

Feb. 20, 1940.

W. F. BOLDT

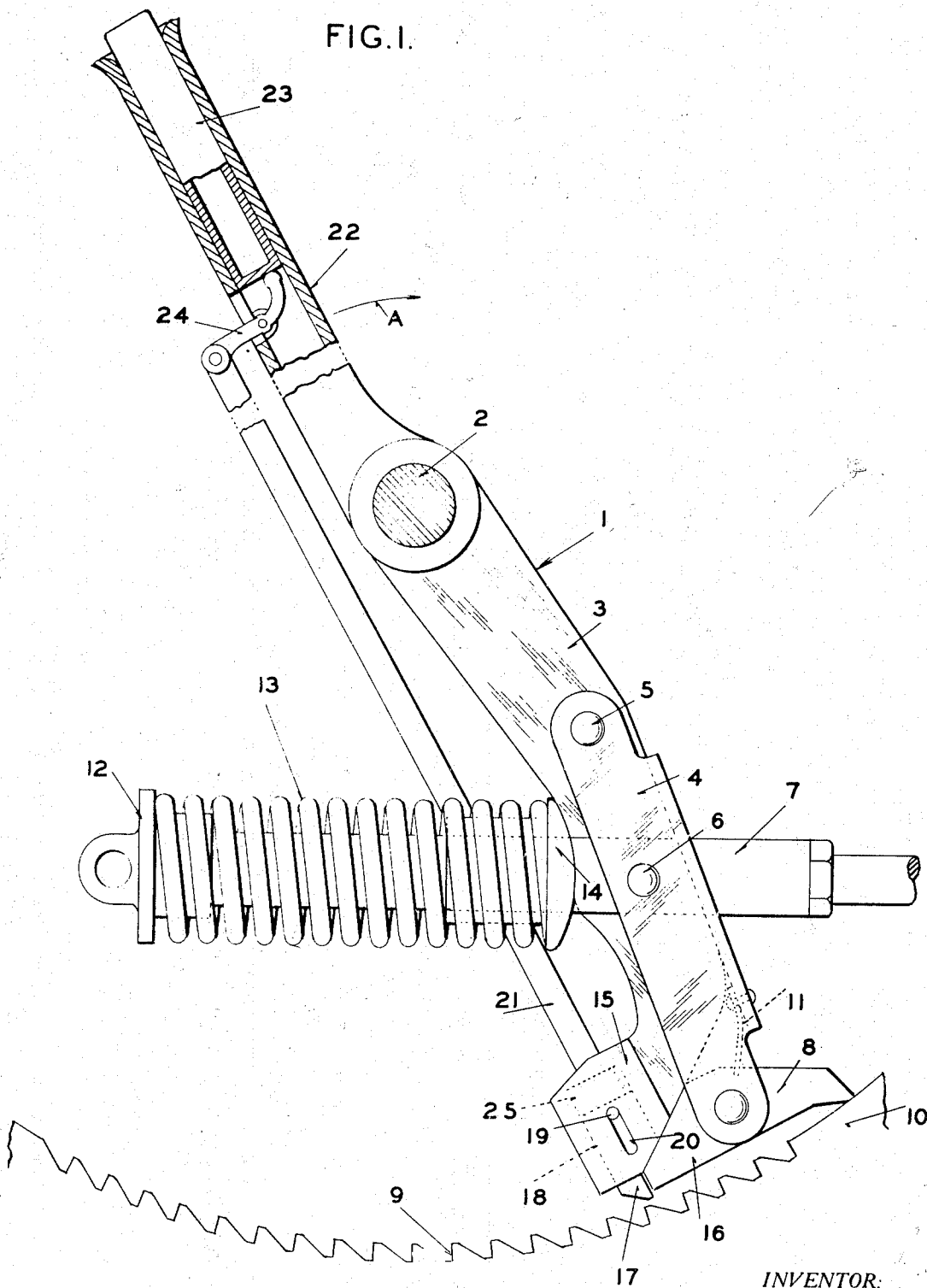
2,190,972

RATIO CHANGING LEVER MECHANISM

Filed Dec. 5, 1938

2 Sheets-Sheet 1

FIG. 1.



INVENTOR:
W. F. BOLDT

BY

J. E. Huffman
ATTORNEY

Feb. 20, 1940.

W. F. BOLDT

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FIG. 2.

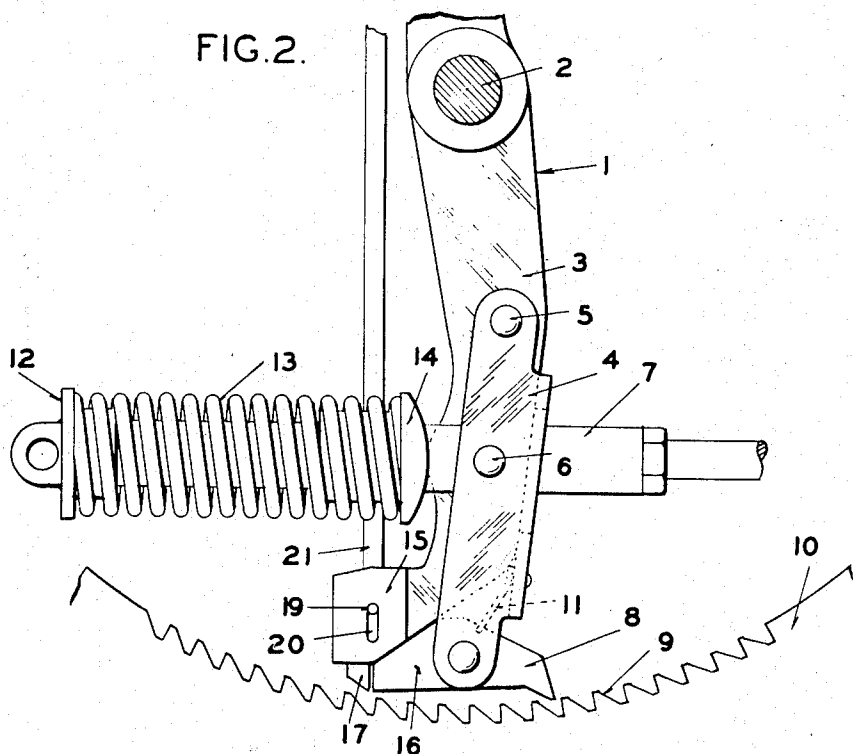
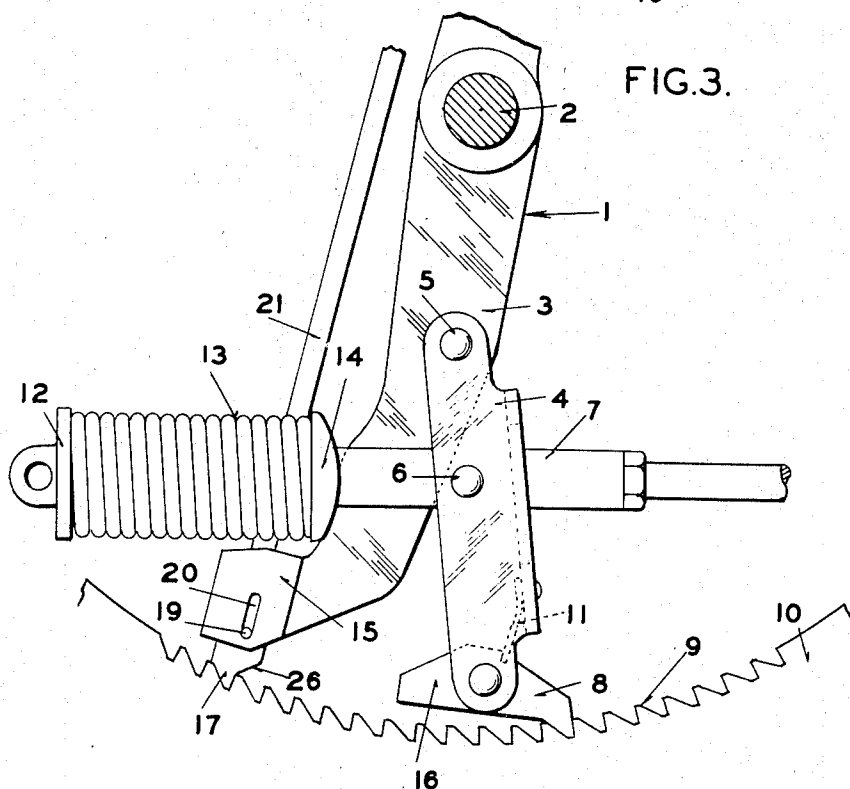


FIG.3.



UNITED STATES PATENT OFFICE

2,190,972

RATIO CHANGING LEVER MECHANISM

Werner F. Boldt, Clayton, Mo., assignor to
Wagner Electric Corporation, St. Louis, Mo.,
a corporation of Delaware

Application December 5, 1938, Serial No. 243,910

11 Claims. (Cl. 74-516)

My invention relates to levers and more particularly to levers which are provided with means for changing the leverage ratio thereof.

One of the objects of my invention is to produce an improved lever mechanism which will permit the leverage ratio thereof to be automatically changed from one ratio to a higher ratio when the force necessary to move the member being actuated reaches a predetermined value.

Another object of my invention is to provide means for holding the lever mechanism in any position it may assume and to also permit the lever mechanism to be readily released when desired.

Other objects of my invention will become apparent from the following description taken in connection with the accompanying drawings in which Figure 1 is a view showing my improved lever mechanism in inoperative position; and Figures 2 and 3 are views showing the leverage mechanism in two operative positions.

Referring to the drawings in detail, numeral 1 indicates the main lever which is pivotally mounted upon a shaft 2 fixed to some suitable support. The lower arm 3 of this lever has associated therewith an auxiliary lever 4 pivotally mounted at its upper end to said arm by a pin 5 and also pivotally mounted at its intermediate portion by means of a pin 6 to a pull-rod 7 connected to the mechanism to be actuated. The lower end of the auxiliary lever 4 has pivotally mounted thereon a pawl 8 which is adapted to cooperate with the teeth 9 on a fixed plate 10. The auxiliary lever carries a leaf spring 11 for normally biasing the pawl 8 toward engagement with the teeth 9.

The pull-rod 7 extends to a point beyond the arm 3 and auxiliary lever 4 and mounted on its end is an abutment member 12 for cooperation with one end of a compression spring 13 positioned on the pull-rod. The inner end of the spring has associated therewith an abutment sleeve 14 slidably mounted upon the pull-rod and forming an abutment surface for engagement by the arm 3 of the main lever 1.

The lower end 15 of arm 3 is so constructed as to cooperate with the tail 16 of pawl 8 and when said end is in the position shown in Figure 1, the pawl will be held in inoperative position. The lower end portion 15 carries a detent 17 which is slidably mounted in a suitable socket 18 and prevented from turning thereon by means of a pin 19 cooperating with a slot 20. The detent 17 is actuated by a rod 21 which extends upwardly

along side the main lever 1 to a point adjacent the top of the upper arm 22 of said lever. This rod is controlled by a plunger 23 slidably mounted in the hollow end of the main lever, the lower end of said plunger cooperating with a short lever 24 which is pivoted on the main lever and connected to the upper end of rod 21. A spring 25 biases the detent 17 toward a position where it engages the teeth 9 on plate 10 but, as shown in Figure 1, this engagement is prevented when the parts are in inoperative position due to the beveled surface 26 (Figure 3) of the detent engaging with the tail 16 of pawl 8.

When the parts are in the position shown in Figure 1, the pull-rod 7 will be in its inoperative position and the mechanism which is being actuated will be released. If it is now desired to operate the pull-rod, the upper end of arm 22 of the main lever is grasped by the hand of the operator and the lever rotated in a clockwise direction, as indicated by the arrow A. The pull-rod 7 will be actuated through the spring 13 by means of the lower arm 3. The auxiliary lever 4 will be carried with arm 3 of the main lever 1 and their relative positions will not be changed. The positions of the parts as the lever 1 is initially moved to operate the pull-rod are as shown in Figure 2.

When the force necessary to move the pull-rod reaches a predetermined value, which is determined by spring 13, the spring will begin to be compressed. This compression of the spring will result in arm 3 of the main lever being moved away from the auxiliary lever 4. When this relative movement between the two levers is sufficient, pawl 8 will be forced into engagement with one of the teeth 9 by the action of leaf spring 11 and the lower end of the auxiliary lever will now be held stationary. The relative movement between the lower arm 3 and the auxiliary lever 4 also permits spring 25 to move detent 17 so that it can engage one of the teeth 9 on plate 10.

Continued movement of lever 1 in the direction of arrow A will now result in additional compression of spring 13 and the swinging of the auxiliary lever 4 about its lower end due to the pivotal connection of arm 3 with the auxiliary lever 4 by means of pin 5. The pull-rod, instead of being actuated directly by the main lever, will now be actuated through the auxiliary lever 4, thus increasing the leverage ratio. When the pull-rod has been moved sufficiently, it will be held in the desired position by means of the detent 17. The position which the parts assume

after the pull-rod has been operated to the desired position is shown in Figure 3.

When it is desired to release the pull-rod, the operator need only press downwardly on the plunger 23 at the top of the main lever, thus causing the detent 17 to be disengaged from the cooperating tooth 9. This will now permit the lower arm 3 of the lever to move in a counter-clockwise direction and to a position where the lower end of arm 3 will engage the tail 16 of pawl 8, thereby forcing the pawl out of engagement with its cooperating tooth 9. The lever 1 and the auxiliary lever 4 will now assume their inoperative positions as shown in Figure 1.

It is apparent from the above description that the lever mechanism permits the leverage ratio at which the pull-rod is being actuated to be materially increased and at a time when the force necessary to operate the pull-rod is a predetermined value. In the particular construction shown the leverage ratio after the change-over has taken place is approximately two and one-half times the previous leverage.

My improved mechanism has been found to be very useful in applying brakes. When my leverage mechanism is used to actuate the friction element, said element will be brought into engagement with the drum by the first movement of lever 1 and 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 distance that the pull-rod 7 must be operated 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 changing the time of the leverage ratio 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 support, a main lever pivoted on the support and adapted to be actuated by a force applied directly thereto, an auxiliary lever connected to the main lever, an actuable member connected to the auxiliary lever, a yieldable member for operatively connecting the main lever and member, and ratchet means for establishing a fixed fulcrum for the auxiliary lever about which the auxiliary lever is rotated by movement of the main lever when said yieldable member yields and permits relative movement between the levers.

2. In a lever mechanism, a support, a main lever pivoted on the support, an auxiliary lever pivoted on the main lever, an actuable member connected to the auxiliary lever at a point spaced from the pivotal connection with the main lever, means for causing the levers to move as a unitary structure to operate the member when the required actuating force to move said member is less than a predetermined value, said means embodying means for permitting the main lever to move relatively to the auxiliary lever when said force is greater than the predetermined value, and means for causing said main lever when

moved relatively to the auxiliary lever to operate the member through the auxiliary lever, said last named means embodying means for establishing a fulcrum for the auxiliary lever independent of its connection with the main lever and with the member.

3. In a lever mechanism, a support, a main lever pivoted on the support, an auxiliary lever pivoted at one end on the main lever, an actuable member connected to an intermediate portion of the auxiliary lever, means for causing the levers to move as a unitary structure to operate the member when the required actuating force to move said member is less than a predetermined value, said means embodying means for permitting the main lever to move relatively to the auxiliary lever when said force is greater than the predetermined value, and means for causing said main lever when moved relatively to the auxiliary lever to operate the member through the auxiliary lever, said last named means embodying means for establishing a fulcrum for the other end of the auxiliary lever.

4. In a lever mechanism, a support, a main lever pivoted on the support, an auxiliary lever pivoted on the main lever, an actuable member connected to the auxiliary lever, means for causing the levers to move as a unitary structure to operate the member when the required actuating force to move said member is less than a predetermined value, said means embodying means for permitting the main lever to move relatively to the auxiliary lever when said force is greater than the predetermined value, and means comprising a pawl carried by the auxiliary lever and a cooperating fixed toothed member for establishing a fulcrum for said auxiliary lever whereby the main lever can operate the actuable member through the auxiliary lever when said main lever is permitted to move relatively to the auxiliary lever.

5. In a lever mechanism, a support, a main lever pivoted on the support, an auxiliary lever pivoted on the main lever, an actuable member connected to the auxiliary lever, means for causing the levers to move as a unitary structure to operate the member when the required actuating force to move said member is less than a predetermined value, said means embodying means for permitting the main lever to move relatively to the auxiliary lever when said force is greater than the predetermined value, means comprising a pawl carried by the auxiliary lever and a cooperating fixed toothed member for establishing a fulcrum for said auxiliary lever whereby the main lever can operate the actuable member through the auxiliary lever when said main lever is permitted to move relatively to the auxiliary lever, and means for automatically releasing said pawl from the toothed member by the main lever when it is permitted to return to the position it had prior to its relative movement with respect to the auxiliary lever.

6. In a lever mechanism, a support, a main lever pivoted on the support, an auxiliary lever pivoted on the main lever, an actuable member connected to the auxiliary lever, means for causing the levers to move as a unitary structure to operate the member when the required actuating force to move said member is less than a predetermined value, said means embodying means for permitting the main lever to move relatively to the auxiliary lever when said force is greater than the predetermined value, means for causing said main lever when moved relatively to the

auxiliary lever to operate the member through the auxiliary lever, said last named means embodying means for establishing a fulcrum for the auxiliary lever independent of its connection with the main lever and with the member, and releasable means for maintaining the levers in their operative positions.

7. In a lever mechanism, a support, a main lever pivoted on the support, an auxiliary lever pivoted on the main lever, an actuatable member connected to the auxiliary lever, a spring connecting the member to the main lever, said spring permitting the main lever to operate the member without relative movement between the levers when the force necessary to move the member is less than a predetermined value and to permit relative movement between the levers when said force is of a greater value, and means operable by the relative movement of the levers for establishing a fixed fulcrum for said auxiliary lever and permitting said main lever to operate the member through the auxiliary lever.

8. In a lever mechanism, a support, a main lever pivoted on the support, an auxiliary lever pivoted on the main lever, an actuatable member connected to the auxiliary lever, a spring connecting the member to the main lever, said spring permitting the main lever to operate the member without relative movement between the levers when the force necessary to move the member is less than a predetermined value and to permit relative movement between the levers when said force is of a greater value, a pawl carried by the other end of the auxiliary lever, a fixed toothed member, and means operable by the relative movement of the levers for permitting the pawl to engage the toothed member and establish a fulcrum for the auxiliary lever whereby the main lever can operate the member through the auxiliary lever.

9. In a lever mechanism, a support, a main lever pivoted on the support, an auxiliary lever pivoted on the main lever, an actuatable member connected to the auxiliary lever, a spring connecting the member to the main lever, said spring permitting the main lever to operate the member without relative movement between the levers when the force necessary to move the member is less than a predetermined value and to permit relative movement between the levers when said force is of a greater value, a pawl carried by the

other end of the auxiliary lever, a fixed toothed member, means normally causing said pawl to be inoperative and operable by the relative movement of the levers for permitting the pawl to engage the toothed member and establish a fulcrum for the auxiliary lever whereby the main lever can operate the member through said auxiliary lever, and releasable means for maintaining the levers in their operative positions.

10. In a lever mechanism, a support, a main lever pivoted on the support, an auxiliary lever pivoted at one end on the main lever, an actuatable member connected to a pull-rod pivoted to an intermediate portion of the auxiliary lever, a compression spring carried by the pull-rod and interposed between the pull-rod and the main lever, said spring permitting the main lever to operate the pull-rod without relative movement between the levers when the force necessary to move the pull-rod is less than a predetermined value and to permit relative movement between the levers when said force is of a greater value, and means operable by the relative movement of the levers for establishing a fixed fulcrum for the other end of the auxiliary lever and permitting said main lever to operate the pull-rod through the auxiliary lever.

11. In a lever mechanism, a support, a main lever pivoted on the support, an auxiliary lever pivoted at one end on the main lever, an actuatable member connected to a pull-rod pivoted to an intermediate portion of the auxiliary lever, a compression spring carried by the pull-rod and interposed between the pull-rod and the main lever, said spring permitting the main lever to operate the pull-rod without relative movement between the levers when the force necessary to move the pull-rod is less than a predetermined value and to permit relative movement between the levers when said force is of a greater value, a pawl on the other end of the auxiliary lever, a toothed member for cooperating with the pawl, cooperating means carried by the pawl and the main lever for permitting said pawl to engage the toothed member when the levers move relatively to each other, and manually controlled detent means carried by the main lever and cooperating with the toothed member for holding the levers in operative positions.

WERNER F. BOLDT.