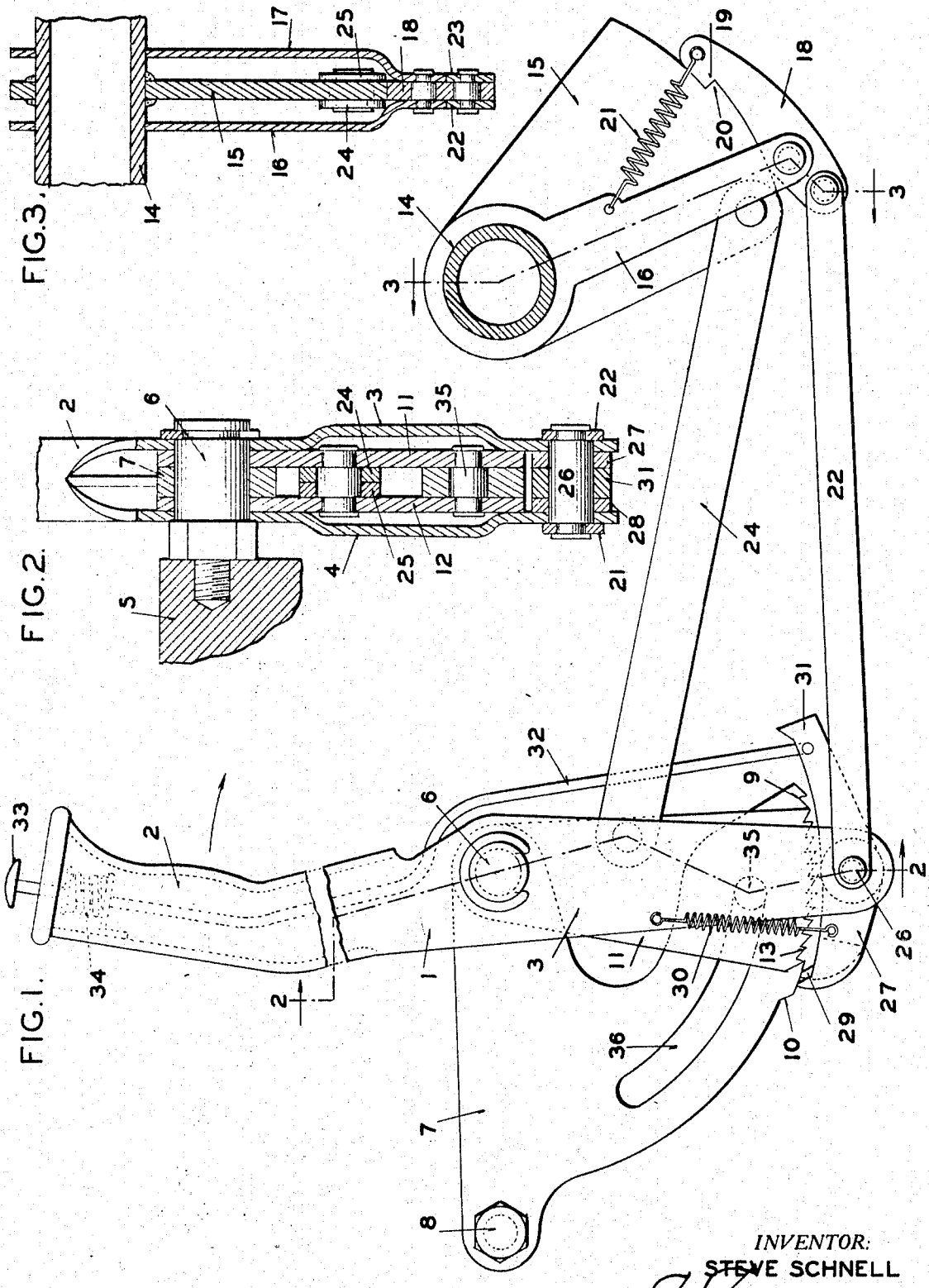
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AUTOMATIC VARIABLE LEVERAGE MECHANISM

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AUTOMATIC VARIABLE LEVERAGE MECHANISM

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My invention relates to levers and more particularly to lever mechanisms which permit the leverage ratio to be automatically changed.

One of the objects of my invention is to produce an improved lever mechanism of the type referred to which will actuate a member by one leverage ratio and then when the force necessary to actuate said member becomes greater than a predetermined value, the leverage ratio will be automatically changed.

Another and more specific object of my invention is to produce a leverage mechanism whereby a member may be operated by a lever through one connection and at a given leverage ratio and when the force necessary to actuate the member becomes a predetermined value, said connection will become inoperative and the lever will then operate the member through a second connection and at a higher leverage ratio.

Still another object of my invention is to provide a lever mechanism of the type above referred to with manually-controlled detent means for holding the mechanism in any of its operative positions and for also permitting the mechanism to be released and returned to its inoperative position whenever the main control lever is returned to its inoperative position.

Other objects of my invention will become apparent from the following description taken in connection with the accompanying drawing in which Figure 1 is a side view of a lever mechanism embodying my invention; Figures 2 and 3 are cross-sectional views taken on the lines 2—2 and 3—3, respectively, of Figure 1 and showing details of construction.

Referring to the drawing in detail, numeral 1 indicates a main hand lever having an upper hollow portion 2 and a bifurcated lower portion providing arms 3 and 4. The lever is pivoted at its intermediate portion to a support 5 by means of a pin 6. A fixed plate 7 of irregular shape is also mounted on the support by means of the pivot pin 6 and a bolt 8, the portion which cooperates with the pin 6 extending between the arms 3 and 4. The lower portion of the plate extends adjacent the lower ends of the arms and the edge thereof is provided with teeth 9 and a shoulder 10. Also pivotally mounted on pin 6 within the arms 3 and 4 and on opposite sides of plate 7 are two arms 11 and 12 of like construction. These arms are of such length as to extend to the lower edge of plate 7 and the end edges thereof are provided with teeth 13.

The member to be operated by the lever is shown as a shaft 14 which may be suitably connected to any other device which it is desired to control. An arm 15, in the form of a plate, is secured to the shaft and the shaft also rotatably carries two similar arms 16 and 17 positioned on opposite sides of plate 15. The lower ends of these arms extend below the plate and pivotally mounted thereon is a detent 18 having at one end a shoulder 19 for cooperation with a shoulder 20 on plate 15, said shoulder being normally held in engagement by a spring 21. The other end of the detent is pivotally connected to a pair of links 22 and 23 which are pivotally connected to the lower end of arms 3 and 4 of the main lever 1. The pivotal connection between the detent and the links is such, in relation to the pivot of the detent, that when force is transmitted through the links to move plate 15, a component of force will be present which tends to cause shoulder 19 to become disengaged from shoulder 20 against the bias of spring 21. A pair of links 24 and 25 are also provided to connect the lower end of plate 15 with the intermediate portions of arms 11 and 12.

The pin 26 which connects the links 22 and 23 to the lower ends of arms 3 and 4 carries two similar pawls 27 and 28 for cooperation with teeth 13 on the lower ends of the arms 11 and 12. The free ends of the pawls are secured together by means of a toothed member 29 interposed between and welded to the pawls. This toothed member lies in the same plane as plate 7 and cooperates with shoulder 10 to disengage the pawls from teeth 13 when the lever is released. A spring 30 biases the pawls toward engagement with the teeth. Also pivotally mounted on pin 26 is a pawl 31 extending in the opposite direction to pawls 27 and 28 and adapted to cooperate with the teeth 9 on plate 7. This pawl is controlled by a rod 32 which extends upwardly through the hollow portion 2 of lever 1 and carries a button 33 whereby the pawl can be disengaged by the thumb of the operator when his hand is gripping the upper end of the lever. A spring 34 biases the rod to a position where pawl 31 will automatically engage with the teeth 9 when the lever is moved. In order to form a stop for determining the "off" position of lever 1, the arms 11 and 12 carry a pin 35 which engages the forward end of a slot 36 in plate 7.

Referring to the operation of the lever mechanism just described, when it is desired to rotate shaft 14, lever 1 is grasped by the hand of the

operator and moved in the direction of the arrow. With the parts in the "off" position, as shown, the first movement of the lever results in force being transmitted through links 22 and 23 and pawl 18, thereby rotating plate 15 and the shaft. Rotation of plate 15 will cause links 24 and 25 to swing arms 11 and 12 in a clockwise direction and at a greater rate than the lower arms 3 and 4 of the lever due to the fact that links 24 and 25 are connected to arms 11 and 12 at a point closer to pivot 6. Initial movement of lever 1 also causes the toothed member 29 on the pawls to ride down shoulder 10 and permit the pawls to be in a cooperating position with respect to teeth 13, the teeth, however, ratcheting past the pawls due to the more rapid movement of arms 11 and 12 than the lower end of the lever.

When the force being transmitted through links 22 and 23 becomes of such value that the component thereof tending to disengage the detent 18 is sufficient to overcome the bias of spring 21, the shoulders 19 and 20 will be forced out of engagement and the connection between the links and the plate will be broken. Since the pawls 27 and 28 are already in position to cooperate with teeth 13, these pawls will pick up a tooth and cause arms 11 and 12 to move as a unit with the lower end of lever 1. Force will now be transmitted through links 24 and 25 to plate 15, thereby continuing the rotation of this plate and the shaft but at a higher leverage ratio since links 24 and 25 are connected to arms 11 and 12 at a point closer to the axis of lever 1. The movement of lever 1 brings pawl 31 into position for cooperation with teeth 9, thus causing lever 1 to be held in any operative position desired when the lever has been moved the desired distance.

When it is desired to release the lever mechanism and return the parts to their "off" position, rod 32 is pushed downwardly, thereby disengaging pawl 31. The lower end of lever 1 is now free to move in a counter-clockwise direction and when moved sufficiently in this direction to bring the toothed member 29 into engagement with shoulder 10, pawls 27 and 28 will be positively moved to an inoperative position, thereby permitting arms 11 and 12 to move relatively to the lever and return to their original positions.

My improved lever mechanism has been found to be useful in operating numerous kinds of mechanisms, an example being the application of brakes. The first movement of lever 1 will cause the friction element of the brakes to be brought into engagement with the drum at the low leverage ratio which is the desired operation. The change-over to the high leverage ratio will automatically take place as soon as the greater force is necessary to apply pressure to the friction element and force it into braking engagement with the drum. Regardless of the angle that shaft 14 or plate 15 must be rotated to bring the friction element into engagement with the drum, the change in leverage ratio will automatically take place at the proper time. It is thus seen that the wear of the friction element will have no effect in altering the time of the change-over.

Being aware of the possibility of modifications in the particular structure herein described without departing from the fundamental principles of my invention, I do not intend that its scope be limited except as set forth by the appended claims.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In a lever mechanism, a member to be actuated, a pivotally mounted lever, a pivotally mounted arm, a rigid connection between the lever and the actuated member, a second connection between the pivoted arm and the actuated member, means for causing the first named connection to become inoperative and incapable of transmitting any force when the force transmitted therethrough by the lever to move the actuated member is greater than a predetermined value, said arm being moved by said second connection when the actuated member is moved by the first connection, and means for connecting the pivoted arm to the lever whereby when said first connection is caused to be inoperative the actuated member will be operated through the arm and the second connection, said last named means comprising teeth on the end of the arm and a cooperating pawl pivotally carried by the lever.

2. In a lever mechanism, a member to be actuated, a pivotally mounted lever, a member pivoted coaxially with the lever, means comprising an automatically operable disconnecting means for connecting the lever and the actuated member, said disconnecting means causing the connection to be inoperative when the force transmitted therethrough by the lever to move the actuated member is greater than a predetermined value, a connection between the pivoted member and the actuated member, means for connecting the pivoted member and the lever for unitary movement when said connecting means is caused to be inoperative whereby the actuated member will be operated through the connection between it and the pivoted member, and manually releasable means for holding the lever in any of a plurality of operative positions.

3. In a lever mechanism, a member to be actuated, a pivotally mounted lever, a member pivoted coaxially with the lever, means for connecting the lever and the actuated member and comprising a link pivotally connected at one end to the lever and a yieldable detent means connecting the other end of the link to the actuated member, said detent means being automatically moved to a disconnecting position where no force can be transferred through the link when the force transmitted therethrough by the lever to move the actuated member is greater than a predetermined value, a second link connecting the pivoted member and the actuated member, and means for automatically connecting the pivoted member and the lever for unitary movement when the detent means assumes a disconnecting position.

4. In a lever mechanism, a member to be actuated, a pivotally mounted lever, a member pivoted coaxially with the lever, means comprising a link and yieldable detent means for connecting the lever and the actuated member, said detent means being automatically moved to a disconnecting position when the force transmitted therethrough by the lever to move the actuated member is greater than a predetermined value, a second link connecting the pivoted member and the actuated member, means for automatically connecting the pivoted member and the lever for unitary movement when the detent means assumes a disconnecting position, and manually releasable means for holding the lever in operative position.

5. In a lever mechanism, a member to be ac-

tuated, a pivotally mounted lever, a member pivoted coaxially with the lever, means comprising a link and yieldable detent means for connecting the lever and the actuated member, said detent means being automatically moved to a disconnecting position when the force transmitted therethrough by the lever to move the actuated member is greater than a predetermined value, a second link connecting the pivoted member and the actuated member, means for automatically connecting the pivoted member and the lever for unitary movement when the detent means assumes a disconnecting position, a fixed plate provided with teeth, a pawl carried by the lever for cooperating with the teeth of the plate to hold the lever in any of a plurality of operative positions, and means carried by the lever for releasing the pawl.

6. In a lever mechanism, a shaft, an arm fixed to the shaft, a pivotally mounted lever spaced from the shaft, a connection between the lever and the arm including a yieldable detent, an arm pivoted coaxially with the lever, a second connection between the last named arm and the arm fixed to the shaft, means comprising a pawl carried by the lever for automatically connecting the lever to the coaxially pivoted arm when the force transmitted through the first connection is of such value as to cause the yieldable means to assume a disconnecting position, and manually releasable means for holding the lever in its operative position.

7. In a lever mechanism, a pivoted member to be actuated, a second member pivoted coaxially therewith, a remote pivotally mounted lever, an arm pivoted coaxially with the lever, a detent pivoted on the second member and engaging the actuated member, a link connected to the lever and to the detent in such a manner that the detent will be disengaged from the actuated member when a predetermined force is transmitted through the link by the lever, a second link connecting the arm and the actuated member, and means for automatically connecting the arm to the lever for unitary movement when the detent is disengaged.

8. In a lever mechanism, a pivoted member to be actuated, a second member pivoted coaxially therewith, a remote pivotally mounted lever, an arm pivoted coaxially with the lever, a detent pivoted on the second member and engaging the actuated member, a link connected to the lever and to the detent in such a manner that the detent will be disengaged from the actuated member when a predetermined force is transmitted through the link by the lever, a second link connecting the arm and the actuated member, means comprising a pawl pivotally carried by the lever and cooperating teeth on the arm for automatically connecting the arm to the lever for unitary movement when the detent is disengaged, and means for positively disengaging the pawl from any tooth with which it may be engaged when the lever assumes an inoperative position.

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