June 21, 1966 M. L. LAHARTY 3,256,998

EMERGENCY SWING-REVERSING CONTROL FOR CRANES AND OTHER HORIZONTALLY SWINGING LOAD HANDLING APPARATUS

Filed Jan. 18, 1965 2 Sheets-Sheet 1

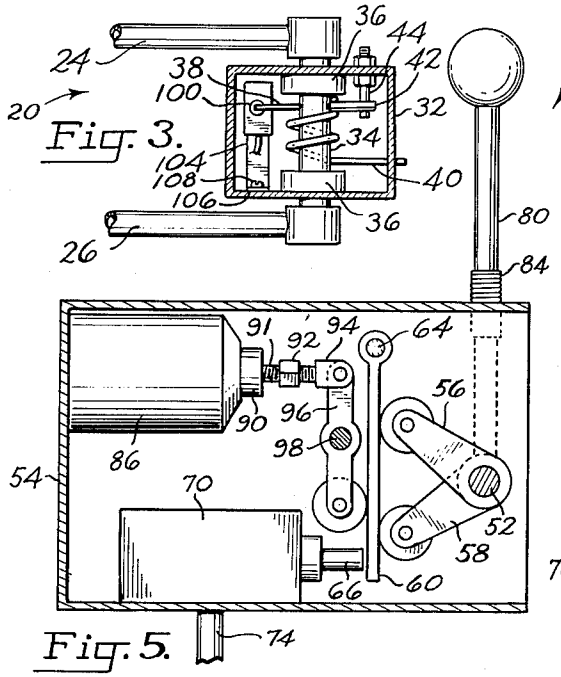


Fig. 3.

Fig. 5.

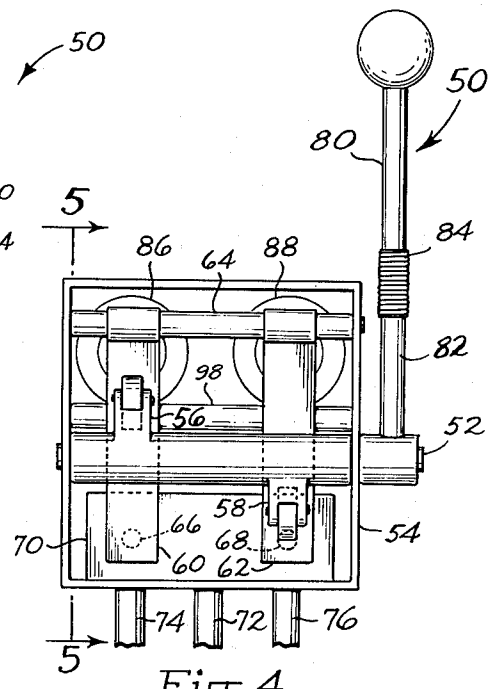


Fig. 4.

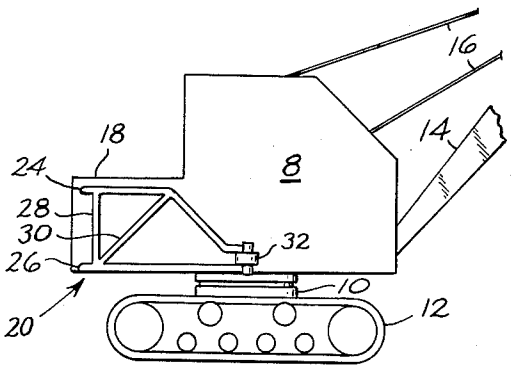


Fig. 2.

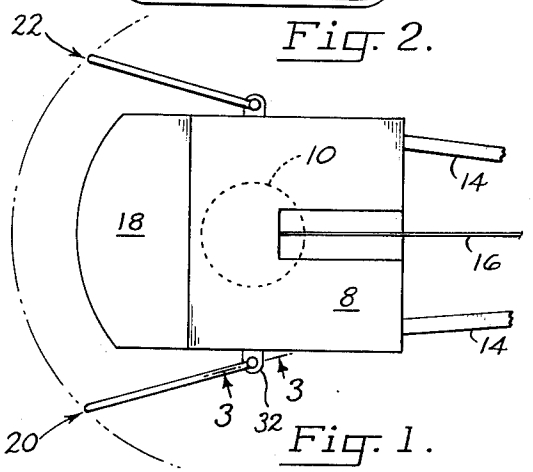


Fig. 1.

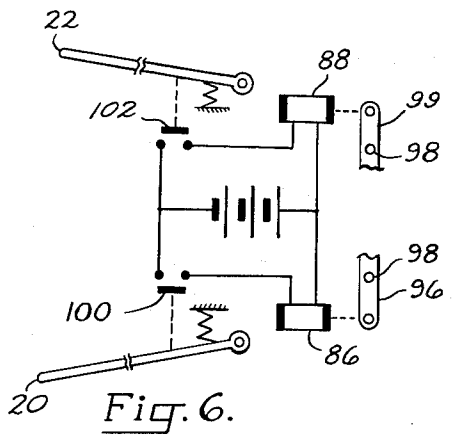


Fig. 6.

Milo L. Laharty
INVENTOR.

BY Eugene D. Farley
Atty.

June 21, 1966 M. L. LAHARTY 3,256,998

EMERGENCY SWING-REVERSING CONTROL FOR CRANES AND OTHER HORIZONTALLY SWINGING LOAD HANDLING APPARATUS

Filed Jan. 18, 1965 2 Sheets-Sheet 2

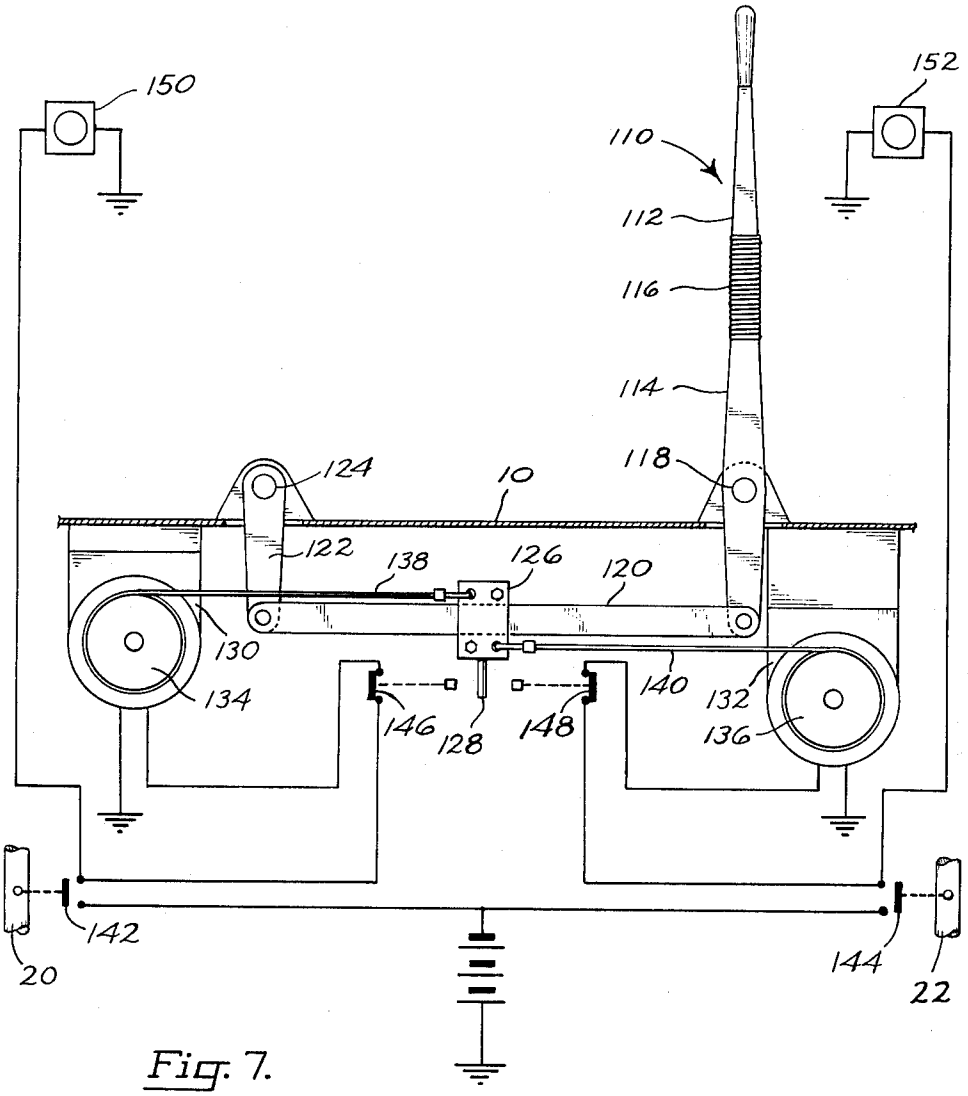


Fig. 7.

Milo L. Laharty
INVENTOR.

BY Eugene O. Farley
Atty.

United States Patent Office 3,256,998 Patented June 21, 1966

3,256,998

EMERGENCY SWING-REVERSING CONTROL FOR CRANES AND OTHER HORIZONTALLY SWINGING LOAD HANDLING APPARATUS

Milo L. Laharty, Roseburg, Oreg., assignor to Forrest Industries, Inc., Dillard, Oreg. a corporation of Oregon

Filed Jan. 18, 1965, Ser. No. 426,060
8 Claims. (Cl. 212—39)

This invention relates to an emergency control for reversing automatically the horizontally swinging motion of cranes, shovels, and other heavy load handling apparatus.

During the operation of cranes, shovels and like apparatus, many men have been killed or badly injured by being crushed between the rear of the apparatus and a wall, timber or other massive obstruction. Since the operator of the apparatus cannot see to the rear and is intent upon handling a load supported on a forwardly extending boom, the avoidance of such accidents is difficult and a constant source of worry. Moreover it detracts materially from the skillful performance of the operator's duties.

It is the general object of the present invention to provide an emergency swing-reversing control for cranes, shovels and like load handling apparatus which will sense the presence of a person standing to the rear of the apparatus in a location where he may be injured and which will reverse the swinging motion of the apparatus substantially instantaneously, thereby avoiding injuring the person.

Further objects of the present invention are the provision of an emergency swing-reversing control for cranes and the like, which control is applicable to the conventional shift and drive mechanism of the crane without substantial modification thereof; which instantaneously reverses the swinging movement of the crane; which is reliable in its operation; which is simple and inexpensive to install; and which easily is adjustable both as to the extent of the protected area and the degree of reverse motion achieved.

The swing reversing control of my invention is broadly applicable to cranes, shovels or other machines which are controlled hydraulically, manually or with steam. Such apparatus is characterized by having a body pivoted for horizontal swinging movement. Reversible drive means are connected to the body for swinging it in right swing and left swing arcs. Shift means are connected to the drive for adjusting it between right swing, left swing, and neutral operating conditions.

The control of the invention includes at least one substantially horizontal contact lever extending rearwardly and outwardly a predetermined distance from a central point on at least one side, usually both sides, of the body of the apparatus. The lever is mounted for movement toward and away from the apparatus. Resilient means act on the lever for maintaining it in a position normally away from the apparatus. Link means connect the lever and the shift means of the apparatus for reversing the shift means when the lever is moved toward the apparatus body.

Thus as the rear end of the apparatus sweeps against a person who is standing in the path of its swinging movement, the lever on the side of the apparatus is depressed. This immediately operates the shift mechanism of the apparatus to reverse its swinging motion by a predetermined amount, overriding any force which may be applied to the shift means by the operator in an effort to continue its movement in the forward direction. In this manner the person is saved from serious injury.

Considering the foregoing in greater detail and with particular reference to the drawings, wherein:

FIGS. 1 and 2 are schematic plan and side elevational views, respectively, of the body of a crane or shovel illustrating the manner of attachment of the herein described swing-reversing control;

FIG. 3 is a detail vertical sectional view, taken along line 3—3 of FIG. 1 and illustrating one manner of mounting the control on the side of the apparatus;

FIG. 4 is a detail view in end elevation illustrating the manner of application of the presently described control to an hydraulically operated swing shifting mechanism for the crane or shovel;

FIG. 5 is a sectional view in side elevation taken along line 5—5 of FIG. 4;

FIG. 6 is a circuit diagram of the electric circuit employed in the control of FIGS. 4 and 5; and

FIG. 7 is a sectional view illustrating the application of the presently described control to a crane or shovel provided with a mechanical shift, a schematic wiring diagram also being included.

The manner of installation of the control of the invention to a conventional crane is shown in FIGS. 1 and 2. As usual, the crane consists of a crane body **8** mounted on a turntable **10** supported on track drive **12**. An arm **14** with conventional rigging **16** extends forwardly from the body. A counterweight **18** extends rearwardly from the body.

The operator's station is located forwardly on the body where he is afforded a clear view of arm **14** and the work being handled. However, the area behind the crane is concealed from him. It includes the area swept by the rear portion of the crane body as it swings from right to left, particularly evident in FIG. 1. A person standing in this area is likely to be crushed against any obstruction which may be present in it.

To safeguard against this contingency at least one side, preferably both sides, of the body are provided with substantially horizontal contact lever means indicated generally at **20, 22**. These are arranged to sweep the danger area behind the crane body. When one of them contacts a solid object such as the body of a bystander, it is depressed and actuates through a suitable linkage the shifting mechanism of the crane, reversing it so that injury to the bystander is prevented.

As shown in FIG. 2, lever means **20** preferably has a gate-shaped construction covering a substantial vertical area. It includes a top lever arm **24**, a bottom lever arm **26**, a cross piece **28** and a diagonal brace **30**.

The lever assembly extends rearwardly a predetermined distance and outwardly at a predetermined angle from a central point on the body at which is located a bracket support **32**. A vertical shaft **34** is journaled in bearings **36** contained in the bracket. The inner ends of lever arms **24, 26** are fixed to the ends of this shaft, as appears in FIG. 3.

Vertical shaft **34** mounts a radial contact pin **38**, the purpose of which will appear hereinafter. It also mounts a coil spring **40** arranged in such a manner as to provide resilient means acting on the lever arms for maintaining them in a position normally away from the crane body.

Accordingly the upper end of spring **40** is anchored on a radial post **42** extending outwardly from shaft **34**. The lower end of the spring is anchored in an opening through bracket **32**.

Stop means also are provided for limiting the degree of outward rotation of lever **20**. To this end there is provided a stop **44**, the position of which is adjustable in a slot extending across the top of bracket **32**. Post **42** bears against stop **44** when lever **20** is in its outermost position, which is determined adjustably in this manner.

Link means are provided for linking contact levers **20, 22** with the shifting mechanism which controls the swinging motion of the crane. Although the link means

may comprise a mechanical connection, it preferably includes electrically operated elements to insure its sensitivity and rapid response. It thus may be applied to shifts which are fluid controlled, as by means of hydraulic fluid, steam or air, or to shifts which are mechanically operated. Its application to a conventional fluid controlled shift is illustrated in FIGS. 4, 5 and 6.

A rigid, manually operated swing shift lever, not illustrated but analogous to flexible lever **50**, is fixed to a rocking cam bar **52** journaled between the side walls of case **54**. Fixed to cam bar **52** are a first roller cam **56** and a second roller cam **58**.

The rollers of cams **56, 58** bear respectively against plates **60, 62** which are hinged at one end to a support shaft **64**. The outer ends of plates **60, 62** bear against the plungers **66, 68** of an hydraulic valving unit **70**.

The valving unit is of conventional construction and is fed by conduit **72** with hydraulic fluid under pressure from a central reservoir. When plunger **66** is depressed, the flow of fluid is diverted through conduit **74** to mechanism which swings the crane, for example, to the left. When plunger **68** is depressed, fluid is diverted through conduit **76** to mechanism which swings the crane to the right.

By the present invention there is added to the control described above a superimposed control which is actuated by levers **20, 22** and which in an emergency takes away the manual control normally exerted by the operator, instantaneously reversing the swinging motion of the crane to prevent a possible accident.

To this end there is employed a flexible control lever **50** including an upper segment **80** and a lower segment **82** interconnected through a resiliently deformable segment **84** which may be, for example, a length of stiff coil spring.

Also employed are electric link means connecting together lever **22** and cam bar **52** so that the latter may be moved as necessary to accomplish the desired reversal of the swinging motion of the crane body. The construction and manner of application of the electric link means employed are evident from a consideration of FIGS. 4, 5 and 6.

Mounted inside case **54** are a pair of solenoid thrust units **86, 88**. Each of these with its associated mechanism is similar to the other and accordingly solenoid unit **86** alone is illustrated.

The thrust shaft **90** of solenoid **86** mounts an extension **91** divided into two sections having reverse threads. An adjustment nut **92** is threaded onto the shaft for adjusting the extent of its thrust.

The end of shaft extension **91** is pivotally connected by means of a connector **94** to the shaft of a roller cam **96**. The latter is pivoted intermediate its ends on a stationary shaft **98**. The roller of the cam bears operatively against one side of swinging bar **60** against the other side of which bears the roller of cam **56**.

The construction of the mechanism associated with solenoid unit **88** is similar, there being a roller cam **99**, illustrated schematically in FIG. 6 which bears against swinging bar **62**, opposing the roller of cam **58**.

Limit switch **100** of a pair of limit switches **100, 102** in an electric circuit with solenoids **86, 88** is housed in a post **104**, FIG. 3, contained in bracket **32** on the side of the crane body. The post is mounted on a base **106** which adjustably is secured in a slot in the base of the bracket by means of bolts **108**. This makes possible adjustment of the position of limit switch **100** with reference to contact pin **38** on vertical shaft **34** which mounts lever **20**, determining the sweep of the lever which must occur before energization of the crane reversal mechanism takes place.

As is evident in the circuit diagram of FIG. 6, such reversal occurs when either one of contact levers **20, 22** is depressed, as by striking the body of a person standing in the path of the crane as it swings from side to side.

Assuming the operator has moved operating lever **50** in a direction such as to cause the crane to swing to the left as viewed in FIG. 1 and that contact lever **20** thereupon is depressed by striking a person who is in the path of the swinging crane, the result will be that limit switch **100** will be closed, energizing solenoid **86**. This will actuate roller cam **96** which will rotate swinging bar **60**.

Such rotation will have two effects. First of all it shuts off the valve unit controlled by plunger **66**, arresting the swinging motion of the crane body to the right. Secondly, by backing off cam **56** it rotates cam bar **52**. This actuates cam **58**, also fixed to cam bar **52**, depressing hinged plate **62** as well as plunger **68** of valve unit **70**. This in turn reverses the movement of the crane body, causing it to swing to the right as viewed in FIG. 1 until solenoid **86** comes to the end of its stroke and relieving anyone who may have been in danger.

The foregoing sequence occurs irrespective of the fact that the operator may have been oblivious to the danger and may have continued to move lever **52** in the direction of right swing. The force exerted by solenoid **86** through cam **96** is sufficient to overside the pressure exerted by the operator, since lever **50** flexes at the coil spring joint **84** between its two sections **80, 82**.

An alternate form of the invention, in which the control is applied to a mechanically controlled shift for a crane or other swinging apparatus, is illustrated in FIG. 7.

In this form of the invention, the body **8** is provided again with rearwardly and outwardly extending lever units **20, 22**. The mechanical swing shift includes an operating lever **110** having upper and lower segments **112, 114** interconnected by a resiliently deformable segment **116** which may comprise a length of stiff coil spring.

Lever **110** is fulcrumed about a pivot pin **118**. Its lower end is coupled to one end of a connecting rod **120**, the other end of which is connected to a crank **122**. The latter in turn is fixed to a shaft **124** which operates the swinging mechanism of the crane in a conventional manner.

To accomplish the purpose of the present invention, the forgoing conventional construction is modified by bolting to connecting rod **120** a plate **126** mounting a contact pin **128**.

Connecting rod **120** may be driven in forward and reverse directions independently of pressure exerted by the operator on lever **110**, by means of a pair of motors **130, 132** having mounted on their shafts reels **134, 136**, respectively, upon which are wound cables **138, 140**. The ends of the cables are fixed adjustably to opposite sides of plate **126**. Accordingly, as one or the other of the cables is wound up on its reel, connecting rod **120** is moved in one direction or the other, thereby shifting the swinging drive mechanism of the crane into reverse.

Energization of one or the other of motors **130, 132** is accomplished by means of an electric circuit, also illustrated in FIG. 7. Normally open limit switches **142, 144** corresponding to limit switches **100, 102** of the embodiment of FIG. 6, are located on the crane body in working relation to levers **20, 22** respectively. Normally closed limit switches **146, 148** are located so that they may be actuated by the movement of pin **128** on plate **126**.

Also included in the circuit are a pair of horns or other sound making devices **150, 152**.

The operation of the FIG. 7 form of the invention is as follows:

When lever **20** is depressed by contact with a bystander during swinging operation of the crane, switch **142** is closed. This closes the circuit including horn **150**, normally closed switch **146**, and motor **130**.

The motor thereupon drives reel **134** pulling on cable **138**. This moves connecting rod **120** to the left as viewed in FIG. 7, and reverses the swinging movement of the crane, even against pressure exerted manually by the operator on lever **110**, which flexes at joint **116**.

Movement of connecting rod **120** continues until contact pin **128** strikes normally closed switch **146**, open-

ing it and breaking the circuit. Motor **130** thereupon is stopped, arresting the reverse swinging motion of the crane and permitting the operator to continue its normal operation.

It accordingly will be seen that there is provided an apparatus in which the several objects of this invention are achieved and which is well adapted to meet the conditions of practical use.

It is to be understood that the form of my invention herein shown and described is to be taken as a preferred example of the same and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

Having thus described my invention, I claim:

1. In load handling apparatus having a body pivoted for horiozntal swinging movement, reversible swing drive means connected to the body, and shift means connected to the drive means for adjusting the drive means between right swing, left swing, and neutral operating conditions; and emergency-swing reversing control comprising:

(a) substantially horizontal contact lever means extending rearwardly and outwardly a predetermined distance from at least one side of the body,

(b) mounting means mounting the contact lever means for movement toward and away from the body,

(c) resilient means acting on the contact lever means for maintaining it in a position normally away from the body, and

(d) link means connecting together the lever means and shift means for reversing the shift means when the lever means is moved toward the body of the apparatus.

2. The control of claim **1** wherein the link means comprises electrical link means including an electric circuit, a switch in the electric circuit positioned for actuation by the lever means, and solenoid-operated ram means in the electric circuit and positioned adjacent the shift means for altering the same.

3. The control of claim **1** wherein the shift means includes a pivotal cam bar mounting a radially extending cam and a fluid-operated valve engaged by the cam for operating a fluid control circuit operable to shift the drive means; and wherein the link means comprises electrical means including an electric circuit, an electric switch in the circuit positioned for actuation by the contact lever means, a solenoid in the electric circuit, cam means connected to the solenoid and engaging the bar for reversing the switch means upon energization of the solenoid.

4. The control of claim **1** including a manually operating lever connected to the shift means, the operating lever including a length of stiffly resilient material having a stiffness predetermined to permit manual operation of the shift means through the operating lever during normal operation of the apparatus, but to permit overriding of the operating lever and reversal of the shift means upon actuation of the contact lever means.

5. The control of claim **1** including a manually operated lever connected to the shift means, the operating lever including a length of stiffly resilient coil spring having a stiffness predetermined to permit manual operation of the shift means through the operating lever during normal operation of the apparatus, but to permit overriding of the operating lever and reversal of the shift means upon actuation of the contact lever means.

6. The control of claim **1** wherein the shift means includes a connecting rod interconnecting an operator's control lever and a shifting mechanism and having a contacting member thereon; and wherein the link means comprises electrical link means including an electric circuit, a first electric switch positioned for actuation by the contact lever means and operable to make the circuit, a second electric switch in the electric circuit positioned to be contacted by the contact member on the connecting rod and operable to break the circuit, an electric motor in the circuit, and drum operated cable means driven by the electric motor and connected to the connecting rod for reversing the shift means, upon actuation of the first switch by the contact lever, for a time interval terminated by actuation of the second switch by the contact member on the connecting rod.

7. In load handling apparatus having a body pivoted for horizontal swinging movement, reversible swing drive means connected to the body, and shift means connected to the drive means for adjusting the drive means between right swing, left swing, and neutral operating conditions; an emergency swing reversing control comprising:

(a) a pair of vertically spaced lever arms extending rearwardly a predetermined distance and outwardly at a predetermined angle from a central pivot point on at least one side of the body,

(b) a vertical shaft mounting the inner ends of the arms,

(c) journal means journalling the shaft on the side of the body,

(d) resilient means acting on the lever arms for maintaining them in a position normally away from the body, and

(e) link means connecting together the lever arms and the shift means for reversing the shift means when the lever arms are moved toward the body.

8. The apparatus of claim **7** wherein the resilient means comprises a coil spring encircling the shaft and having one of its ends anchored thereon with the other end anchored to a stationary frame member, the spring being arranged for maintaining the lever arms in a position normally away from the body.

References Cited by the Examiner

UNITED STATES PATENTS

3,168,729 2/1965 Volberg ---------- 212—39 X

FOREIGN PATENTS

1,149,150 5/1963 Germany.

HUGO O. SCHULZ, *Primary Examiner.*

ARTHUR L. LEVINE, *Assistant Examiner.*