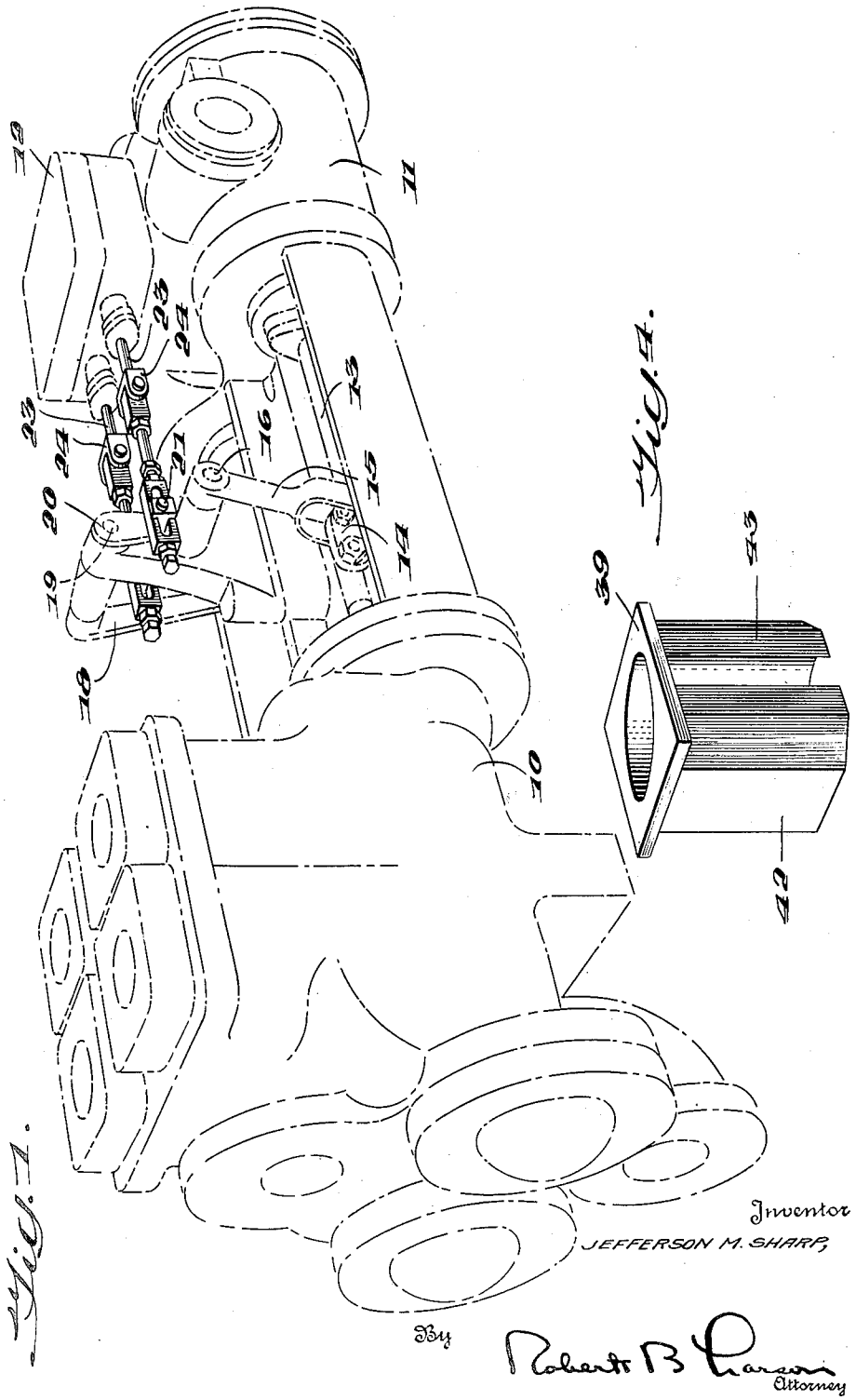
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LOST MOTION LINKAGE

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Fig. 2.

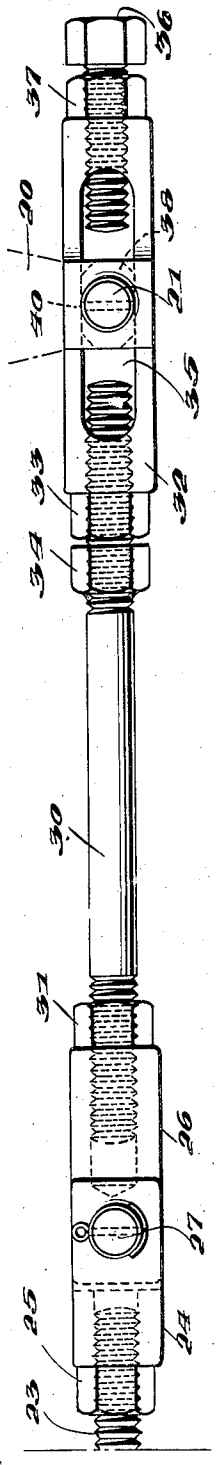
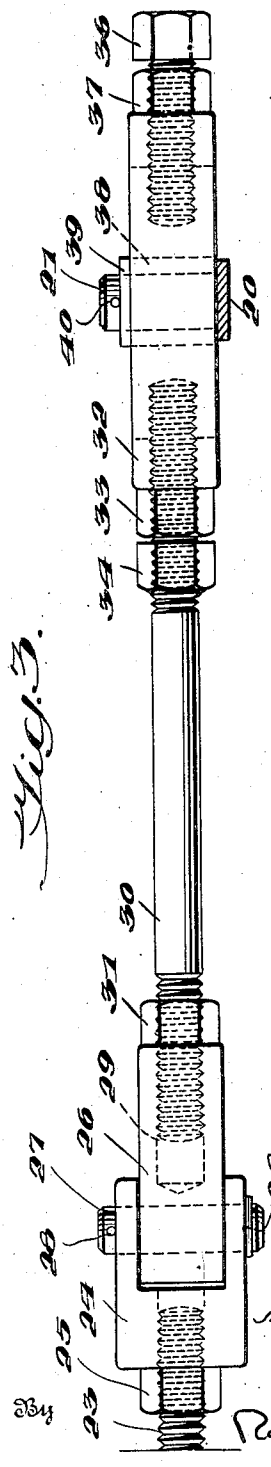


Fig. 3.



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LOST MOTION LINKAGE

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3 Claims. (Cl. 74—586)

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This invention relates to an adjustable lost motion linkage, that is, to a mechanical linkage for connecting two moving parts where it is desired that lost motion be introduced between the two parts, and where it is desirable that the amount of lost motion be adjustable. The novel linkage is particularly useful with pumps of the type in which it is necessary to impart operating movement to valves. However, it will be apparent that the novel linkage is not limited to pump use.

In the past, lost motion linkages have been in common use for operating moving parts such as the valves of certain types of pumps. However, known lost motion linkages have several well known defects which the trade has attempted to remedy for many years. For example, many of the previous linkages provided adjustment only at one end of the motion and not at the other. Where these linkages did provide adjustment at both ends of the lost motion connection, they necessitated numerous additional parts in order to secure the desired mode of operation. Such a structure is shown in U. S. Patent No. 782,002, issued to Cable in 1905.

Another recognized defect in the prior linkages was the danger of pinching and mashing the fingers if an attempt was made to adjust the amount of lost motion during operation of the mechanism.

Still another shortcoming of the old linkages was the necessity for making left and right hand parts when it was desired to use the linkages on devices such as duplex type pumps. This of course caused additional expense and required suppliers of spare parts to keep an additional part.

A primary object of the present invention is to overcome substantially all of the shortcomings of the prior art adjustable lost motion linkages.

Another object of the invention is to provide a simple adjustable lost motion linkage which is adjustable at both ends of the lost motion.

Another object of the invention is to provide an adjustable lost motion linkage which can be readily adjusted while in operation without any danger of pinched or mashed fingers.

A further object of the invention is to provide an adjustable lost motion linkage which may be used on either side of a duplex pump or other dual-hand construction without the necessity for utilizing different right and left hand parts.

Still another object of the invention is to provide an adjustable lost motion linkage which

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can be used on existing pumps and other installations without modification of the standard machine.

It is another object of this invention to provide a novel adjustable lost motion linkage comprising a minimum number of parts which are readily assembled and disassembled, and well adapted to large scale production at low cost.

A further object of the invention is to provide an adjustable lost motion linkage particularly adapted for use in pump valve operating mechanisms in which adjustment can be made in the amount of lost motion during operation and without affecting the valve setting.

It is also an object of the invention to provide a novel sliding lost motion block designed to be of minimum size and weight while nevertheless performing its function with full efficiency.

These and other objects of the invention will be apparent from the following specification and the accompanying drawings, in which

Fig. 1 is a perspective view showing the application of the novel lost motion linkage to a horizontal duplex type steam pump;

Fig. 2 is a side elevational view of the lost motion linkage itself;

Fig. 3 is a top plan view of the linkage shown in Fig. 2; and

Fig. 4 is a perspective view of the novel sliding lost motion block used in the construction shown in Figs. 1–3.

Referring now to Fig. 1, I have shown the novel adjustable lost motion linkage in heavy lines as used with a conventional horizontal duplex type steam pump, although it will be apparent that the linkage finds ready application to countless other types of machinery which have need of an adjustable lost motion linkage.

In Fig. 1, the pump comprises a liquid end 10 in which a pair of reciprocable pistons (not shown) carry out a pumping action. At the other end of the pump is the steam end 11 within which are a pair of reciprocable pistons (not shown) driven by steam under pressure. In order to achieve reciprocation of the pistons in the steam end 11 of the pump, it is necessary to operate sliding valves (not shown) mounted in a housing 12 atop the steam end of the pump, these valves serving the function of directing steam to, and exhausting steam from the two sides of the pistons upon which the steam exerts its pressure. Each of these pistons is connected directly to the corresponding pumping pistons in the liquid end 10 by a piston rod 13 so that

the movement of the pistons in the steam end 11 drives the pistons in the liquid end 10.

Each piston rod 13 carries a crosshead 14 to which is pivoted the lower end of a valve motion lever 15 which is keyed at its upper end to a cross shaft 16. Shaft 16 is connected to a shorter upwardly extending lever arm (not shown) in such a manner that reciprocation of rod 13 causes oscillation of lever arm 15, shaft 16 and the shorter lever arm. A similar piston rod (not shown) on the other side of the pump oscillates a lever arm 18 which oscillates a transverse shaft 19 to oscillate a downwardly extending lever arm 20. Both the upwardly extending short lever arm which is not shown, and the short lever arm 20 have transversely extending crank pins, the pin of arm 20 being shown at 21.

Referring now to Figs. 1–3, the valves (not shown) in housing 12 are controlled by valve stems 23, each valve stem being threaded into a valve stem head 24. Standard hexagonal lock nuts 25 are provided for locking the valve stems 23 with relation to the valve stem heads 24. The lost motion connections shown in solid lines in Fig. 1 are identical on both sides of the pump so that it will be sufficient to describe one of the linkages in detail with reference to Figs. 2 and 3.

Valve stem head 24 is bifurcated and is pivotally attached to a valve rod end 26 by a transverse valve stem head pin 27 which is retained in place by cotter pins 28 or the like. As is conventional in pumps of this type, means (not shown) prevent rotation of the valve stem 23 so that pin 27 is always maintained parallel to the axis about which the corresponding short lever 20 oscillates. Valve rod end 26 is provided with a longitudinally extending threaded hole 29 into which is screwed the threaded end of an adjustable valve rod 30. A lock nut 31 is provided for fixing the relative positions of valve rod end 26 and valve rod 30.

At its other end which is also threaded, valve rod 30 screws into a longitudinally extending threaded opening in one end of a lost motion link 32. A lock nut 33 is positioned on the threaded end portion of rod 30 adjacent lost motion link 32 and another standard hexagonal nut 34 is welded to rod 30 to provide means for turning rod 30 by a suitable wrench.

It is important in this structure that the threads on both ends of rod 30 be of the same pitch and hand (usually right-hand) so that when rod 30 is turned for a purpose which will be explained presently, the distance between valve rod end 26 and lost motion link 32 remains the same and the valve setting is not varied.

Lost motion link 32 comprises an elongated block having a central cut-out or slot 35 only slightly wider than the diameter of pin 21 and extending a substantial portion of its length. Slot 35 opens onto each side of the link. A threaded hole extends into each end of link 32 into communication with the slot, one of these holes being the one which receives one end of rod 30. The other hole in link 32 receives a cap screw 36 which has a lock nut 37. As shown in Figs. 2 and 3, the ends of slot 35 are thus defined by the ends of rod 30 and screw 36.

Pin 21 of short lever arm 20 extends into slot 35 and flanged collar 38 shown in detail in Fig. 4 is positioned about pin 21 with the flange 39 of the collar on the side of link 32 removed from arm 21. A cotter pin 40 or the like retains the collar on pin 21, the flange 39 of the collar 38

being substantially larger in diameter than slot 35.

From Figure 4 it will be clear that collar 39 actually comprises two blocks 42 and 43 held together by flange 39, the space between the upper and lower edges of blocks 42 and 43 being open. This construction permits the width of slot 35 to be only slightly greater than the diameter of pin 21 so that the size of link 32 may be held to a minimum. The blocks 42 and 43, however, provide ample protection for pin 21 and take the blows from the ends of rod 30 and screw 36 at the ends of the relative motion between link 32 and pin 21.

In the pump shown in Fig. 1 it is desired to operate the valves in valve housing 12 intermittently as the valves must be shifted each time the pistons in steam end 11 approach the ends of their travel in each direction. This shifting of the valves reverses the connection of the exhaust and the steam under pressure so as to reverse the movement of the piston against which the steam under pressure acts. In order to shift the valves controlling the steam only at the ends of the travel of the pistons, the lost motion connections are provided between valve stems 23 and oscillating levers 20.

The movement of crank pins 21 in slots 35 provides the lost motion as the valves are shifted only at the times when collars 29 on pins 21 strike the ends of rods 30 and bolts 36.

It is important that the lost motion connection be adjustable to assure that the steam valves are shifted at exactly the right instant. Incorrect adjustment causes knocking due to over travel of the steam pistons and also results in a decrease in the efficiency of the pump.

In order to adjust the amount of lost motion permitted by link 32, the effective length of slot 35 is variable by merely loosening lock nuts 31 and 33 to permit rotation of rod 30, and by loosening lock nut 37 to free bolt 36. In order to rotate rod 30, the fixed nut 34 is gripped by a suitable wrench, the result of this rotation being that the end of rod 30 which extends into slot 35 is moved into or out of the slot as desired. After the desired setting is reached, lock nuts 31 and 33 are again tightened.

As previously explained herein, the provision of threads of the same pitch and hand on both ends of rod 30 causes rod 30 to screw into valve rod end 26 the same amount as it is screwed out of lost motion link 32, and vice versa, so that the distance between valve rod end 26 and link 32 is not varied in the process of adjusting the amount of lost motion. As a result, no variation is made in the valve setting. By valve setting is meant the total distance through which the valve moves.

In order to adjust the effective length of slot 35 in the direction of bolt 36, it is merely necessary to loosen lock nut 37 and rotate bolt 36 until the proper setting is reached, after which lock nut 37 is again tightened.

For convenience, all of the hex nuts 25, 31, 33, 34 and 37, and the head of cap screw 36 are made the same size so that the same wrench or wrench adjustment may be used on all of these parts.

The lost motion connection which I have invented provides a structure which is of minimum size, which is adjustable in both directions of travel, and which is, in the additional ways previously referred to herein, a real improvement over previous lost motion linkages. The linkage which I have invented may be readily applied to

existing machinery such as pumps of the type described. Such pumps are conventionally provided with a valve stem, valve stem head, valve stem head pin and valve rod end so that modification of the pump is unnecessary in installing the new linkage.

While I have described the linkage with reference to its use on a pump, I do not wish to be limited to such use of the linkage, for the device is equally valuable for use on other types of machinery utilizing lost motion connections. The linkage which I have described is only a preferred embodiment of my invention and it is my intention to cover by my patent all variations of the device falling within the inventive concept as defined by the appended claims.

I claim:

1. In a lost motion linkage of the type wherein a pin slides in an elongated slot having a width substantially equal to the diameter of the pin, the novel feature comprising a collar for protecting said pin, said collar comprising a pair of oppositely disposed protective collar portions spaced in the direction of the length of the slot to provide an opening for said pin, and a flangelike collar portion holding said protective portions in fixed positions relative to each other.

2. In a lost motion linkage, the combination of a lost motion link having an elongated slot therein, a movable arm on one side of said link, a pin carried by said arm, said pin being of substantially the same width as said slot and projecting into said slot so as to be slidable along the length of the slot, a protective collar for said pin having spaced protecting portions on each side of said pin in the direction of the length of the slot, a flangelike collar portion of greater width than the slot normally positioned on the side of the link opposite said arm and fixed to said protecting portions to hold said protecting portions in fixed positions relative to each other,

and means cooperating with said pin to retain said collar in position and thereby to retain said pin in said slot.

3. A mechanical linkage for providing a lost motion connection between two relatively movable parts, comprising a link member having an elongated internal slot, a connecting member operably associated with the first of said moving parts and extending through a portion of said link member into one end of said slot, the second movable part extending into the slot from one side thereof and being freely movable longitudinally in said slot, and means for adjustably positioning said connecting member with respect to said link to vary the distance which said member extends into said slot, whereby the effective length of said slot and the extent of free movement of said second part in said slot is variable, said second movable part which extends into said slot having approximately the same width as said slot, and a collar mounted about said second part, said collar comprising thickened protective portions positioned on opposite sides of said second part to take the blows at each end of its movement in the slot, and a flange portion normally positioned outside said slot for holding said protective portions in fixed positions relative to each other.

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