May 23, 1944. H. C. MacGRAHAM 2,349,507

LEVER MECHANISM

Filed July 30, 1943

Fig. 2

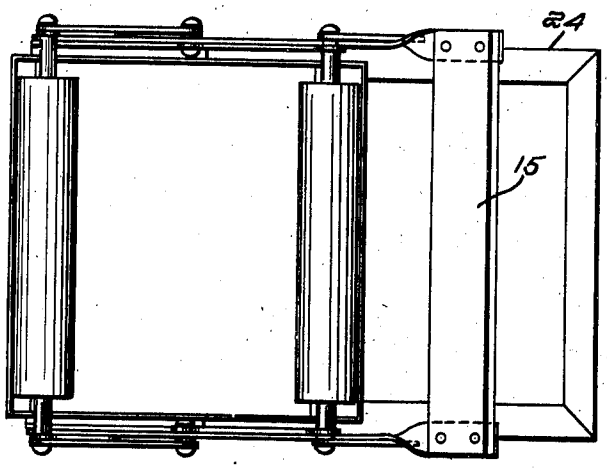


Fig. 3.

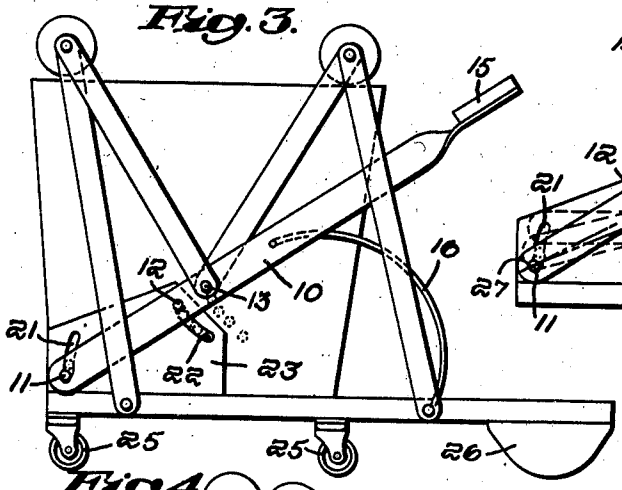


Fig. 1.

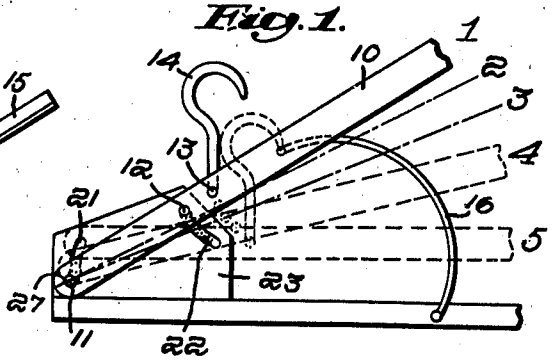
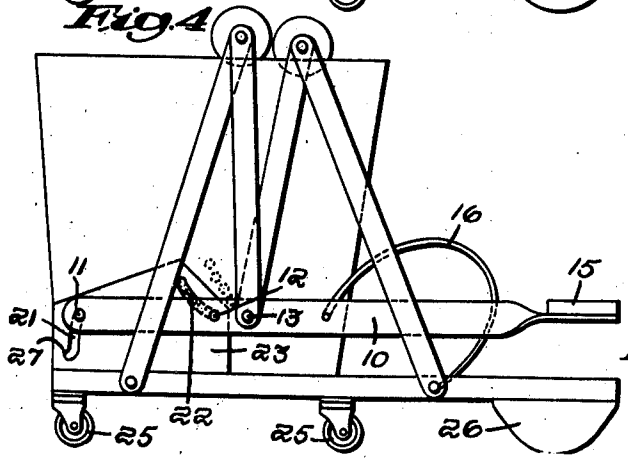


Fig. 4



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LEVER MECHANISM

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3 Claims. (Cl. 74—516)

This invention relates to improvements in lever mechanisms.

More particularly it relates to means for changing the leverage ratio during a lever's single stroke, as, from a low ratio in the early part of the stroke to a high ratio during the latter part of the same stroke.

By this means the first part of a lever's unidirectional stroke may move a tool or element from its position of rest quickly to its operating position, and then, without special attention of the operator, may in the latter part of the same stroke press, or feed, the tool with greater force while the tool operates.

This may be used in a great variety of circumstances. Illustrative instances are, for applying a brake to its drum; for closing the jaws of a vise by a foot lever, where a person is working on a succession of articles of approximately equal size to which the vise and lever are adjusted; and for the powerful closing and firm holding of a casement window. Or, the kind of change can be reversed, so as to start with the powerful leverage, as, for easily starting movement of a heavy body whose continued and final movement does not require so much force. The invention may be applied in connection with levers actuated in any way, as by hand or foot, or by mechanical or other power.

The invention can be embodied in several forms, in each of which the lever beam is provided with two fulcrum formations which are to serve as fulcrums successively, each located so as to provide one of the ratios at which the lever is to be effective, by being set on the beam at different distances from the work point, according to the different ratios of leverage desired. These said formations may be two pins; and they may be operated and guided by each being adapted to run in its own fixed slot in a support. Each such slot has the run of its edge walls shaped and located so that, when a swing of the beam is proceeding about the pin in the other slot acting as a fulcrum, this slot cams its own pin and the beam in the direction which is lengthwise of the beam, to draw that first fulcrum pin off its bearing, and at the same time to move its own pin into position to engage its fulcrum bearing, which may be the opposite wall of its own slot, and so take over the function of being fulcrum.

When cam slots are thus employed to make the shift, it is possible to make the change occur abruptly, from low to high ratio, by constituting the first fulcrum bearing as a ledge or shoulder, with which the slot wall makes an abrupt angle. The diameter and curvature of this pin, as the pin slips over the edge, contribute to the camming of the other pin into its position for acting as second fulcrum.

Useful application of the lever mechanism of the invention is illustrated herein by showing it applied to a mop-wringer over a bucket, in which rollers, that stand spread when at rest, are, by a foot lever, brought together at low ratio leverage, with relatively short initial lever travel, and then become pressed strongly at high ratio leverage for squeezing the mop while a substantial length of stroke of the lever is still available.

In the accompanying drawing:

Figure 1 is a diagrammatic side elevation of one form of leverage mechanism embodying the invention, which can be used for any purpose, and is specifically the form illustrated in Figures 2, 3 and 4;

Figure 2 is a plan of a mop wringer in which the invention is applied;

Figure 3 is a side elevation of the same at an initial position of the lever, the wringer rollers being spread;

Figure 4 is a side elevation of the same at a final position of the lever, the wringer rollers being pressed together.

Referring to the drawing, Figure 1 diagrammatically indicates five of the positions, marked respectively 1, 2, 3, 4, 5, occupied during a single stroke by a lever whose beam 10 rigidly carries two fulcrum pins, respectively 11 at a greater and 12 at a lesser distance from the fixed point 13 on the beam, where the lever is applied to the work by any suitable connection, typified by the hook 14. The end of the power arm at the right, broken away in Figure 1, is seen at 15 in Figures 2, 3 and 4, the lever in this instance being a foot lever, whose return to position 1 after a stroke is effected by a spring 16 seen in Figures 3 and 4. In the particular instance here illustrated, the pin 11 is the fulcrum at positions 1, 2 and 3; and the pin 12 is the fulcrum at positions 4 and 5, each pin pressing upward against a bearing in a plate 23 of sheet metal that stands firmly on a base 24 which, for convenience of mobility, has casters 25 and a foot 26.

The pin 11 travels in a slot 21 that has at its lower end a ledge or shoulder 27, best seen in Figure 4, against which the first fulcrum pin 11 stands and bears upward, acting as fulcrum when the lever is at rest in its initial position and during the early part of its stroke. From the edge of that ledge the slot 21 runs upward in direction for an unopposed run of the fulcrum

pin 11 while the second fulcrum pin 12 is functioning as fulcrum in its slot 22.

During a complete downward lever stroke the slot 22 initially provides in its under wall a cam that draws the first fulcrum pin 11 off from its bearing 27; and then in its opposite wall this slot 22 provides a bearing that makes the pin 12 become fulcrum. To accomplish this the slot has a run much like a third-quadrant arc. As represented in full lines in Figure 1 the first fulcrum 11 stands against its bearing 27; and it remains there through the dot and dash positions 2 and 3; but in the dotted positions 4 and 5 the cammed travel of the second fulcrum pin 12 has drawn the pin 11 off the ledge 27, and the second fulcrum pin has attained the positions respectively of the two small circles seen in Figure 1 lowest in the slot 22. In these positions the curvature of the slot 22 has resulted in the upper side of that slot becoming an obstacle to upward movement of the pin 12, so that that side of the slot becomes a bearing for the second pin 12 as a fulcrum, the pin 11 then being free to rise in slot 21. The pin 12 and its bearing being much nearer to the work point 13 than the bearing which the pin 11 had, the beam has a higher ratio of leverage for pulling on the work which the hook 14 indicates. The inclined path travelled by the work point 13 during this downward and slightly endwise travel of the lever is indicated by the row of dotted small circles.

Ball or roller bearings (not shown) may be provided for reducing friction of the pins at slots or links. Adaptations and adjustments of the mechanism may be made to fit it for various ratios and uses.

Although the mechanism is here shown only as applied to a lever of the second class, in which the work point is between the power and the fulcrum, the invention is not limited to levers of that class.

It is intended that the patent shall cover by suitable expression in the appended claims, whatever features of patentable novelty are herein disclosed.

I claim as my invention:

1. A mechanism for shifting the leverage of a lever during a single uni-directional stroke of that lever, comprising the combination, with the beam of the lever, of two fulcrum pins set on the beam at different distances from the work point of the lever; and a support with two separate slots each providing a bearing for one of said pins to act as a fulcrum; the beam of said lever being mounted for endwise movement relative to the support during its stroke; the said slots having edges which are cams guiding their respective pins for the stroke-travel of the beam to cause endwise movement of the beam such that the pins successively have fulcrum bearing during the stroke.

2. A mechanism as in claim 1 in which the said slots extend in angular relation to each other, each with transverse and with longitudinal components relative to the beam; the said two slots being located and arranged, in each direction of travel of the beam, for the beginning part of one cam slot to unseat the fulcrum pin that is in the other slot, and for the end part of that other cam slot to seat the fulcrum pin that is in the said one slot.

3. A mechanism as in claim 1 in which the said fulcrum bearings are separated at a distance from each other on the support, in lengthwise direction of the beam; the said means moving the beam endwise are cam slots in the support; one said slot having a ledge at its end, for the fulcrum bearing of its pin, the run thence being at an abrupt angle; and the other said slot having a cam side with a run for the second pin for drawing the first pin off its fulcrum ledge during a part of the lever's stroke, and a run on the other side of its slot, to constitute the fulcrum bearing of the second pin during the remainder of stroke.

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