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Wortley

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[54] **LOST MOTION ADJUSTMENT DEVICE FOR RECIPROCAL ELEMENTS**

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[51] Int. Cl. F01b 31/14, F15b 15/24

[58] Field of Search 92/13.5, 13.51, 13.7, 13.8; 74/828, 1

[56] References Cited

UNITED STATES PATENTS

2,670,683	3/1954	Lundh	92/13.8 X
2,929,253	3/1960	Baldelli	92/13.7 X

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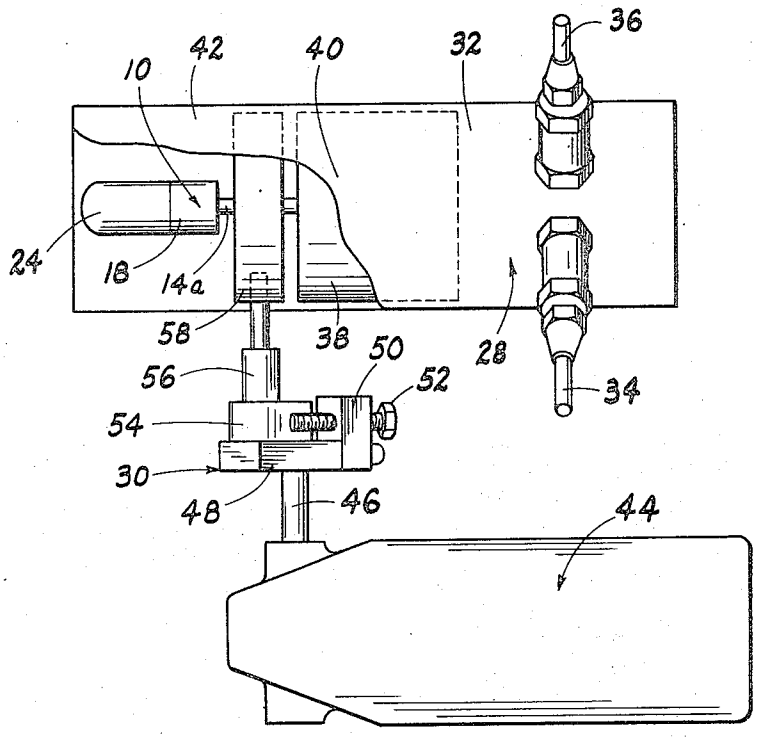
[57] ABSTRACT

A lost motion adjustment device for reciprocal elements including a movable block or body engagable with the reciprocal element for transmitting movement thereto, and an adjustment assembly cooperating with the movable body for selectively controlling the timing of the stroke of the reciprocal element.

5 Claims, 5 Drawing Figures



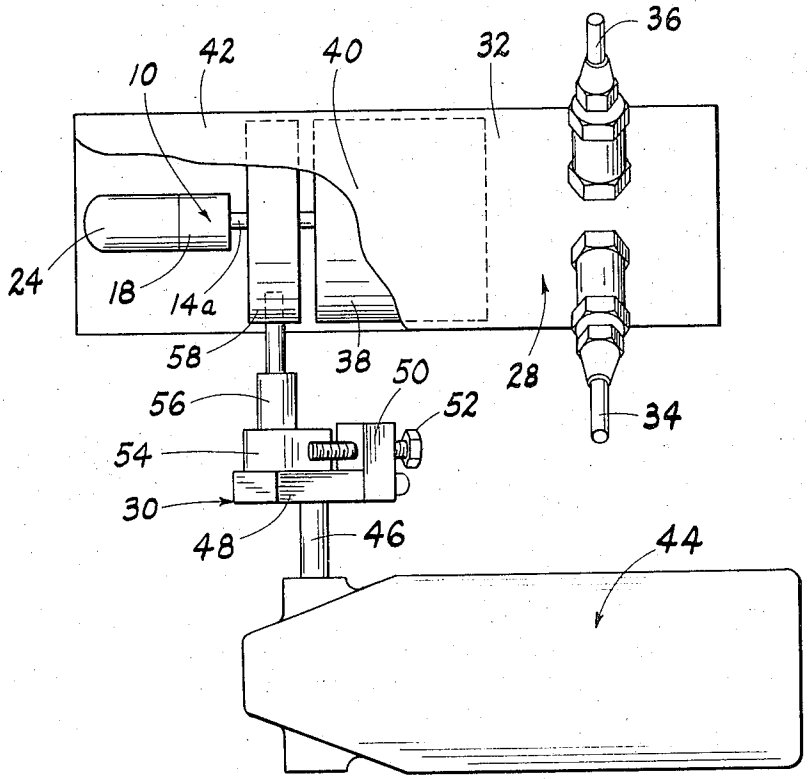


Fig. 3

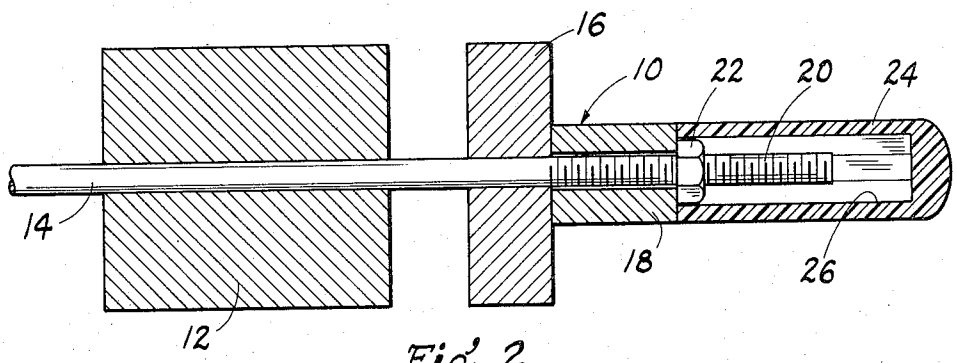


Fig. 2

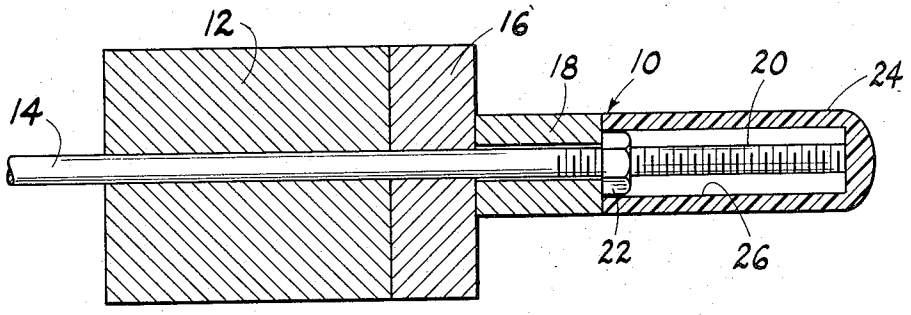


Fig. 1

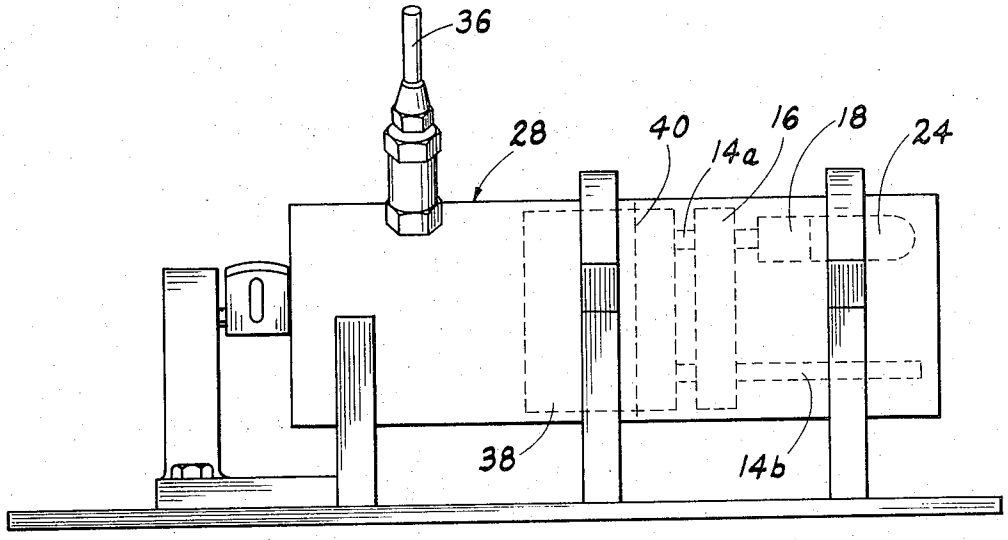


Fig. 5

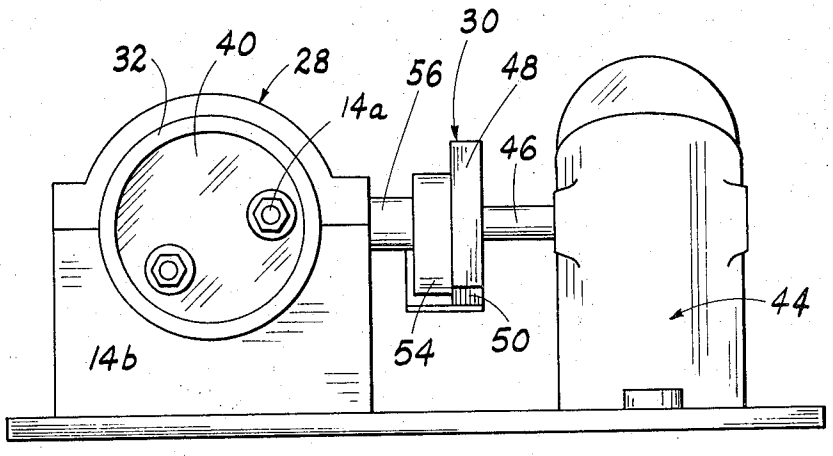


Fig. 4

LOST MOTION ADJUSTMENT DEVICE FOR RECIPROCAL ELEMENTS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to improvements in adjustment means for reciprocal elements and more particularly, but not by way of limitation, to a lost motion adjustment device for controlling the timing of the stroke of a pump piston.

2. Description of the Prior Art

During the operation of many reciprocal elements, such as the pump piston of a positive displacement pump, it is frequently desirable to control the timing of the stroke of the reciprocal element. For example, in the case of a positive displacement type pump, the reciprocal piston is usually actuated by a power source such as a motor, and means is normally provided for connecting the pump piston with the drive shaft of the motor whereby the rotational motion of the drive shaft is translated into linear motion for the piston. During the operation of the pump, it may be necessary or desirable to alter the timing of the stroke of the piston in a manner which will not interfere with or change the normal operation of the motor. This is frequently accomplished by means of a lost motion action between the power source or motor and the piston during the stroke of the piston. The present day lost motion-type devices are usually somewhat difficult to adjust and may require an interruption of the operation of the pump and motor in order to vary the timing of the pump stroke.

SUMMARY OF THE INVENTION

The present invention contemplates a novel lost motion adjustment device which is extremely simple and efficient in use for adjusting the lost motion action for selectively controlling the timing of the stroke of a reciprocal element, such as a pump piston, or the like. The novel lost motion adjustment device comprises connecting rod means secured to the reciprocal element for movement simultaneously therewith, and a movable block member slidably disposed on the connecting rod means for selective engagement with the reciprocal element for transmitting movement thereto in one direction. Adjustable stop means is also carried by the connecting rod means for cooperating with the block member to transmit movement to the reciprocal element in an opposite direction and provide for selective control of the lost motion action to control the timing of the stroke of the reciprocal element. The stop means is particularly designed and constructed for ease of adjustment without interrupting the operation of the reciprocal element.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional elevational view of a lost motion adjustment device embodying the invention in relation and depicts one relative position of adjustment therefor.

FIG. 2 is a view similar to FIG. 1 depicting another position of adjustment therefor.

FIG. 3 is a plan view of a pump assembly incorporating a lost motion adjustment device embodying the invention thereon.

FIG. 4 is an end view of a pump assembly incorporating a lost motion adjustment device embodying the invention thereon.

FIG. 5 is a side elevational view of a pump assembly incorporating a lost motion adjustment device embodying the invention thereon.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings in detail, and particularly FIGS. 1 and 2, reference character 10 generally indicates a lost motion adjustment device for a reciprocal element 12. The lost motion adjustment device 10 comprises a connecting rod 14 which extends longitudinally through the reciprocal element 12 and is secured thereto in any well known manner for simultaneous movement therebetween. As particularly shown in FIGS. 1 and 2, the rod 14 is centrally disposed with respect to the reciprocal element 14 and in the event the element 14 is a piston member, the rod 14 may be an extension of the piston rod. Of course, it is to be noted that the rod 14 may be completely independent of any piston rod, or the like. It is preferable, however, that the rod 14 be disposed substantially parallel with the longitudinal axis of the element 12.

A block member 16 is slidably disposed on the rod 14 and is movable therealong in alternate directions toward and away from the reciprocal element 12 in a manner and for a purpose as will be hereinafter set forth. As shown herein, the block member 16 is provided with an outer periphery complementary with or corresponding to the size of the outer periphery of the reciprocal element 12. However, it is to be noted that the block 16 may be of a smaller outer peripheral size, or larger, with respect to the reciprocal element 12, as desired. A sleeve member 18 is loosely disposed on the rod 14 and disposed on the opposite side of the block member 16 with respect to the reciprocal element 12. The outer extremity of the rod 14 is threaded, as shown at 20, and a suitable nut 22 is threadedly disposed therein in any well known manner.

The nut 22 is preferably of a hex-type or square outer periphery or otherwise provided with flat sides and corners for facilitating turning or rotating thereof for a purpose as will be hereinafter set forth. An elongated protector member of end cover 24 having an internal bore 26 extending longitudinally therein is disposed around the outer extremity of the rod 14 as clearly shown in FIGS. 1 and 2, and the cross-sectional configuration of the bore 26 is complementary with the outer configuration of the nut 22 for receiving the nut 22 therein. In addition, it will be readily apparent that rotation of the protector or cover 24 about its longitudinal axis will transmit rotation to the nut 22 for adjusting the position of the nut on the threaded portion 20 as will be hereinafter set forth. The cover 24 may also be secured to the sleeve 18 in any well known manner (not shown) whereby the cover 24 will maintain the sleeve 18 substantially concentrically disposed with respect to the rod 14. Alternatively, the cover 24 may be completely independent from the sleeve 18 and held against longitudinal movement in any suitable manner (not shown) without interfering with rotational movement about its own longitudinal axis.

The nut 22 may be spaced at substantially any desired distance from the reciprocal element 12 for receiving the sleeve 18 thereagainst to provide the de-

sired maximum spacing between the sleeve 18 and the reciprocal element 12 to provide the desired lost motion action during reciprocation of the element 12. This may be accomplished, of course, by rotating the nut 22 by manually rotating the cover or protector 24. When the nut 22 is positioned on the threaded portion 20 in such a manner as shown in FIG. 1, it will be apparent that the reciprocal element 12, block 16, sleeve 18, nut 22 and cover 24 will all reciprocate as a unit, with no lost motion action being provided for the element 12. However, with the nut 22 spaced a further distance from the element 12, as shown in FIG. 2, the block 16 is free to be moved along the rod 14 throughout the distance between the sleeve 18 and element 12 independently of any linear movement of the element 12 or the sleeve 18, nut 22 and cover 24.

As the block 16 is moved in a left hand direction as viewed in FIG. 2, as soon as the block 16 travels through a sufficient distance, it is brought into engagement with the element 12. Any continued movement of the block 16 in this left hand direction will cause the element 12 to move simultaneously therewith in the same direction. When the direction of movement of the block 16 is reversed, or in a right hand direction as viewed in FIG. 2, the block 16 will move independently of the element 12 until the block 16 has moved through a sufficient distance for engaging the sleeve 18 which in turn engages the nut 22. At this position, the element 12 will begin to move simultaneously with the block 16 in the right hand direction through the connection thereof with the rod 14.

The lost motion adjustment apparatus 10 may be utilized for controlling the timing of the stroke of substantially any desired reciprocal element. For example, as shown in FIGS. 3, 4 and 5, the device 10 may be used in combination with a suitable positive displacement pump 28, which may be of the general type shown in my U.S. Pat. No. 3,453,968, issued July 8, 1969, and entitled "Positive Displacement Pump" and a motion transfer device 30, such as shown in my U.S. Pat. No. 3,638,505, issued Feb. 1, 1972, and entitled "Motion Transfer Device." The pump 28 may be mounted in any suitable manner, as particularly shown in FIGS. 4 and 5, and comprises an outer housing 32 having a pumping chamber (not shown) therein with the usual inlet 34 and outlet 36. A reciprocal piston 38 is disposed in the pumping chamber and, as shown herein, extends beyond the outer end 40 of the housing 32. Suitable packing means (not shown) is interposed between the inner periphery of the housing 32 and the outer periphery of the piston 36 for precluding leakage of fluid therebetween. Of course, the housing 32 may be provided with a shield or extension portion 42 extending longitudinally therefrom for substantially encasing the exposed portion of the piston 38 and the lost motion adjustment device 10, as desired. In this event, a longitudinal slot (not shown) or access opening is preferably provided for facilitating connection to and adjustment of the device 10 in a manner as will be hereinafter set forth.

Of course, as the piston 38 is reciprocated within the pumping chamber, the suction stroke thereof pulls or draws fluid into the chamber through the inlet 34, and the power stroke thereof exhausts or pushes the fluid from the pumping chamber through the outlet 36, as is well known. In the particular type pump disclosed in my aforementioned U.S. Pat. No. 3,453,968, the piston 38 oscillates simultaneously with the reciprocation thereof for alternately opening and closing the ports 34 and 36 to facilitate the pumping action. However, it will be readily apparent that the lost motion device 10 of the present invention is not limited to use with the particular oscillatory and reciprocal element shown herein, but may be utilized with substantially any desired reciprocating element.

The lost motion device 10 is secured to the piston 38 in much the same manner as hereinbefore set forth in connection with the reciprocal element 12. However, due to the oscillatory movement of the piston 38 it may be necessary to movably connect the block 16 to the piston 38 by means of a pair of spaced mutually parallel rods 14a and 14b since motion is transferred to the piston 38 through the block 16 as will be hereinafter set forth. (When the reciprocal element being used in combination with the device 10 does not have oscillatory movement, a single connecting rod may be used as shown in FIGS. 1 and 2.) The sleeve 18 may be disposed on one of the rods, for example, the rod 14*a*, and the nut 22 may be threadedly secured thereto at the desired spacing from the piston 38 to provide the necessary length of travel for the block member 16 between the piston 38 and sleeve 18 for producing the desired lost motion action.

The pump piston 38 is driven by a suitable motor 44 through the drive shaft 46 thereof and the motion transfer device 30 carried by the shaft 46 as set forth in my prior U.S. Pat. No. 3,638,505. The motion transfer device 30 comprises a first block member 48 removably secured to the drive shaft 46 in any suitable manner for rotation simultaneously therewith. A second block member 50 is removably secured to one edge of the first block 48 and extends substantially perpendicularly therefrom in a direction away from the motor 44. An adjusting screw 52 extends transversely through the block 50 and the outer end thereof extends into engagement with an elonated adjuster arm 54 which is pivotally secured to the first block 48. An extension arm 56 has one end loosely secured to the adjuster arm 54 in any suitable manner, such as by a ball and socket type connection, or the like (not shown), and the opposite end thereof is secured to the block 16 of the device 10 at 58 (FIG. 3) in any well known manner, such as by a threaded connection therebetween, or the like, whereby the block 16 is moved by the action of the arm 56.

The axis of the extension arm 56 is disposed substantially parallel with the axis of the drive shaft 46, and the length of the "throw" or off-set position of the arm 56 with respect to the drive shaft 46 may be adjusted as desired by the screw 52 which pivots the adjuster arm 54, and in turn adjusts the position of the extension arm 56 with respect to the drive shaft 46. As the drive shaft 46 rotates, the axis of the arm 56 will move in a circular path about the axis of the shaft 16 thus causing the arm 56 to move in a circular path. This circular movement of the arm 56 causes the block 16 to move in a combined oscillatory and reciprocal movement, and the block 16 transfers these combined movements to the piston 38, with a lost motion action being provided for the linear movement in accordance with the spacing provided between the sleeve 18 and the piston 38.

As the block 16 is moved in a left hand direction, as viewed in FIG. 3, the block 16 will slide along the rods 14*a* and 14*b*. The oscillatory movement of the block 16

will be substantially instantaneously transmitted to the piston 38 by virtue of the connection of the two rods 14*a* and 14*b* between the block 16 and the piston 38. However, the piston 38 will not move longitudinally until the block 16 has moved through a sufficient distance for engaging the sleeve 18, and the sleeve 18 has been moved a sufficient distance for engaging the nut 22. As soon as the sleeve 18 is brought into engagement with the nut 22, any continued movement of the block 16 in the left hand direction will cause the piston 38 to move simultaneously therewith due to the connection of the rods 14*a* with both the nut 22 and the piston 38.

When the return stroke begins, the block 16 will be moved in a right hand direction, and will slide along the rods 14*a* and 14*b* until the block 16 has moved through a sufficient distance for engaging the exposed end of the piston 38 itself. As soon as the block 16 engages the piston 38, any continued movement of the block 16 in the right hand direction causes the piston 38 to move simultaneously therewith. Thus, the piston 38 may be reciprocated and oscillated with substantially any desired lost motion action (or no lost motion action at all) provided in accordance with the required results for the pumping action.

Referring now to FIGS. 1 and 2, in the event the reciprocal element 12 has a linear reciprocal action only, the device 10 may be secured to the rod 14 as hereinbefore set forth, and the rod 14 may either be disposed along the axis thereof, or may be parallel to but offset therefrom, as desired. The block 16 may be reciprocated in any well known manner. When the block 16 is moved in a left hand direction, as viewed in FIG. 2, the block 16 will slide along the rod 14 through the distance between the sleeve 18 and element 12 until the block 16 engages the element 12. When the block 16 engages the element 12, any further movement of the block 16 in the left hand direction will cause the element 12 to move linearaly simultaneously therewith. When the block 16 is moved in a right hand direction, the block 16 will slide along the rod 14 until the block 16 engages the sleeve 18 and the sleeve 18 engages the nut 22. At this position, the element 12 will then move linearaly simultaneously with the block 16, sleeve 18 and nut 22 because of the connection of the rod 14 with both the nut 22 and the element 12.

In order to adjust the position of the nut 22, the cover 24 may be manually rotated about its own longitudinal axis. The complementary configuration between the bore 26 and the outer periphery of the nut 22 transmits rotation to the nut 22, and since the rod 14 is held against rotation by the element 12, the nut 22 will move longitudinally along the threaded portion 20 of the rod 14. The nut 22 is freely slidable within the bore 26 during operation of the reciprocal element 12, of course. It will be readily apparent that the time lag between strokes of the reciprocal element 12 will be determined by the linear speed of the block 16 and the spacing between the sleeve 18 and the element 12. When the block 16 is held adjacent the element 12 as shown in FIG. 1, there will be no lost motion action, of course.

From the foregoing it will be apparent that the present invention provides a novel lost motion adjustment device which may be readily adjusted for timing the stroke of a reciprocal element as desired. The novel lost motion device comprises a slidable block member interposed between the reciprocal element and an adjustable stop means. The linear movement of the block member is transmitted to the reciprocal element, with a lost time action provided for the element in accordance with the spacing between the element and the adjustable stop. The lost motion adjustment device is simple and efficient in operation and economical and durable in construction.

Whereas the present invention has been described in particular relation to the drawings attached hereto, it should be understood that other and further modifications, apart from those shown or suggested herein, may be made within the spirit and scope of this invention.

What is claimed is:

1. In combination with a reciprocal element, a lost motion adjustment device comprising connecting rod means carried by the reciprocal element, movable block means slidably secured on the outer periphery of the connecting rod means, stop means movably secured on the outer periphery of the connecting rod means on the opposite side of the block means with respect to the reciprocal element, and adjusting means carried by the connecting rod means on the opposite side of the stop means with respect to the reciprocal element and directly engagable with the stop means for adjusting the position thereof with respect to the reciprocal element whereby the movement of the block means may be selectively varied to provide substantially any desired lost motion action for the reciprocal element.

2. In combination with a reciprocal element, a lost motion adjustment device as set forth in claim 1 wherein the rod means extends substantially parallel to the axis of the reciprocal element.

3. In combination with a reciprocal element, a lost motion adjustment device comprising connecting rod means carried by the reciprocal element, movable block means slidably secured to the connecting rod means, adjustable stop means movably secured to the connecting rod means and disposed on the opposite side of the block means with respect to the reciprocal element whereby the movement of the block means may be selectively varied to provide substantially any desired lost motion action for the reciprocal element, wherein the stop means comprises sleeve means slidably disposed on the connecting rod means, and nut means threadedly secured to the connecting rod means and adjustable thereon for limiting the movement of the sleeve means in one direction, and wherein the nut means comprises a nut member threadedly secured to the connecting rod means and adjustable thereon, and cover means disposed around the outer extremity of the connecting rod means and nut means and engagable with the nut member for transmitting rotation thereto for adjusting the position of the nut member on the connecting rod means.

4. In combination with a reciprocal element, a lost motion adjustment device as set forth in claim 3 wherein the cover means is provided with a longitudinally extending bore having a configuration complementary to the configuration of the outer periphery of the nut member for transmitting rotation to the nut upon rotation of the cover means about its longitudinal axis.

5. In combination with a reciprocal element, a lost motion adjustment device comprising connecting rod

means carried by the reciprocal element, movable block means slidably secured to the connecting rod means, and adjustable stop means movably secured to the connecting rod means and disposed on the opposite side of the block means with respect to the reciprocal element whereby the movement of the block means may be selectively varied to provide substantially any desired lost motion action for the reciprocal element, and wherein the stop means comprises sleeve means slidably disposed on the connecting rod means and oppositely disposed from the block means with respect to the reciprocal element, said nut means being adjustable on said connecting rod means completely independent from manipulation of the sleeve means for limiting the movement of the sleeve means in one direction.

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