Feb. 14, 1967 E. B. LONG 3,304,100

HYDRAULIC APPARATUS FOR LOCKING A SIDE SHIFTABLE EXCAVATOR

Filed April 22, 1965 2 Sheets-Sheet 1

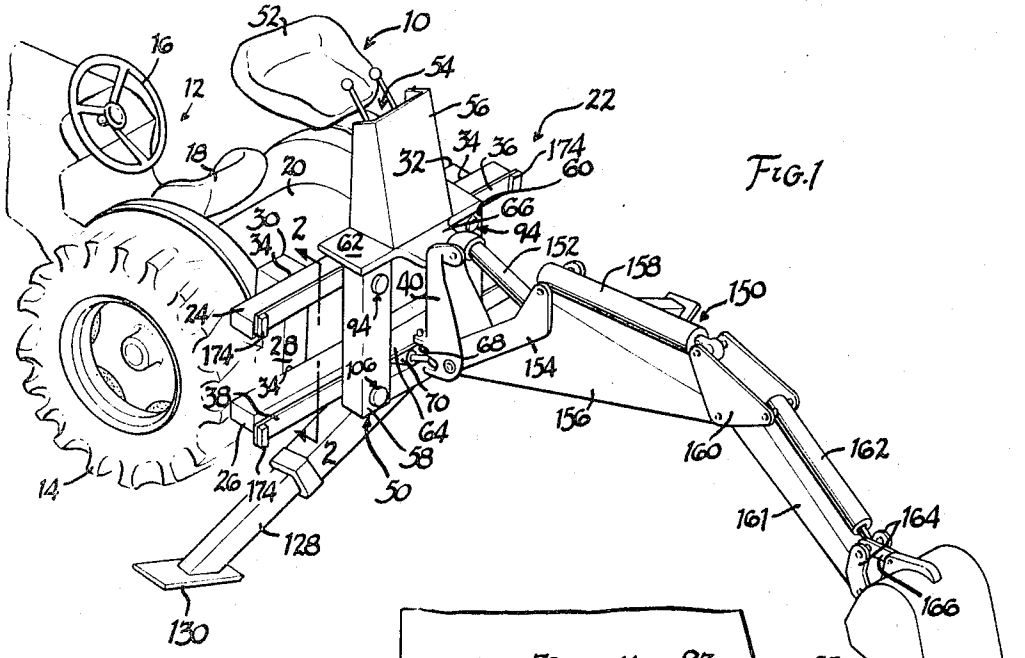


FIG. 1

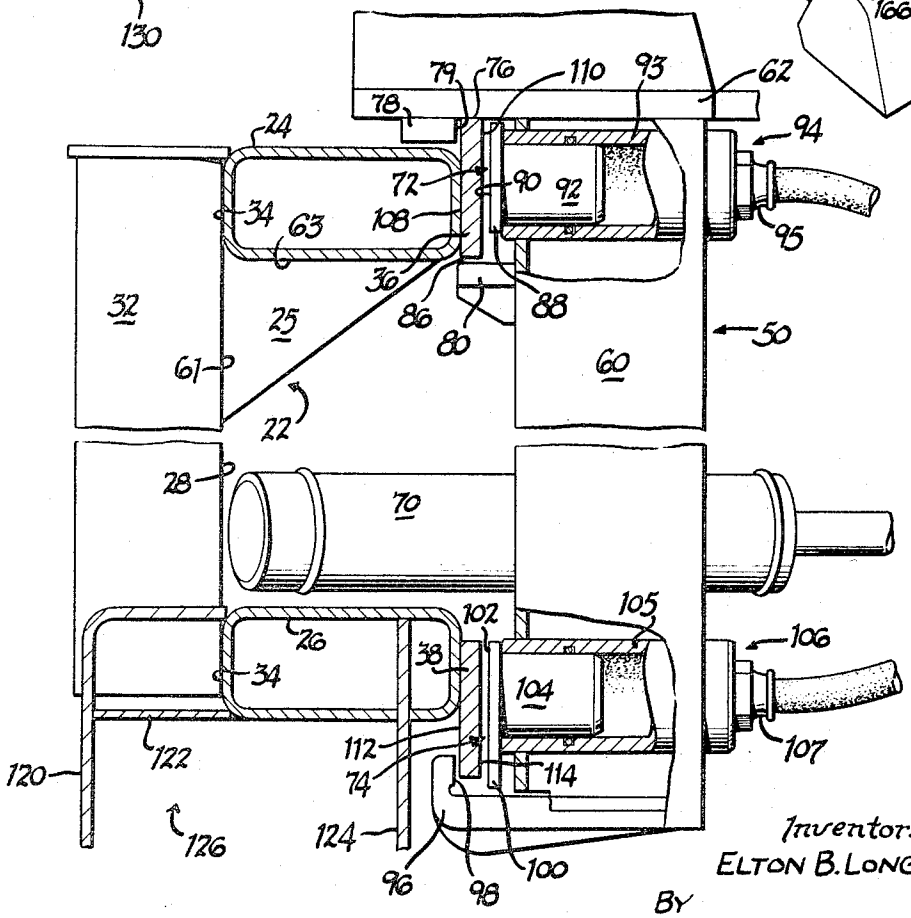


FIG. 2

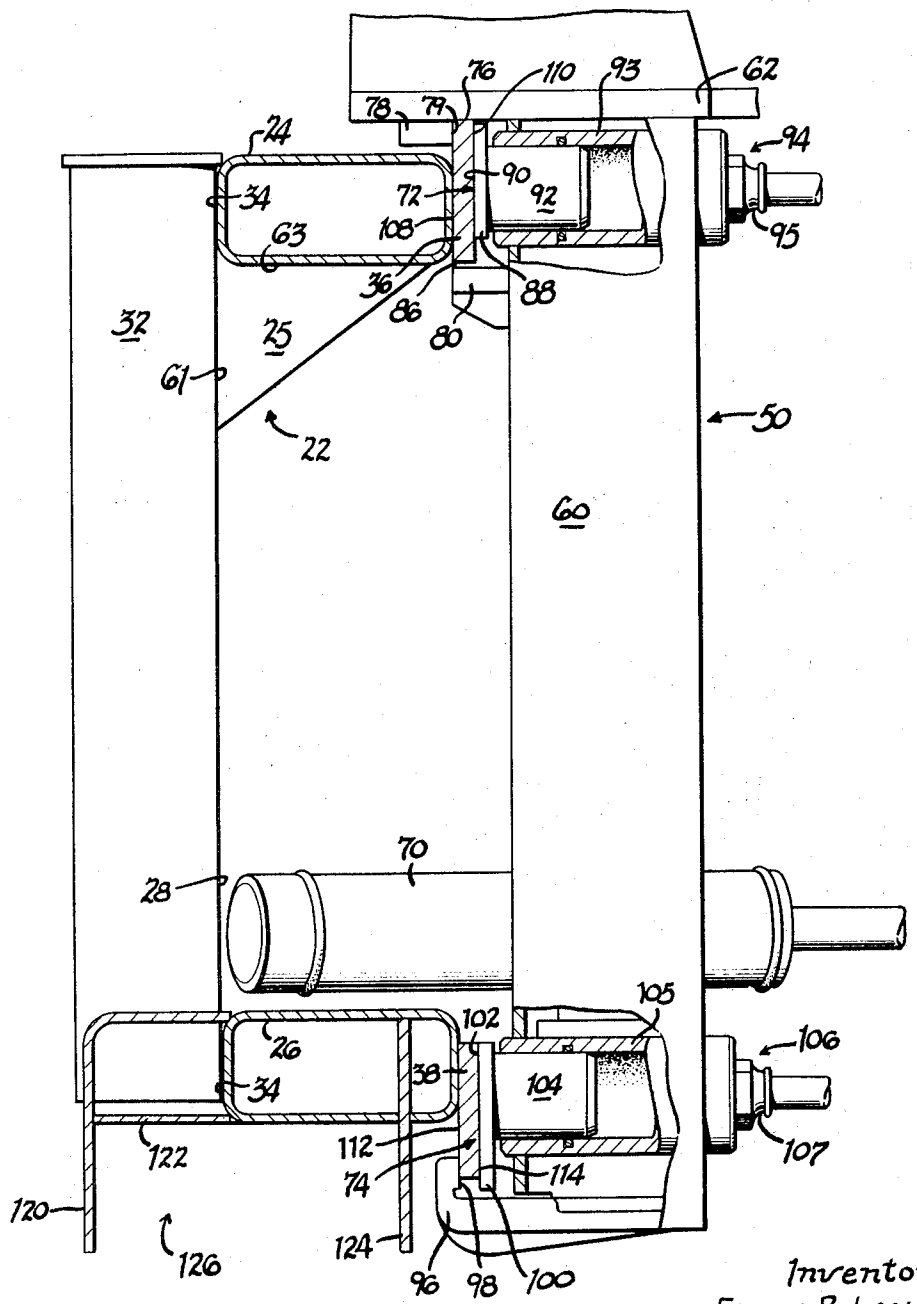
Inventor.
ELTON B. LONG
BY
Wilson, Settle & McKinnon
ATTORNEYS

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HYDRAULIC APPARATUS FOR LOCKING A SIDE SHIFTABLE EXCAVATOR

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FIG. 3



Inventor.
ELTON B. LONG

BY
Wilson, Settle & McKinnon
ATTORNEYS

United States Patent Office 3,304,100 Patented Feb. 14, 1967

3,304,100

HYDRAULIC APPARATUS FOR LOCKING A SIDE SHIFTABLE EXCAVATOR

Elton B. Long, Burlington, Iowa, assignor to J. I. Case Company, Racine, Wis., a corporation of Wisconsin

Filed Apr. 22, 1965, Ser. No. 450,114
3 Claims. (Cl. 280—456)

The present invention relates generally to a side shiftable excavator, such as a backhoe, and more particularly to a novel system, including apparatus, for hydraulically locking a side shiftable or mobile frame which carries an earth working implement, such as a backhoe assembly, in any one of an infinite number of positions along a fixed and immobile frame which is carried by the tractor chassis. This inventive system hydraulically locks the mobile frame to the immobile frame without requiring exact, precise tolerance adherance and component alignment between the frames and is easily hydraulically locked and unlocked for more rapid repositioning of the mobile frame and the implement without requiring that the excavator operator leave his seat.

In the past, it has been common commercial practice in the excavating art to mechanically lock the mobile frame of an excavator, such as a backhoe, to an immobile frame. Such mechanical locks, previously used, include frame connections such as: (1) a fixed number of aperture positions in the immobile frame and through one of which a bolt assembly is to extend, which bolt assembly may be tightened mechanically to secure the mobile frame in a desired position (for example, see United States Patent 3,139,199) and (2) a pair of horizontal slots positioned at different elevations in the mobile frame and through which passes one or more bolts, which bolts are also attached to the mobile frame and may be mechanically tightened to lock the mobile frame in the desired position (for example, see United States Patent 3,156,488).

Such mechanical locks are objectionable since repositioning of the mobile frame is costly, time consuming, and annoying, requiring that the operator dismount the excavator, mechanically loosen the lock by use of a wrench or the like, remount the excavator, re-situate the mobile frame in the desired new position with respect to the immobile frame by use, for example, of the bucket and crowd cylinder, again dismount the excavator, mechanically tighten the lock by use of the wrench or the like, and again remount the tractor for further excavation. Furthermore, such mechanical locks tend to loosen during excavation, requiring expenditure of further excessive time and attention. These mechanical locks also often encounter mechanical interference which makes locking impossible or extremely difficult due to component misalignment (such as misalignment of matching apertures in the mobile and immobile frames) resulting from wear, abuse and the like. In addition, the versatility of the prior art excavators of the side shiftable type have been limited since almost all of such mechanical locking devices have only a fixed number (such as 4, 6, 8 etc.) of positions in which the mobile frame may be locked.

Therefore, it would be a valuable contribution to the side shiftable excavating art to provide a system for hydraulically locking the mobile frame in any one of an infinite number of positions along the immobile frame, which hydraulic lock does not tend to loosen during excavation, does not necessitate precise alignment between

the frames to avoid mechanical interference and does not require that the operator dismount from the excavator to unlock, to lock or to reposition the mobile frame.

This invention provides such a system. Generally, the presently preferred embodiment of this invention structurally includes upper and lower generally horizontally disposed slide rails integrally carried by the immobile frame. The swing post of the excavator is mounted on a vertically extending side shiftable or mobile frame which spans the distance between the two slide rails. This mobile frame is rectangular in outline and considerably smaller than the mobile frame. The mobile frame (which also carries the backhoe operator seat) is slidable on the immobile frame along the slide rails and is provided with a top slide rail guide projecting from the mobile frame toward the tractor and being engageable at 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. This slide rail and guide arrangement is more fully disclosed in co-pending application Serial No. 449,966 filed on even date herewith and assigned to the assignee of the present invention. The slide rail and guide arrangement per se, therefore, constitutes no part of the present invention.

The mobile frame may be locked in position at a selected location along the immobile frame by means of four hydraulic cylinders carried by the mobile frame at the respective corners thereof. The cylinders are jointly actuatable forwardly (i.e. toward the tractor) to project the cylinder piston rods carrying pressure bearing surfaces into pressurized frictional engagement with the rearwardly facing surfaces of both slide rails. Actuation of the hydraulic cylinders also displaces the mobile frame a slight distance away from the tractor chassis transverse to the length of the slide rails causing back-up pressure bearing surfaces which are directly mounted upon the mobile frame to pressurizingly engage the front facing surfaces of both slide rails. Thus, the mobile frame may be hydraulically locked in one of an infinite number of positions by pressurized frictional force exerted along both sides of both slide rails without requiring the operator to leave his seat. No exact alignment of the bearing surfaces and the slide rails is needed. Subsequently, retraction of the hydraulic pistons followed by use of the crowd cylinder and the bucket of the backhoe assembly will accommodate easy relocation of the mobile frame, after which the hydraulic cylinders may again be used in the manner previously described to lock the mobile frame in position.

Accordingly, it is a primary object of this invention to provide, in a side shiftable excavator, a novel apparatus for hydraulically locking the mobile frame in any one of an infinite number of positions along the immobile frame.

Another object is the provision, in a side shiftable excavator of a system including apparatus, for hydraulically locking the mobile frame in a desired position without necessitating essentially accurate alignment between the mobile frame and the immobile frame.

A further object is the provision in a side shiftable excavator of a system including apparatus for rapidly hydraulically locking the mobile frame in a desired position which eliminates the need for the operator to leave his seat upon the excavator in order to so reposition the mobile frame.

These and other objects and features of this invention will become more fully apparent from the following de-

scription and appended claims in conjunction with the accompanying drawings wherein:

FIGURE 1 is a perspective view of a tractor mounted side shiftable backhoe equipped with the novel hydraulic locking system of this invention;

FIGURE 2 is a cross sectional view taken along 2—2 of FIGURE 1 illustrating the novel hydraulic locking mechanism of this invention in the open or unlocked position; and

FIGURE 3 is a cross sectional view similar to FIGURE 2 illustrating the novel hydraulic lock mechanism of this invention in its retracted locked or closed position.

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-mount 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 embodiment depicted in the drawings 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** and 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** per se constitutes part of the prior art.

The immobile frame

The immobile frame **22** along with the general manner in which the mobile frame **50** is carried in a slide rail and slide rail guide arrangement by the immobile frame **22** constitutes part of the invention of co-pending application Serial No. 449,966, filed on even date herewith and assigned to the assignee of the present invention. 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 preferably 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 upper beam **24** is further supported by a pair of diagonally disposed braces **25**, fabricated preferably from hollow rectangular cross sectional stock, which are welded or otherwise secured to the faces **28** of 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 generaly horizontally, with the top slide rail **36** projecting above the beam **24** and the bottom slide rail **38** projecting beneath the beam **26**.

Integrally attached to the lower beam **26**, as 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** (FIGURE 1), each of which have a ground engaging pedestal **130**. The stabilizer legs **128** (one of which is illustrated in FIGURE 1) are pivotably 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**, as previously stated. 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 mobile frame **22**.

The mobile frame **50** structurally comprises a pair of vertically extending 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 have an integral ear **66** and **68**, respectively, upon which the swing post **40** is pivotally 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 upon the immobile frame **22** by the backhoe assembly **150** and by the mobile frame **50** is transmitted through the plate **62** solely 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** 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** at **84** (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 or ram **88** providing a pressure bearing surface **90**. The pressure bearing pad or ram **88** is integrally connected to a piston **92** which is reciprocably carried within a casing **93** of a cylinder assembly **94**. Each of the two cylinder assemblies **94** is illustrated as being a one way cylinder and is in fluid communication with the hydraulic system (not shown) of the tractor **12** through the port **95**.

Each lower slide rail guide **74** 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 or ram **100** providing a pressure bearing surface **102** (the pressure bearing pad or ram **100** being integrally attached to a piston **104** reciprocally disposed within a casing **105** of a cylinder assembly **106**). The rear of each of the two cylinder casings **105** is in fluid communication with the hydraulic system (not shown) of the tractor **12** through a port **107**.

Thus, when the mobile frame **50** is locked in a predetermined position along the slide rails **36** and **38** of

the immobile frame **22** as depicted in FIGURE 3 (by reason of extension of the pistons **92** and **104** of the cylinder assemblies **94** and **106**, respectively, through introduction of hydraulic fluid through the ports **95** and **107**), the top slide rail **36** and the two top guides **72** as well as 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**. Assumption of this overturning moment by the immobile frame **22** is achieved by (1) pressurized engagement between the face **79** of each back-up stop **78** and the side surface **108** of the slide rail **36** and the pressurized engagement of the pressure bearing surface **90** of each pad or ram **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 **96** against the side surface **112** of the bottom slide rail **38** and pressurized engagement between the pressure bearing surface **102** of each pad or ram **100** with the side surface **114** of the slide rail **38**, all responsive to extension of the two top pistons **92** and the two bottom pistons **104**. As seen in FIGURE 1, one of the top cylinder assemblies **94** and one of the bottom cylinder assemblies **106** are, respectively, attached to each of the vertically extending columns **58** of the mobile frame **50** in any desired manner as, for example, by welding. Thus, by use of the four cylinder assemblies **94** and **106**, the mobile frame **50** may be positioned in any one of an infinite number of positions along the immobile frame **22** so that the mobile frame does not tend to loosen during excavation and without necessitating that precise alignment between the two frames be provide in order to avoid mechanical interference. Significantly, the hydraulic locking mechanism of this application allows the operator to unlock, reposition and then relock the mobile frame in any desired position along the immobile frame without necessitating that the operator leave his seat and dismount the excavator.

Operation

The mobile frame **50** may be locked in any desired position at a selected location along the immobile frame **22** by use of the four hydraulic cylinders **94** and **106** which are carried by the mobile frame **50** at the respective corners thereof. Briefly, to reposition the mobile frame **50**, the pistons **92** and **104** of the cylinder assembly **94** and **106**, respectively, are jointly retracted by exhausting hydraulic fluid from the rear of the cylinder assemblies through the ports **95** and **107**. This joint retraction moves the pressure bearing surfaces **90** and **102** of the rams or pressure bearing pads **88** and **100** out of pressurized engagement with the sides **110** and **114** of the slide rails **36** and **38**, respectively, i.e. from the position of FIGURE 3 to that of FIGURE 2. As can be appreciated by inspection of FIGURES 2 and 3, retraction of these pistons accommodates a slight shifting of the mobile frame axially of the tractor toward the tractor causing the back-up stop **78** to be relieved from pressurized engagement at **79** with the side **108** of the slide rail **36** and the surface **98** of the back-up pad **96** to be relieved out of pressurized frictional engagement with the surface **112** with the bottom slide rail **38**. This position is schematically and somewhat ideally illustrated in FIGURE 2.

Of course, although not shown in FIGURE 2, some slide contact between the surface **108** of the slide rails **36** and the surface **79** of the stop **78** as well as between the surface **102** of the ram **100** and the surface **114** of the slide rail **38** will still remain as a result of the transmitted overturning moment caused by the cantilevered suspension of the backhoe assembly **150**, which moment is transmitted from the mobile frame **50** to the immobile frame **22** even when the overall apparatus **10** is idle. By use of the crowd cylinder **162** and the bucket **168** of the backhoe assembly **150**, easy relocation of the mobile frame **50** with respect to the immobile frame **22** may be accommodated in a well known manner.

When the mobile frame **50** has been located in the desired new position, the four cylinder assemblies **94** and **106** are jointly actuated by introduction of hydraulic fluid under pressure through the ports **95** and **107** into the rear of the cylinders to extend the pistons **92** and **104**. This projects the rams **88** and **100** at surfaces **90** and **102** into pressurized frictional engagement with the slide rail surfaces **110** and **114**, respectively. Actuation of the hydraulic cylinders **94** and **106** to extend the pistons **92** and **104**, respectively, also displaces the mobile frame **50** a slight distance away from the tractor chassis **20** transverse to the length of the slide rails **36** and **38**. This forces the back-up pressure bearing surface **98** of the back-up pad **96** and the surface **79** of the stop **78** into pressurized frictional engagement with the front facing surfaces **108** and **112**, respectively, of the slide rails.

Thus, the mobile frame **50** may be hydraulically locked in any one of an infinite number of positions by pressurized frictional force exerted solely along each side of both slide rails without requiring the operator to leave his seat and dismount the excavator. No exact alignment of the pressure bearing surfaces of the slide rail guides and the slide rail is needed either initially or after significant wear and abuse has been imposed upon the excavator **10**.

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 an excavating device having a side shiftable frame slidably carried by use of slide rail guides along at least upper and lower slide rails of a stationary frame, the improvement comprising means for hydraulically locking the side shiftable frame in any one of an infinite number of positions along the stationary frame including at least one hydraulic cylinder having a ram at the distal end of the piston accommodating surface-to-surface pressurized engagement between the ram and stationary frame so that the side shiftable frame may be rapidly relocated with respect to the stationary frame in any desired position merely by hydraulic actuation without requiring the operator of the excavating device to leave his seat and dismount the excavating device.

2. In an excavating device having a side shiftable frame slidably carried by use of slide rail guides along at least upper and lower slide rails of the stationary frame, the improvement comprising means carried by the side shiftable frame for hydraulically locking the side shiftable frame in any one of an infinite number of positions along the stationary frame including at least one hydraulic cylinder having a ram at the distal end of the piston accommodating surface-to-surface pressure engagement between the ram and at least one of said slide rails, and at least one back-up pad carried by the side shiftable frame accommodating pressure engagement with the side shiftable frame when side shiftable frame is locked in position relative to the stationary frame whereby the side shiftable frame may be rapidly relocated with respect to the stationary frame in any desired position merely by hydraulic actuation without requiring the operator to leave his seat upon the excavating device.

3. In an excavating device having a side shiftable frame slidably carried by use of slide rail guides along at least upper and lower slide rails of a stationary frame, the improvements comprising hydraulic locking means carried by the side shiftable frame to hydraulically lock the side

shiftable frame in contiguous pressurized frictional abutting relation with the stationary frame in any one of an infinite number of positions along the stationary frame including a plurality of hydraulic cylinders each having a bearing surface at the distal end of the piston rod, said bearing surfaces being engageable in surface-to-surface pressurized frictional abutting relation with the side surface remote from the stationary frame of both slide rails, and a plurality of back-up pads carried by the side shiftable frame and displaceable into and out of pressurized frictional engagement with the side surface most adjacent

to the stationary frame of both slide rails responsive to energizing and de-energizing of the hydraulic cylinders.

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LEO FRIAGLIA, *Primary Examiner.*