March 5, 1968 R. J. MILLER 3,371,435

SIDE-SHIFTABLE EXCAVATOR

Filed April 22, 1965

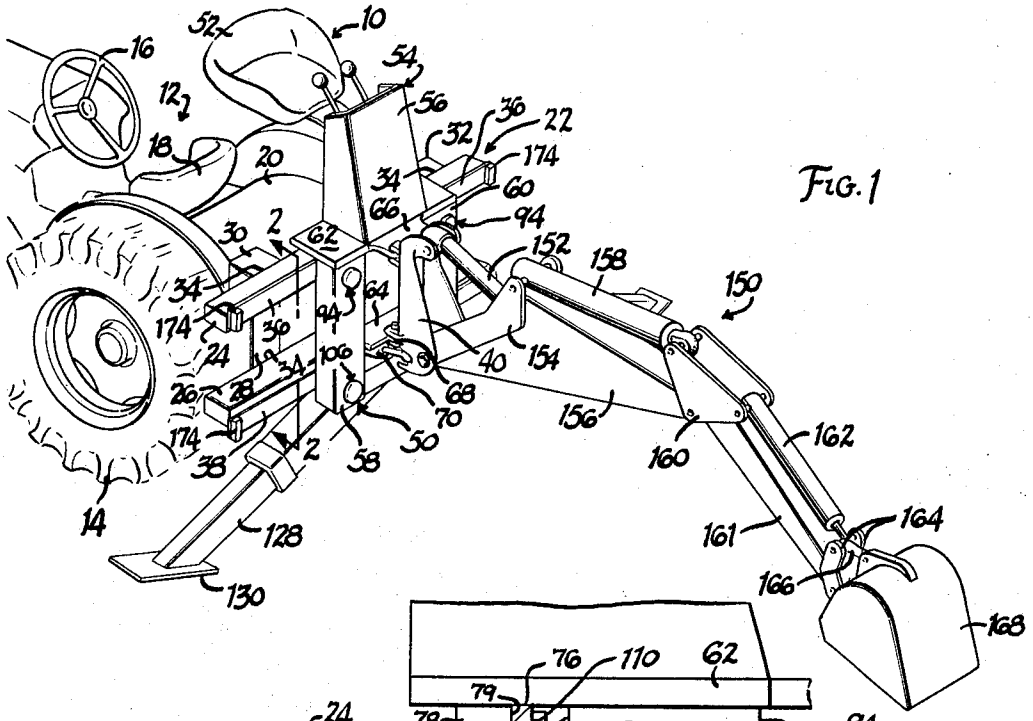

FIG. 1

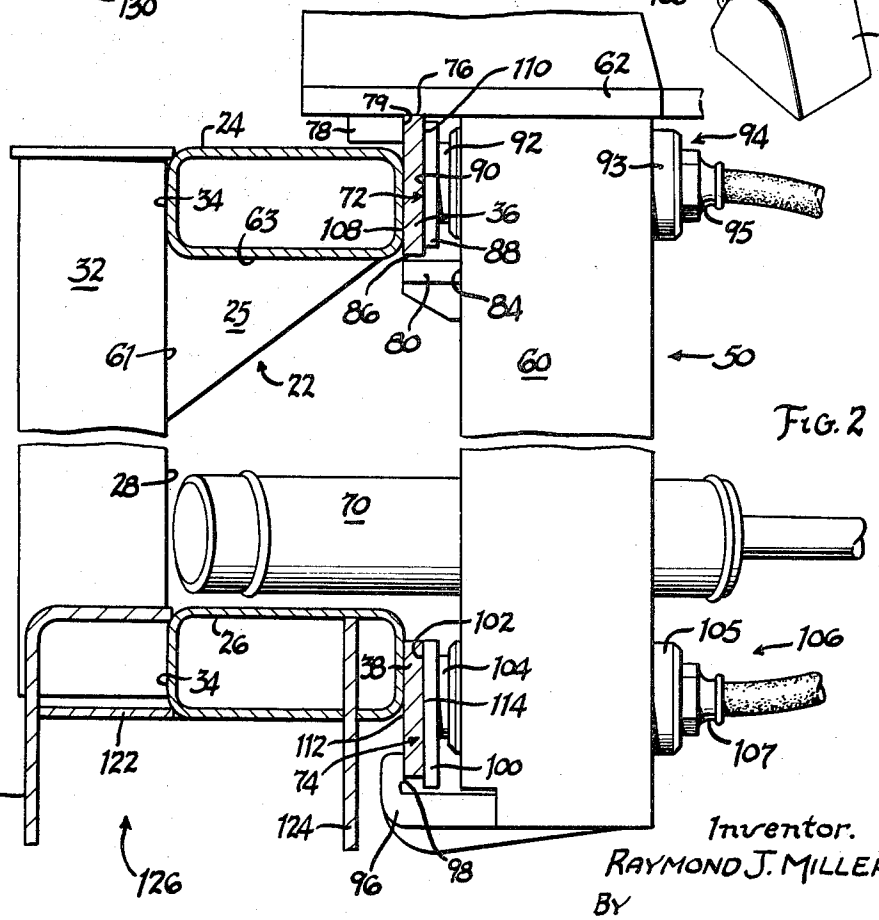

FIG. 2

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SIDE-SHIFTABLE EXCAVATOR

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6 Claims. (Cl. 37—103)

ABSTRACT OF THE DISCLOSURE

A side-shiftable excavator having a stationary frame and a mobile frame. The stationary frame has a pair of slide rails supported in spaced relation which slidably receive the mobile frame. The mobile frame has means engaging the top and sides of the upper rail and only the sides of the lower rail to facilitate easy relative displacement of the two frames. Limit means are provided and will engage the bottom of the top rail upon significant upward movement of the mobile frame with respect to the fixed frame.

Background of the invention

The present invention relates generally to a side-shiftable excavator and more particularly to a system, including a novel apparatus, having a unique slide rail construction, integrally carried at one end of a tractor of the backhoe variety or the like and upon which a side shiftable mobile frame is slidably supported, the mobile frame carrying an excavating apparatus, such as a backhoe assembly. The novel apparatus of this invention substantially eliminates binding between the mobile and immobile frames due to improper tolerances, misalignment and the like during repositioning of the mobile frame along the slide rails, and also accommodates both easy separate fabrication of the immobile and mobile frames and ready positioning of the mobile frame, as a unit, upon the immobile frame.

In the past, it has become common commercial practice in the excavating art to mount a backhoe excavating assembly or the like upon a frame, which frame is slidable relative to a fixed frame. The fixed frame is mounted upon the backhoe tractor or the like. Such devices are commonly generically denominated as side shiftable excavators.

In order to properly transmit the load imposed by the slidable or mobile frame, by the backhoe assembly or the like, and the loads created during excavation, three basic requirements should be satisfied. First, the weight of the mobile frame and the backhoe assembly should be vertically transmitted effectively to and readily assumed by the immobile frame. Second, the mobile frame should be supported in such a way as to prevent rotation or pivotal movement of the mobile frame about the immobile frame which would otherwise result due to the overhanging moment caused by the weight of the mobile frame and backhoe assembly, and the forces generated during excavation. Third, the mobile frame should be supported to accommodate easy repositioning of the mobile frame along the immobile frame transverse of to achieve the desired excavating position.

In an effort to satisfy the foregoing three requirements, the prior art of the side shiftable excavator type has predominantly used either (1) variously configurated upper and lower slide rails secured to the immobile frame and upon which the mobile frame slides (for example, see United States Patent 3,117,685), or (2) variously shaped upper and lower channels or recesses within which studs, bolts or the like are fitted and secured to support the mobile frame in a desired position (for example, see United States Patent 3,156,488). In either case the weight of the mobile frame (and the excavating equipment carried by the mobile frame), the excavating loads and the previously described overturning moment are transmitted in part to both (1) the upper slide rail, channel or recesses and (2) the lower slide rail, chamber or recesses, as the case may be. As a result of this type of load transmission, in order for the mobile frame to be readily slidable with respect to the immobile frame, exact alignment between the slide rails and the guides receiving the same, or between the channels and the studs, or between the recesses and the bolts must exist initially and must be maintained through the lifetime of the excavator in spite of abuse and wear. Thus, the manufacturig tolerances to which these prior art excavating devices have been necessarily subjected significantly escalates the initial cost of the equipment and the restoration of alignment following abuse and wear necessitates relatively high maintenance expenditures.

In view of the foregoing, it would be a valuable contribution to the side shiftable excavator art, to provide a method and means for slidably mounting a side shiftable or mobile frame upon an immobile frame so that the weight, excavation loads and overturning moment imposed by the mobile frame are readily assumed by the immobile frame and wherein the mobile frame is easily slidably repositioned without the need to provide components manufactured to close tolerances and where misalignment due to abuse, wear and the like does not cause binding between the frames or does not otherwise inhibit the ability of the mobile frame to be slidably displaced displaced along the immobile frame.

Summary of the invention

Generally, the presently preferred embodiment of this invention structurally includes a frame which is fixedly secured to the tractor chassis, this frame consisting of two superimposed horizontal tubes of hollow rectangular cross sectional configuration acting as beams and joined by welding or the like at the rear side to a pair of transversely spaced vertical posts or columns of similar cross section. The attachment of the fixed or immobile frame to the tractor chassis is made by forwardly projecting ears carried by the columns and secured to attachment arms on the tractor.

The rear faces of the beams carry vertically disposed planar plates preferably of solid rectangular cross section, which plates constitute slide rails and are welded or otherwise integrally secured to the rear faces of the beams. The plates or slide rails are vertically aligned with each other at different elevations.

The swing post of the excavator or backhoe is mounted on a vertical side-shiftable or mobile frame which spans the distance between the slide rails. This mobile frame is rectangular in outline and considerably smaller than the immobile frame. The mobile frame (which also carries the excavator operators seat) is slidable on the implement or mobile frame and is provided with a top slide rail guide projecting from the mobile frame toward the tractor and being engageable at various times with the top, the bottom and both sides of the top slide rail. The mobile frame also carries a bottom slide rail guide which is engageable with both sides of the bottom slide rail.

By this slide rail and guide arrangement, the upper slide rail resists at its sides the vertical torque or overturning moment imposed by the mobile frame responsive to the vertical load component applied to the excavator or backhoe swing post, resists at the bottom of the upper slide rail any upward thrust, and carries at the top of the upper slide rail essentially the entire weight load vertically imposed by the mobile frame upon the immobile frame. The lower slide rail solely assists in resisting the vertical torque or overturning moment and does not carry any

significant portion of the vertical weight load, thereby avoiding binding due to inaccurate tolerances and due to misalignment of components.

The mobile frame may be locked in position at a selected position by mechanical means of well known type or by the hydraulic apparatus disclosed in co-pending application Ser. No. 450,114, now Patent No. 3,304100, filed on even date herewith and assigned to the assignee of the present invention. The hydraulic apparatus of that plication Ser. No. 450,114, now Patent No. 3,304,100, of this application and briefly described herein, though constituting no part of the present ivention.

Accordingly, it is a primary object of the present invention to provide in a side shiftable excavator or the like a novel means for facilitating easy displacement of the mobile frame with respect to the immobile frame without requiring that components be manufactured to close tolerances and without requiring relatively exact alignment between the two frames as prerequisites to avoid binding.

An additional important object of the present invention is the provision in a side-shiftable excavator or the like of a novel means for carrying the mobile frame upon the immobile frame, whereby the frames may be easily separately fabricated and the mobile frame may be readily positioned upon and removed from the immobile frame as a unit.

A further object of this invention is the provision in a side-shiftable excavator or the like of a unique immobile frame which is strong, durable, economical to fabricate and requires only a small number of components.

These and other objects and features of this invention will become more fully apparent from the following description and appended claims taken in conjunction with the accompanying drawings, wherein:

FIGURE 1 is a perspective view of a tractor mounted backhoe equipped with the novel slide rail construction of the present invention; and

FIGURE 2 is a cross sectional view of the novel slide rail construction taken along line 2—2 of FIGURE 1.

General

Reference is now made to the drawings wherein like numerals are used to designate like parts throughout. FIGURE 1 illustrates in perspective a tractor-mounted backhoe, generally designated **10**, which comprises a tractor **12** having rubber tires **14**, a steering wheel **16**, a driver's seat **18**, and a chassis **20**. The tractor **12**, of course, is only representative of one of several types of tractors which could be utilized in conjunction with the present invention. Naturally, track-mounted tractors are also encompassed by the present invention.

Generally, the presently preferred embodiment of this invention structurally includes a fixed or immobile frame, generally designated **22**, which is integrally fastened to the tractor chassis **20** by forwardly projecting ears (not shown) or the like carried by the immobile frame **22** and secured to attachment arms (not shown) on the tractor chassis **20**. A side shift or mobile frame **50** is carried by the immobile frame **22**. A swing post **40** is pivotably supported by the mobile frame **50** and carries, in a conventional manner, a backhoe assembly **150** which comprises a boom cylinder **152**, an anchor bracket **154**, a boom **156**, a dipper stick or crowd cylinder **158**, a triangularly shaped pivotable bracket **160**, a dipper stick **161**, a bucket cylinder **162**, links **164** and **166** and a bucket **168**. The backhoe assembly **150** constitutes part of the prior art per se.

The immobile frame **22** comprises two generally horizontally extending beams **24** and **26** of hollow rectangular cross sectional configuration which are joined by welding or the like to the rear side **28** of a pair of transversely spaced, vertically extending columns **30** and **32**, also of hollow rectangular cross sectional configuration. The welds so joining the beams **24** and **26** to the columns **30** and **32** are identified by the numerals **34**. The beam **24**

is further supported by a pair of diagonally disposed braces **25**, fabricated from hollow rectangular cross sectional stock, which are welded or otherwise secured to the columns **30** and **32** at **61** and to the beam **24** at **63**.

The rear faces of each of the beams **24** and **26** carry vertically disposed plates **36** and **38**, preferably of solid rectangular cross section. These plates **36** and **38** constitute slide rails and are preferably welded or otherwise integrally secured at the rear faces of the beams **24** and **26**. The slide rails **36** and **38**, as can be seen by inspection of the figures, are vertically aligned with each other at different elevations and extend generally horizontally with the slide rail **36** projecting above the beam **24** and the slide rail **38** projecting beneath the beam **26**.

Integrally attached to the lower beam **26**, as, for example, by welding, are three members including an angularly-shaped member **120**, a horizontally disposed plate **122** and a vertically disposed plate **124**. In combination, the angle **120** and the plates **122** and **124** constitute a bracket generally designated **126**. The bracket **126** supports the stabilizer or outrigger legs **128**, each of which have a ground engaging pedestal **130**. The stabilizer legs **128** (only one of which is illustrated in FIGURE 1) are pivotally mounted to the downwardly extending portion of the angularly-shaped member **120** and to the vertically disposed plate **124** by means of a pin and aperture assembly (not shown).

The mobile frame

The swing post **40** of the overall excavator **10** is mounted on the generally vertically extending side shiftable or mobile frame **50**. The mobile frame **50** spans the distance between the slide rails **36** and **38**. This mobile frame is rectangular in outline and considerably smaller than the immobile frame **22**. The mobile frame **50** carries with it an excavator operator's seat **52**, and a control panel **54** having a cover **56**. The mobile frame **50** is slidable, under certain conditions, along the previously described slide rails **36** and **38** of the immobile frame **22**.

The mobile frame **50** structurally comprises a pair of columns **58** and **60** integrally connected to a top plate **62** (which carries the control panel **54** and the cover **56**) and to a bottom support plate **64**. The top support plate **62** and the bottom support plate **64** each provide an integral ear **66** and **68**, respectively, upon which the swing post **40** is pivotably mounted by connecting pins (hidden from view). The swing post **40** is hydraulically rotatable responsive to actuation of a pair of swing cylinders, only one of which is illustrated in the figures, being identified by the numeral **70**.

The mobile frame **50** is slidably carried by the immobile frame **22** along the two slide rails **36** and **38** and is provided with two top slide rail guides, generally designated **72**, and two bottom slide rail guides, generally designated **74**. The upper slide rail **36** and the two guides **72**, in combination, constitute primary load-carrying members in that the downward vertical load imposed by the backhoe assembly **150** and by the mobile frame **50** is transmitted through the plate **62** to the top surface **76** of the slide rail **36**. No downward vertical load is transmitted to the lower slide rail **38**.

Each upper slide rail guide **72** is generally C-shaped and comprises a back-up stop block **78** integrally secured to the top plate **62**, as by welding, a bottom stop block **80** integrally secured to the columns **58** and **60** of the mobile frame **50** (which contacts the bottom **86** of the upper slide rail **36** to transmit any upward thrust generated during excavation and the like), and a pressure bearing pad **88** providing a pressure bearing surface **90**. The pressure bearing pad **88** is integrally connected to a piston rod **92** of each of two cylinder assemblies **94**.

Each lower slide rail guide **74** is generally L-shaped and comprises a back-up stop member **96** providing a pressure bearing surface **98** (the back-up stop **96** being integrally attached at the bottom to the columns **58** and

60 and a pressure bearing pad 100 providing a pressure bearing surface 102 (the pressure bearing pad 100 being integrally attached to a piston rod 104 of each of two cylinder assemblies 106). The above-described hydraulic arrangement constitutes part of the invention of application Ser. No. 450,114, previously referred to.

Thus, when the mobile frame 50 is locked in a predetermined position along the slide rails 36 and 38 of the immobile frame 22 by reason of extension of the piston rods 92 and 104 of the cylinder assemblies 94 and 106, respectively, (1) the top slide rail 36 and the two top guides 72 as well as (2) the bottom slide rail 38 and the two bottom guides 74 each in combination constitute anti-rotate assemblies. These anti-rotate assemblies receive the previously described overturning moment caused by the cantilevered suspension of the backhoe assembly 150. This is achieved by (1) pressurized engagement between the face 79 of the stop 78 and the side surface 108 of the slide rail 36 and pressurized engagement of the pressure bearing surface 90 of the pad 88 with the side surface 110 of the slide rail 36, and (2) pressurized engagement of the pressure bearing surface 98 of each back-up pad 98 against the side surface 112 of the bottom slide rail 38 and pressurized engagement between the pressure bearing surface 102 of each pad 100 with the side surface 114 of the slide rail 38.

Therefore, the upper slide rail 36 and the two guides 72 in combination constitute both (1) vertical load carrying members as well as (2) anti-rotate members while the lower slide rail 38 and the two guides 74 in combination constitute only anti-rotate members. Thus, binding due to imprecise manufacturing tolerances and misalignment of components is substantially eliminated even after the components have been subjected to significant wear and abuse.

Operation

The mobile frame 50, which carries the backhoe assembly 150, may be shifted from one position to another along the slide rails 36 and 38 and locked in that position in the manner described in co-pending application Ser. No. 450,114, previously referred to. Briefly, to reposition the mobile frame 50, the piston rods 92 and 104 of the cylinder assemblies 94 and 106, respectively, are retracted. This retraction moves the pressure bearing surfaces 90 and 102 out of pressurized engagement with the sides 110 and 114 of the slide rail 36 and 38, respectively. Also, retraction of these piston rods accommodates a slight shifting of the mobile frame 50 axially of the tractor toward the tractor causing the back-up stop or pal 78 to be relieved from pressurized engagement with the side 108 of the slide rail 36 and the surface 98 of the backup pad 96 to be relieved of pressurized engagement with the surface 112 of the bottom slide rail 38. Of course, some slide contact between the surfaces of the slide rail 36 and 38 and of the guides 72 and 74 will remain as the overturning moment due to the cantilevered suspension of the backhoe assembly 150) is transmitted from the mobile frame 50 to the immobile frame 22. Thereafter, the mobile frame 50 is side shifted manually or by use of the bucket and crowd cylinder along the generally horizontally extending slide rails 36 and 38 to the desired new position where the cylinder assemblies 94 and 106 are again actuated to extend the piston rods 92 and 104. This brings about the locked pressurized rigid relation between the frame 50 and the immobile frame 22 depicted in FIGURE 2 and previously described.

As can readily be appreciated by inspection of the previously described frames 22 and 50, these frames may be separately fabricated with considerable ease and a minimum of component parts and may thereafter be assembled in the mounted position illustrated in the figures by sliding the mobile frame 50 upon the slide rail 36 and 38 transverse to the axis of the tractor 12. Thereafter, stops 174 are bolt mounted or otherwise secured at each end of both slide rails to prohibit inadvertent removal of the mobile frame 50 from the immobile frame 22.

It is to be appreciated that while the foregoing description is devoted to the use of hydraulic means including the cylinder assemblies 94 and 106 to lock the mobile frame 50 in fixed position with respect to the immobile frame 22, that mechanical apparatus, constituting part of the prior art, may also be used to lock the two frames in the desired position.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. In a side-shift excavator a stationary frame carried by the excavator comprising at least two spaced, generally vertical columns, at least an upper and lower beam integrally secured at one side to the columns in essentially transverse relation, and a slide rail integrally secured to each beam along the side of each beam opposite the columns, and a moveable frame carried by the stationary frame comprising first means engageable with both sides, the top and the bottom of one slide rail and second means solely engageable with the sides of the other slide rail whereby binding due to malformation, misalignment and the like during repositioning of the moveable frame relative to the stationary frame is substantially eliminated.

2. In a side-shift excavator, an immobile frame carried by the excavator and a mobile frame carried by the immobile frame, said immobile frame comprising at least two spaced generally vertically extending columns of hollow rectangular cross section, at least an upper and a lower beam of hollow rectangular cross section integrally secured at one side to the columns and extending in general horizontal transverse relation with respect to the columns, and a slide rail of solid generally rectangular cross section integrally secured to each beam at different elevations along the side opposite the columns, the upper slide rail constituting a primary load-carrying member and an aniti-rotate member in combination by reason of being engageable at both sides, at the top and at the bottom thereof with the mobile frame and the lower slide rail constituting only an anti-rotate member by reason of being solely engageable at the sides thereof with the mobile frame whereby binding and the like due to malformation, misalignment and the like during repositioning of the mobile frame relative to the immobile frame is substantially eliminated.

3. In a side-shiftable excavator, a stationary frame carried by the excavator, at least two slide rails integrally secured to the stationary frame and a moveable frame carried by the stationary frame upon the slide rails, said moveable frame comprising first means selectively engageable with both sides, the top and the bottom of one slide rail and second means solely engageable with the two sides of the other slide rail whereby binding due to malformation, misalignment and the like during repositioning of the moveable frame relative to the stationary frame is substantially eliminated.

4. In a side-shiftable excavator, a stationary frame carried by the excavator, at least two slide rails integrally secured to the stationary frame, and a movable frame carried by the stationary frame upon the slide rails, said movable frame comprising first means engageable with at least one side and with the top of one slide rail, second means solely engageable with at least one side of the other slide rail whereby binding due to malformation, misalignment and the like during repositioning of the

moveable frame relative to the stationary frame is substantially eliminated, and stop means to retain the moveable frame against significant upward displacement relative to the stationary frame.

5. In a side-shiftable excavator, an immobile frame carried by the excavator, at least two slide rails integrally secured to the immobile frame, and a mobile frame carried by the immobile frame upon the slide rails, said mobile frame comprising load-transmitting means engaging the top of one of the two slide rails, first moment-transmitting means engaging the top and one side of the one slide rails, second moment-transmitting means engaging one side of the other slide rail, and stop means carried by one of said immobile frames and mobile frame and engageable with the bottom of said one slide rail for limiting the upward displacement of said mobile frame relative to said immobile frame whereby binding due to malformation, misalignment and the like during repositioning of the mobile frame relative to the immobile frame is substantially eliminated.

6. In an excavating device having a side-shift frame carried by a fixed frame, the improvement comprising two slide rails carried by the fixed frame at spaced elevations, spaced load-transmitting support means carried by said side-shift frame and engageable with the sides and top of the upper of said rails, said support means further including means limiting the vertical movement of said side-shift frame on said fixed frame, and guide means interposed between the side-shift frame and the lower of said rails engageable only with opposed sides of said lower rail.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,371,435 March 5, 1968

Raymond Miller

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, lines 27 and 28, after "shiftable" insert -- or --. Column 2, line 12, "manufacturig should read -- manufacturing --; line 30, cancel "displaced"; line 56, "operators" should read -- operator's --. Column 3, line 7, "3,304100" should read -- 3,304,100 --; line 10, "plication" should read -- application --; line 12, "ivention" should read -- invention --. Column 5, line 1, "60" should read -- 60) --; line 23, "98", second occurrence, should read -- 96 --; line 50, "pal" should read -- pad --; line 57, "moment" should read -- moment) --. Column 6, line 20, "seccred" should read -- secured --; line 47, "aniti-rotate" should read -- anti-rotate --.

Signed and sealed this 21st day of October 1969.

(SEAL)
Attest:

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Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents