boss 34 of the plunger 32 of each pump, so as to bring said boss nearer the outer end of the lever, and thereby increase the travel of the pump plunger. By a reverse adjustment of the ring 49, the stroke of the plunger is reduced. The stroke of the plunger controls the amount of the fuel injected and it is obvious that by rotating the ring 49 any desired mixture of fuel may be injected into the cylinder.

When the control disk 42 is rotated in a clockwise direction, the roller 63 on the lever 46 is advanced in the orbit of the cam 60, thus advancing the timing. By a reverse adjustment of the disk, the timing is retarded. It has been found that when the disk 42 is adjusted and the timing is changed, that it is necessary to adjust the ring 49 and the stroke of the plunger 32 proportionately. However, it is sometimes necessary to adjust the stroke of the plunger without increasing, or retarding, the timing. For this reason, the hand levers 55 and 55' are positioned adjacent each other, and it is possible, by tightening the wing nut 59, to adjust both the control disk and ring 42 and 49 simultaneously. Thus when the hand lever 55 is swung to rotate the disk 42, the hand lever 55' will adjust the ring 49 accordingly. When it is desired to lengthen or shorten the stroke of the plunger 32, the wing nut 59 is loosened and the hand lever 55' is operated independently of the lever 55.

The description which has been given recites more or less detail of a particular embodiment of the invention, which is set forth as new and useful, however, I desire it understood that the invention is not limited to such exact details of construction because it is manifest that changes and modifications may be made within the scope of the appended claims, without departing from the spirit of the invention.

What I calim and desire to secure by Letters Patent, is:

1. In a fuel injecting mechanism, a fuel pump, a reciprocating plunger working in said pump, a lever engaging one end of said plunger and freely movable longitudinally with respect to said plunger, a rotatable ring to which one end of said lever is pivoted, whereby said lever may be adjusted longitudinally without radially displacing its pivot point, means for adjusting said ring to move said lever longitudinally with relation to

said plunger to vary the stroke of the plunger, a second lever underlying and supporting said first lever and free from connection therewith so as to be freely moved without moving said first lever, revolving means concentric to said ring periodically engaging the second lever for swinging the same, means concentric to said ring to which the second lever is pivoted, and means for adjusting said concentric means to move the second lever longitudinally in the path of said revolving means to vary the time of fuel injection.

2. In a fuel injetcing mechanism, a fuel pump, a reciprocating plunger working in said pump, a lever engaging one end of said plunger and freely movable longitudinally with respect to said plunger, a rotatable ring to which one end of said lever is pivoted, whereby said lever may be adjusted longitudinally without radially displacing its pivot point, means for adjusting said ring to move said lever longitudinally with relation to said plunger to vary the stroke of the plunger, a second lever underlying and supporting said first lever and free from connection therewith so as to be freely moved without moving said first lever, revolving means concentric to said ring periodically engaging the second lever for swinging the same, means concentric to said ring to which the second lever is pivoted, means for adjusting said concentric means to move the second lever longitudinally in the path of said revolving means to vary the time of fuel injection, and means for connecting the actuating means for the ring with the actuating means for the concentric means, whereby a single operation will actuate both the ring and the concentric means and adjust said levers in the same direction without changing the relation and spacing of their pivots.

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