Dec. 11, 1956 E. SCHUTZ ET AL 2,773,524

SAFETY LOCK FOR RADIAL ARM SAWS AND THE LIKE

Filed Sept. 21, 1953 3 Sheets-Sheet 1

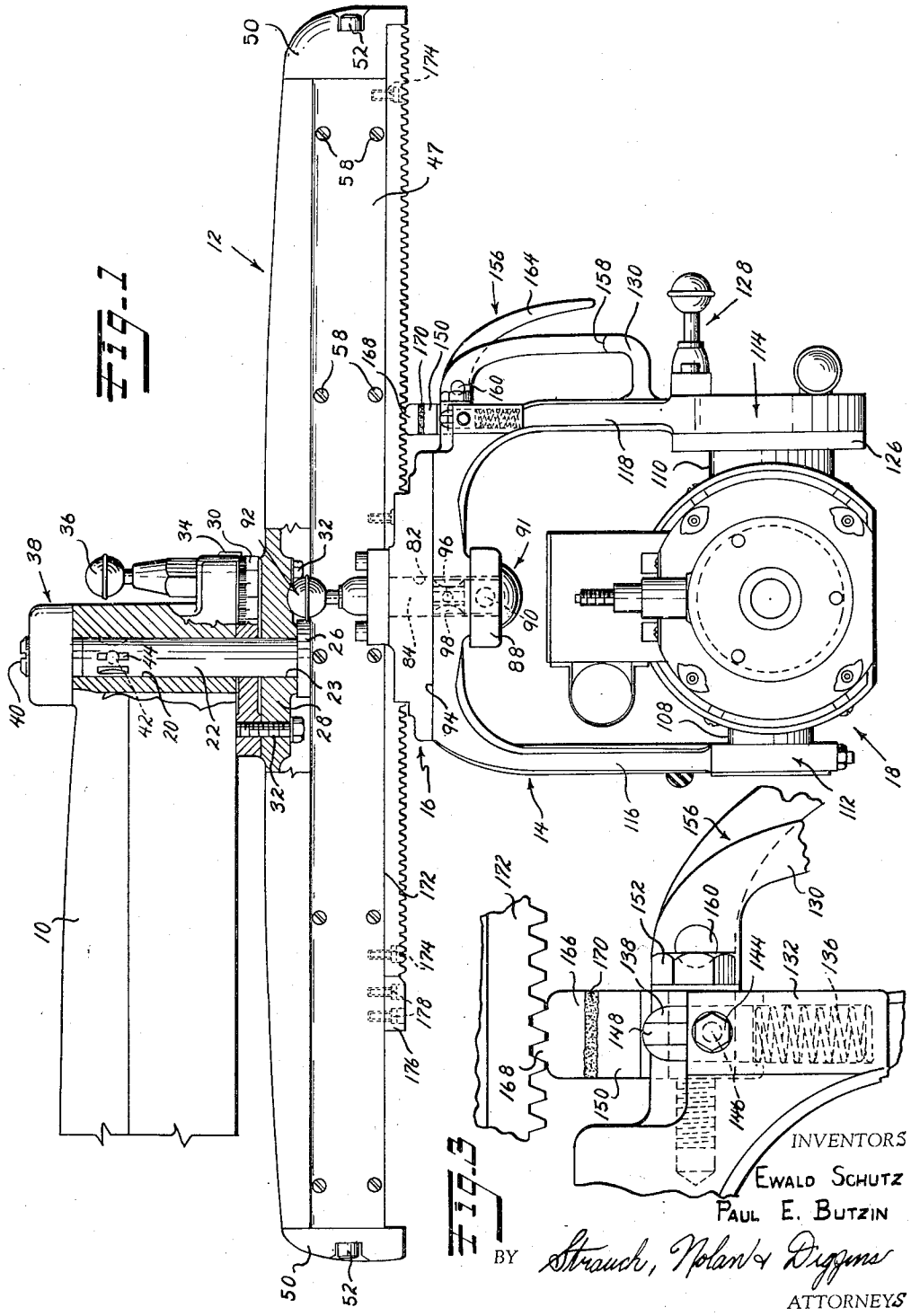


Fig. 1

Fig. 3

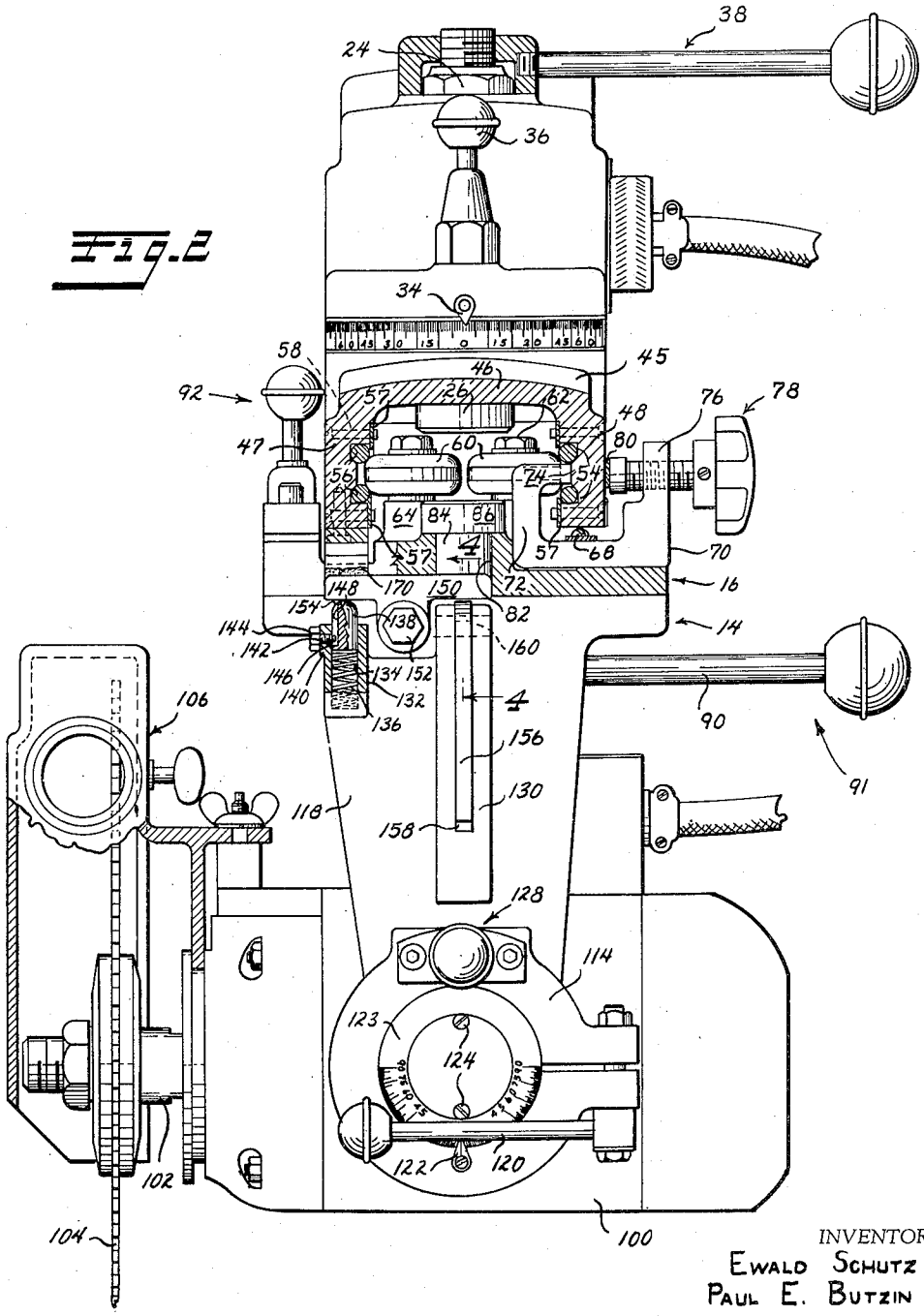
INVENTORS
EWALD SCHUTZ
PAUL E. BUTZIN
BY Strauch, Nolan & Diggins
ATTORNEYS

Dec. 11, 1956 E. SCHUTZ ET AL 2,773,524

SAFETY LOCK FOR RADIAL ARM SAWS AND THE LIKE

Filed Sept. 21, 1953 3 Sheets-Sheet 2

Fig. 2



INVENTORS
EWALD SCHUTZ
PAUL E. BUTZIN

BY Strauch, Nolan & Diggins
ATTORNEYS

Dec. 11, 1956 E. SCHUTZ ET AL 2,773,524

SAFETY LOCK FOR RADIAL ARM SAWS AND THE LIKE

Filed Sept. 21, 1953 3 Sheets-Sheet 3

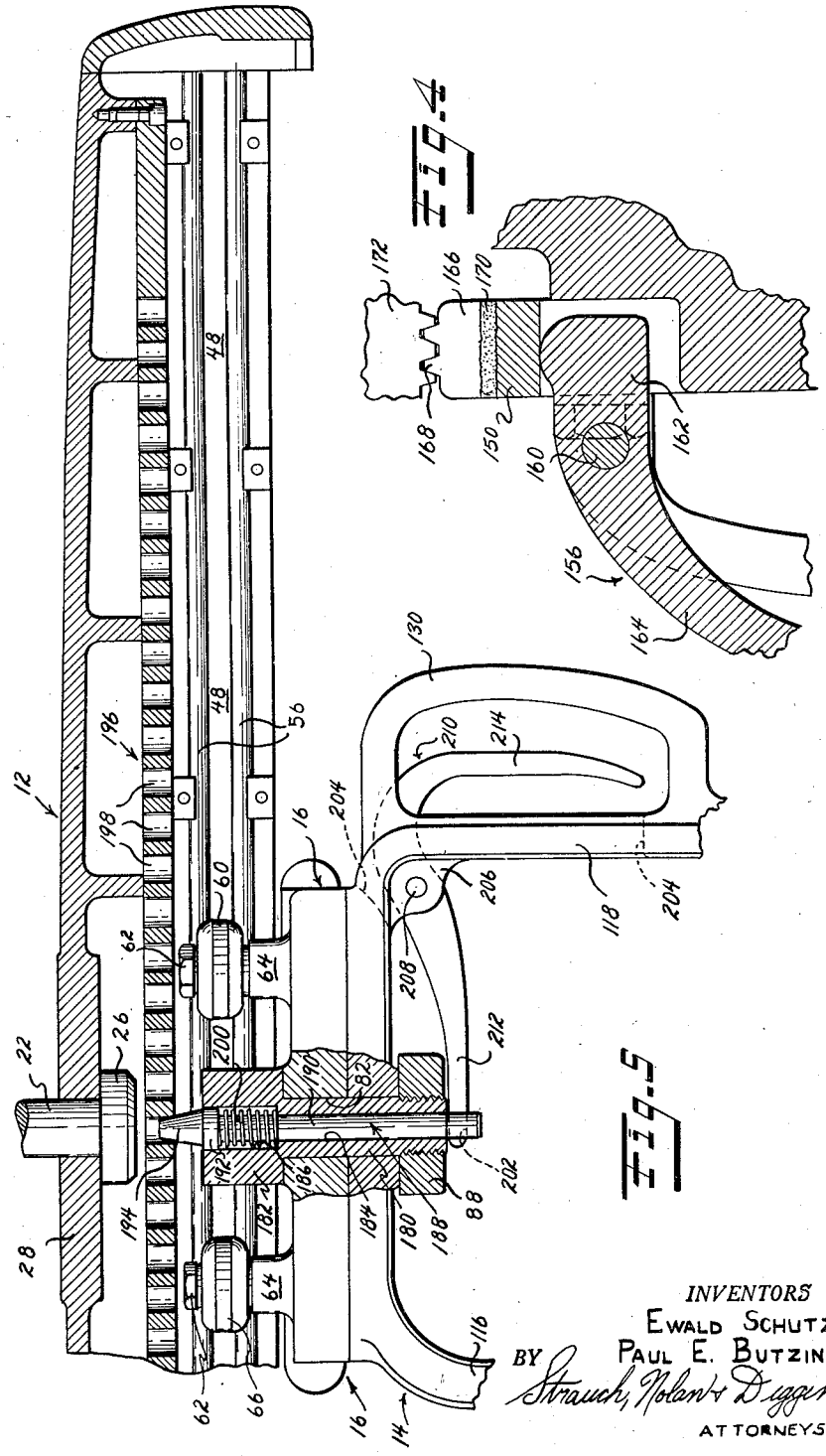


Fig. 4

Fig. 5

INVENTORS
EWALD SCHUTZ
PAUL E. BUTZIN
BY Strauch, Nolan & Diggins
ATTORNEYS

United States Patent Office 2,773,524 Patented Dec. 11, 1956

2,773,524

SAFETY LOCK FOR RADIAL ARM SAWS AND THE LIKE

Ewald Schutz, Leetonia, Ohio, and Paul E. Butzin, Pittsburgh, Pa., assignors to Rockwell Manufacturing Company, Pittsburgh, Pa., a corporation of Pennsylvania

Application September 21, 1953, Serial No. 381,269

3 Claims. (Cl. 143—47)

This invention relates to machine tools and more particularly to automatic safety locks for tools of the type embodying tool carriages longitudinally movable along a supporting member to effect feed movement of a cutting head carrying a high speed rotary cutter. The safety lock of this invention is designed for locking the carriage and cutting head along said supporting member to disrupt feed movement at all times except when feed movement of the carriage and cutting head under manual control of the operator takes place.

The invention is disclosed herein as applied to the well-known "radial arm" saw machines. However, it will be understood that the basic concept may be employed in various other power tools of like character.

As is well known in the art, the radial arm saw has great operational versatility in that it may be operated either with the cutting head stationary and the work fed to the blade or the work stationary and the head moving to perform the cutting operation. Under certain conditions hereinafter described, the cutter becomes an element of extreme danger, particularly when, during operation, the operator releases the operating handle freeing the carriage and its cutting head and cutter from manual controlled feed operation.

The present invention contemplates an improved and simplified latch mechanism performing the general automatic locking functions set out in United States Patent No. 2,297,882. In prior locking mechanisms of this general type, the latch mechanisms are either relatively complex, expensive to build and/or have a tendency to become "hung up," i. e., remain in unlocked position after the operating handle is released. The latter difficulty increases with age and wear and, though it may be remedied to some extent by use of a heavier return spring, the difficulty is replaced by an undesirable increase in the pressure required to hold the trigger in unlocked condition, thereby increasing hand-fatigue of the operator. Furthermore, in prior art of knowledge, the trigger construction is of a design to detract materially from the comfortableness of the operating handle.

The present invention is disclosed herein in two embodiments: in the first, a spring-biased, normally-latched, locking means automatically locks the cutter head carriage against feed movement along the support arm upon release of the operating handle momentarily during cutting operations requiring manual reciprocation of the carriage cutting head and cutter and a separate rip-lock is provided for selectively locking the carriage, cutter head and cutter during ripping or like operations when the cutting head and cutter are intended to have a workpiece fed thereto and the automatic lock is ineffective.

In the second and preferred form of construction, the automatic locking means is effective to automatically lock the cutter head and cutter in all positions thereof.

The primary object of the invention is the provision of improved and simplified safety locking devices for the carriages and cutter heads of radial arm saws and the like.

Another object of this invention is to provide novel trigger operated safety locks which are automatically effective upon release of the manually controlled operating handle of a machine tool to disrupt the feed movement of the cutter head and its carriage.

Still another object of the invention is to provide improved trigger-operated safety locks which are manually released or rendered inoperative during normal manual feed movement of the cutter head involving gripping of the operating handle.

A further object of this invention is the provision of improved trigger-type safety locks wherein the operating trigger assembly associated with the feed control handle of the moveable cutter is so constructed and arranged as to eliminate the possibility of the trigger becoming locked in the unlatched position and which requires only a light return spring.

A still further object of the invention is to provide improved trigger-type safety locks which do not detract from the comfortable grasping of the operating handle in operations requiring manual feed movement of the tool relative to a work piece.

These and other objects and advantages of this invention will be apparent to those conversant with the art from a reading of the following description and subjoined claims in conjunction with the annexed drawings, in which:

Figure 1 is a fragmental elevational view partially in section showing the support arm, track, cutter head and cutter portions of a radial arm saw embodying one form of the present invention;

Figure 2 is an elevational view partially in section of the embodiment shown in Figure 1 as viewed from the right hand side of Figure 1;

Figure 3 (Sheet 1) is a fragmentary enlargement of Figure 1 showing the details of the lock-biasing plunger; and

Figure 4 (Sheet 3) is a fragmental sectional view on line 4—4 of Figure 2.

Figure 5 is a fragmental elevational view similar to Figure 1 showing a modified and preferred form of this invention.

Referring now to the drawings and first, in particular to Figures 1 and 2, the major machine tool components embodied in this invention are a support arm **10**, a track arm **12**, a yoke **14**, a yoke carriage **16** and cutter head **18** journalled in yoke **14**.

In the usual manner, arm **10** is vertically adjustably secured to and extends radially from a vertical support post (not shown). The free end of arm **10** contains a vertical bore **20** non-rotatably but slidably receiving a king bolt **22** extending perpendicularly upwardly from track arm **12** through a suitable aperture **23** therein.

The upper end of king bolt **22** projects from the upper end of bore **20** and is provided with threads engaged by a clamp nut **24** (Figure 2) while the lower end carries a flange **26** which engages the underside of a thickened portion or boss **28** on track arm **12** thereby rotatably suspending the track arm on king pin **22**.

An annular index disc **30** is interposed between planar surfaces circumscribing bores **20** and **23** on the underside of arm **10** and the top side of arm **12** and is fastened to the latter as by screws **32** so as to be rotatable therewith. Calibrations on the periphery of disc **30** coact with a pointer **34** fixed to arm **10** to indicate the precise angular disposition of track arm **12** about the axis of king bolt **22**.

In a manner well known in the art, a miter index stop **36** coacting with equiangularly spaced index holes (not shown) in disc **30** permit indexed angular adjustment of arm **12** for making miter cuts. Similarly, a track clamp arm **38** for loosening and tightening nut **24** permits rotary

adjustment of track arm 12, a suitable set screw 42 cooperating with a selected slot 44 being provided to initially locate the position of arm 38 and prevent rotation of king bolt 22 in bore 20 while permitting a slight axial movement thereof to free arm 12 and disc 30 for rotary adjustment respecting arm 10.

Track arm 12 comprises an inverted-channel shaped member 45 having a web portion 46 and spaced, parallel depending side walls 47 and 48, see Figure 2. The ends of channel member 12 are closed by end plates 50 secured thereto by suitable means such as cap screws 52.

As clearly appears in Figure 2, the internal surfaces of side walls 47 and 48 of arm 12 contain a pair of spaced parallel grooves 54 running the length of the arm and containing cylindrical guide rods or tracks 56 held in position by retaining clips 57 threadedly engaged on the inner ends of screws 58 (Figures 1 and 2) extending through side walls 47 and 48.

A pair of rollers 60, rotatably secured to carriage 16 by means of axle bolts 62 threaded into a suitable boss 64 on the upper surface of carriage 16 and a similar pair (one shown at 66, Figure 5) having axes of rotation defining a plane parallel to the plane of said first pair, cooperate with track rods 56 to suspend the carriage beneath and for longitudinal rolling movement along arm 12.

Secured to the upper surface of carriage 16 adjacent one edge thereof by screws (one shown at 68, Figure 2), is a C clamp 70 having an inner leg 72 constructed and arranged to terminate within running clearance distance of a suitably thickened portion 74 between grooves 54 on the inner surface of wall 48. An outer leg 76 threadedly receives a rip lock clamp screw 78 adapted to move a high friction contact button 80 on the inner end thereof into and out of engagement with the outer surface of wall 48, for selectively locking the carriage against movement along arm 16.

Substantially centrally located in carriage 16 with respect to rollers 60 and 66 is a vertical bore 82 rotatably receiving a yoke king bolt 84 having a supporting flange or shoulder 86 on the upper end abutting the upper surface of the carriage. The lower end of bolt 84 extends through a suitable bore in yoke 14, to which it is non-rotatably secured by a set screw 96 (Figure 1) and is threaded to receive a clamp nut 88 having a radial operating handle 90, which nut and handle constitute a yoke clamping mechanism 91. Thus the yoke is suspended from carriage 16 for relative angular adjustment about the axis of king bolt 84.

This suspension and angular adjustment structure is similar to that of the track arm 12 relative to arm 10. A rip index lever 92 operates a pin or plunger (not shown) which enters a selected one of a ring of index holes or stops (not shown) in the upper surface 94 of the yoke and equiangularly spaced about the axis of king bolt 84, permitting indexed angular adjustment of the yoke 14, and therefore cutting head 18, relative to carriage 16 about a vertical axis. Yoke clamp 91 for loosening and tightening nut 88 permits rotary adjustment of yoke 14 in well known manner, set screw 96 coacting with equally-spaced peripheral slots 98 in the king bolt to initially locate handle 90 and maintain yoke 14 in non-rotatable relation to king bolt 84.

Cutter head 18 consists of a source of rotary power, for example, electric motor 100 having a drive spindle 102 extending from one end and carrying a rotary cutter, such as saw blade 104, fixed thereto in the usual well-known manner. A safety shield 106 adjustably secured to the motor housing encloses a substantial portion of the saw blade, to protect the operator. Motor 100 is supported in yoke 14 by means of oppositely extending trunnions 108 and 110 mounted in journals 112 and 114 on the lower ends of arms 116 and 118 respectively of yoke 14.

Journal 114 consists of a split ring which may be selectively drawn up tight on trunnion 110 by means of a clamp lever 120 to fix the cutter head assembly 18 in a selected position of angular adjustment about the axis of the trunnions for making bevel cuts. The angle of the bevel is indicated by a pointer 122 fixed to split ring journal 114 and a calibrated dial 123 formed on or fastened to the outer end of trunnion 110 as by screws 124.

Indexing of the bevel angles is provided by means of a flange 126 containing a ring of equally spaced index holes or stops (not shown) arranged concentrically about the axis of trunnion 110 and at a suitable radius to be engaged by an index pin or plunger (not shown), selectively moved into and out of said holes or stops by a bevel indexing lever 128.

Secured to or integral with leg 118 of yoke 14 is an operating grip or handle 130 for manually moving the carriage, yoke and cutter head assembly as a unit along the track arm to feed the cutter to and through a suitably supported work piece. Adjacent its upper left hand edge as viewed in Figure 2, yoke leg 118 is provided with an enlargement 132 containing a blind, cylindrical bore 134 within which are disposed a compression spring 136 and a slidable plunger 138.

A boss 140, formed on the upper side wall of enlargement 132, contains a through threaded bore 142 extending normal to and intersecting bore 134. A guide screw 144 threaded into bore 142 carries a key or tenon 146 formed on its inner end so as to project into a longitudinal guide slot 148 in the side of plunger 138. Slot 148 terminates short of the bottom of the plunger so as to cooperate with tenon 146 to limit the extent to which it may be expelled from the bore by spring 136.

A rocker arm 150 pivotally secured intermediate its ends to yoke leg 118 between enlargement 132 and handle 130, as by bolt 152, has one end in engagement with spheroid upper end 154 of plunger 138. A roughly L-shaped operating lever 156, is disposed in a slot 158 in handle 130 and pivotally secured therein as by pin 160. Lever 156 comprises legs of unequal length, the shorter leg 162 (Figure 4) being generally horizontal and extending beneath and operatively engaging the end of rocker arm 150 remote from plunger 138 while the longer leg 164 extends generally downward from pivot 160 and is curved so as to conform with the contour of grip 130 when occupying slot 158 therein as will be seen from the later described operation of the device.

With the yoke 14 turned so that the plane of saw blade 104 is parallel to the longitudinal axis of track arm 12, rocker arm 150 extends transversely with respect to said axis and the end thereof remote from handle 130 extends under the lower edge of side wall 47 of channel member 45 and is provided with a latch member 166 having teeth 168. Latch member 166 may be secured to the rocker arm by any convenient manner, such as welding 170.

Along the lower edge of channel wall 47 a locking rack 172 is secured as by screws 174 (Figure 1). Rack 172 has teeth complementary to and adapted to mesh with those of latch member 166. Rack 172 extends from one end of arm 12 to within a short distance of the other end where an abutment 176 is secured to the arm at the end of the rack by screws 178 thus providing means for limiting the longitudinal travel of the carriage in one direction. Travel in the opposite direction is limited by end plate 50.

Operation

From the structure thus far described, it will be understood that track arm 12 and the elements carried thereby are angularly adjustable about the vertical axis defined by track arm king pin 22; carriage 16, yoke 14 and cutter head assembly 18 are movable as a unit horizontally along the longitudinal axis of track arm 12; yoke 16 and associated cutter head assembly 18 are angularly adjustable about a vertical axis defined by king pin 84; and cutter

head assembly **18** is angularly adjustable about a horizontal axis paralleling blade **104** and defined by its trunnions **108, 110.**

As previously mentioned, the saw may be operatively fed with respect to stationary work piece by gripping handle **130** and moving the carriage, yoke, and cutter head as a unit longitudinally of track arm **12** or may be locked in a preselected position by locking the carriage, yoke and cutter head and feeding the work piece to the cutting blade. When the cutter head is being moved, i. e., reciprocated back and forth along track arm **12** in conventional cross-cutting operation, the plane of the cutting blade **104** must be parallel to the axis of the track arm. By use of the rip index lever **92** and/or yoke clamp lever **91** in the conventional manner, the angular disposition of yoke **14** about the axis of king bolt **84** must be adjusted to achieve such parallelism. In this condition, the relative angular position of yoke **14** and carriage **16** about the vertical axis of king bolt **84** is fixed and is such that the teeth of latch member **166** are in a position to engage those of rack **172.** Under the influence of spring **136** and plunger **138,** rocker arm **150** is biased in a clockwise direction about pivot bolt **152** as viewed in Figure 2 automatically engaging the teeth of the latch member with the rack, thus immobilizing the carriage. To make miter cuts, the horizontal angle of the track arm is adjusted in the usual manner by means of miter index lever **36** and/or track clamp lever **38** without interfering with the automatic locking just described.

With the rip lock clamp screw **78** loosened, gripping of the handle **130** by the operator forces operating lever leg **164** into slot **158** of the handle pivoting operating lever **156** clockwise (Figure 2) about pin **160** causing shorter leg **162** of the lever to pivot rocker arm **150** counterclockwise about bolt **152** thereby disengaging the teeth of latch member **166** from those of rack **172** thus freeing the carriage and parts suspended therefrom for feed movement along the track arm. Upon release of the handle, spring **138** causes reverse operation of the latching mechanism engaging the teeth of latch **166** and rack **172** and locking the carriage in its then position.

It will be appreciated that, due to the slotted construction of operating handle **130,** operating lever leg **164** is disposed entirely within slot **158** when the handle is gripped and, therefore, the grip is as comfortable for the operator as if the trigger lever were not present. Furthermore, lever **156** cannot be pivoted (counterclockwise as viewed in Figure 4) to such an extent that leg **162,** even if severely worn, would become "hung up" and fail to be returned to the locking position by rocker arm **150.**

When the machine is to be used with a stationary cutter, rip lock clamp screw **78** is tightened to lock carriage **16,** yoke **14** and cutter head assembly **18** relative to track arm **12** at a desired point. In this condition, the yoke **14** may be adjusted about the vertical axis of king bolt **84** for making tapering or miter cuts. Turning the yoke from the position shown in Figure 2, i. e., from the position where the plane of saw blade **104** is parallel to the track arm **12,** swings the latch member **166** out of the vertical plane of rack **172** so that the trigger lock is inoperative. The carriage, however, is immobilized by the rip lock clamp assembly as described above. Turning of the yoke to or from the position shown in Figure 2 is naturally accomplished by gripping the handle **130.** Since such gripping releases the trigger mechanism, the automatic lock is operated to disengage the teeth of the latch member and rack before turning of the yoke is accomplished. This effects automatic meshing and unmeshing of the latch and rack teeth and prevents possible damage thereto and to other machine parts. Furthermore, since a change from cross-cutting to ripping operation of the saw necessitates positive action by the operator to position the saw blade in a plane generally longitudinally disposed with respect to the usual rip fence required and provided on such saws and as positive locking of the carriage and its depending structure at a convenient point along track **12** is required, there is little, if any, chance that the operator will fail to operate rip clamp **78** as required.

However, to insure against operator carelessness, the modified form of the invention shown in Figure 5 and presently preferred by certain users is provided. In this embodiment, corresponding reference numerals indicate parts in common with the first described embodiment.

In this modification, yoke **14** is rotatively suspended from carriage **16** by means of a yoke king pin **180** having, in addition to an enlarged head **182** at its upper end supported on the upper surface of the carriage and at its lower end a portion threaded to receive clamp nut **88** of yoke clamp lever assembly **91** as shown in Figures 1 and 2, an axial bore **184** enlarged, as at **186,** in the region of head **182** for the reception of a locking plunger indicated generally at **188.** Plunger **188** includes a guide rod **190** slidably disposed in bore **184** extending a substantial distance upwardly into bore enlargement **186,** an enlarged cylindrical collar portion **192** slidably received in the upper end of enlarged bore **186** and an upwardly extending frusto-conical latching portion **194.**

Substantially centrally located with respect to the transverse dimension of track arm **12** is an elongated latch bar **196** running longitudinally of and secured to the upper inner wall of arm **12.** Bar **196** contains a multiplicity of equally spaced, closely related linearly arranged circular apertures **198** having centers in a vertical plane containing the axis of king bolt **180** and diameters approximately equal to the mean diameter of frusto-conical member **194.** A compression spring **200** interposed between cylindrical portion **192** of locking plunger **190** and the shoulder defined at the juncture of bore **184** and its enlargement **186,** urges the locking plunger upward to a normal position in which its frusto-conical portion is disposed in upward projected position to cooperate with one or the other of apertures **198** which may be in substantial alignment therewith. If desired, the upper face of conical member **194** and the walls of bar **196** separating apertures **198** may be suitably rounded or otherwise shaped to cam member **194** into an aperture **198** in event carriage **16** and its depending structure should come to rest after release of operating handle **130** with member **194** substantially out of alignment with the nearest aperture **198.**

The lower end of rod **190** contains a transverse slot **202** having arcuate, mutually convex, upper and lower surfaces. A much larger slot **204** is provided in leg **118** of yoke **14** substantially in the plane of handle **130** and extending from the lower attachment point of the handle upwardly through the leg and including the corner defined at the junction of the leg with the horizontal portion or web of the yoke. This corner is diagonally bridged by a pair of spaced, parallel webs (one shown at **206,** Figure 5) containing axially aligned apertures supporting a pivot pin **208** which transversely spans slot **204.**

A trigger-type, generally L-shaped locking lever **210** extends through slot **204** and is pivotally secured therein intermediate its ends by pin **208,** substantial operating clearance being provided to allow unobstructed pivotal movement of the lever.

One leg **212** of lever **210** extends in a generally horizontal direction and the end remote from pivot **208** projects through slot **202** in rod **190** while the other leg **214** curves downwardly from the pivot and extends into the D shape region defined by handle **130.**

Operation

The operation of the modified lock is similar to the first described embodiment to the extent that, with parts in the position shown in Figure 5, spring **200** keeps locking plunger **188** raised so that its frusto-conical portion is normally disposed in one of the apertures **198,** thus

locking carriage 16 against movement along track arm 12.

With the machine conditioned for operation wherein the cutter head is to be moved along the arm as already described to feed the cutter to and through a work piece, the operator grips handle 130 and squeezes leg 214 of trigger lever 210 which lowers locking plunger 188 to unlatched position, thus releasing the carriage. When the trigger lever is released, spring 200 raises the locking plunger and the carriage is immobilized in its then position. In this embodiment, the rip lock clamp assembly 70, 78 (Figure 2) may be eliminated, if desired, because the trigger operated lock, due to the coincident centered relation of plunger 188 and the cooperating latch bar 196 and the circular line of engagement of the plunger and the particular engaged aperture, is operative for any angular position of adjustment about the axis of king bolt 186 and during movement from one adjusted position to another. Furthermore, the lock operating lever 210 acts directly on the locking plunger without intermediate linkage elements resulting in a more positive action which is unaffected by wear and not prone to sticking.

It will be appreciated that in both modifications the trigger locking mechanism is simple and inexpensive in construction, fool proof in operation, and provides a comfortable grip for the operator. Furthermore, because of the simplicity and efficiency of the operating linkage it is practical to use a light return spring in the automatic lock mechanism without danger of the mechanism sticking and failing to lock when the trigger is released.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are 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 power tool, a track arm; a carriage mounted on said track arm for longitudinal movement therealong; a yoke secured to said carriage for rotary movement about an axis perpendicular to said track arm and adapted to operatively support a cutter head; grip means on said yoke for manually moving said yoke and carriage as a unit along said track arm; an elongated bar longitudinally fixed to said track arm having a plurality of circular apertures therein with their centers along a line intersecting and substantially normal to said perpendicular axis; a locking plunger slidably mounted on said yoke and carriage for movement along a line coincident with said perpendicular axis irrespective of the angular position of said yoke, said plunger including a circular portion rigid therewith adapted in one position of the plunger to selectively enter one of said apertures and immobilize said carriage; means normally biasing said locking plunger to said one position; and means operatively associated with said handle and locking plunger and selectively operable to move the locking plunger out of said one position.

2. In a power tool, an elongated track arm; a carriage mounted on said track arm for longitudinal movement therealong; a yoke adapted to support a cutter head; a king pin mounting said yoke for pivotal movement about an axis perpendicular to said support arm; a handle on said yoke for manually moving said yoke and carriage as a unit; an elongated locking bar fixed to said track arm having therein a plurality of linearly spaced circular apertures the centers of which are on a line intersecting and substantially normal to said perpendicular axis irrespective of the angular position of said yoke; a coaxial bore in said king pin; a locking plunger slidable in said bore and having a circular portion rigid therewith adapted in one position of said plunger to selectively enter one of said apertures to immobilize said carriage; means normally biasing said plunger to said one position; a trigger lever pivotally mounted on said yoke having one end disposed adjacent said handle to be conveniently manually gripped therewith to pivotally move said lever, the opposite end of said lever being operatively connected to said locking plunger to move the plunger from said one position when said handle and one end are manually gripped.

3. In a power tool having a horizontal track arm, a cutter head assembly and means mounting said assembly on said arm for longitudinal movement therealong and for angular adjustment about a vertical axis: means for automatically locking said cutter head assembly at all angular adjustments thereof against longitudinal movement relative to said arm comprising an elongated member fixedly mounted on said arm and having a plurality of circular, lock-position-defining formations spaced along the length of said member with their centers on a line intersecting and substantially normal to said perpendicular axis; a locking plunger slidably mounted in said cutter head assembly for linear movement along a line coincident to said perpendicular axis irrespective of the angular position of said cutter head, said plunger having a locking formation thereon of circular configuration complementary to said lock-position-defining formations on said elongated member and adapted in one linear position of the plunger to selectively engage one of said lock-position-defining formations and immobilize said cutter head assembly against longitudinal movement relative to said arm, means normally biasing said locking plunger into said one position, and means on said cutter head assembly selectively manually operable to overcome said biasing means and move said latch means out of engagement with said lock-position-defining formations.

References Cited in the file of this patent

UNITED STATES PATENTS

1,528,536	DeWalt	Mar. 3, 1925
1,585,535	Crogan	May 18, 1926
1,638,122	Jull	Aug. 9, 1927
2,297,882	Gardner et al.	Oct. 6, 1942
2,611,398	Schutz	Sept. 23, 1952