April 22, 1958 R. F. BANNOW 2,831,237

SLIDE LOCKING MECHANISM

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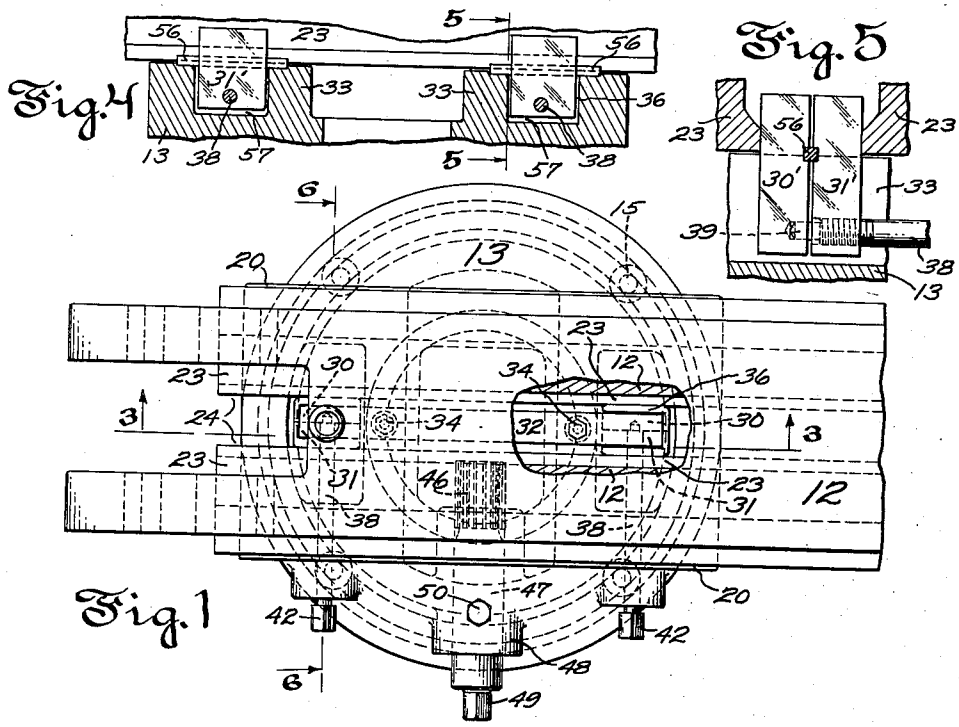


Fig. 1

Fig. 4

Fig. 5

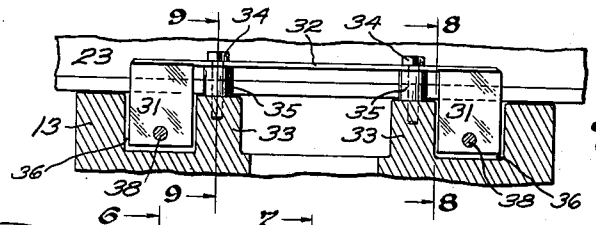


Fig. 3

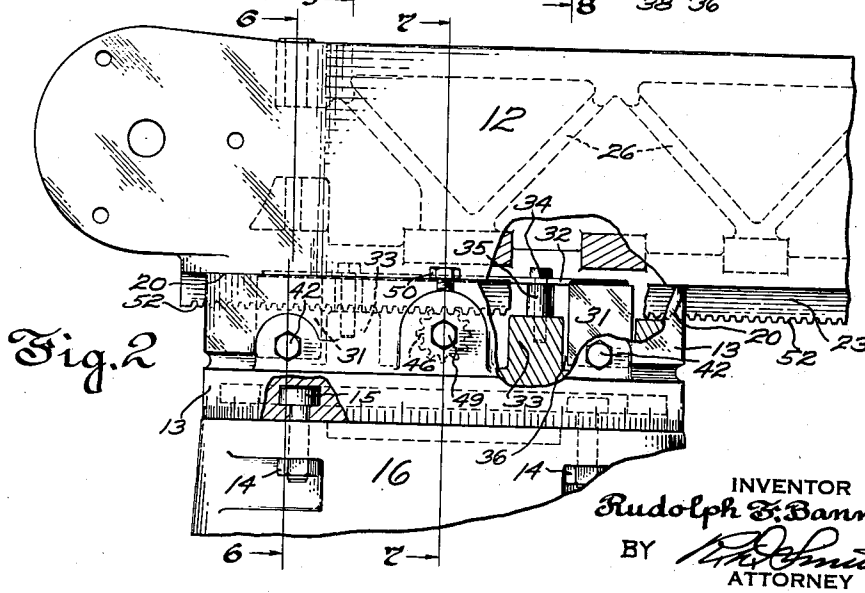


Fig. 2

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Fig. 6

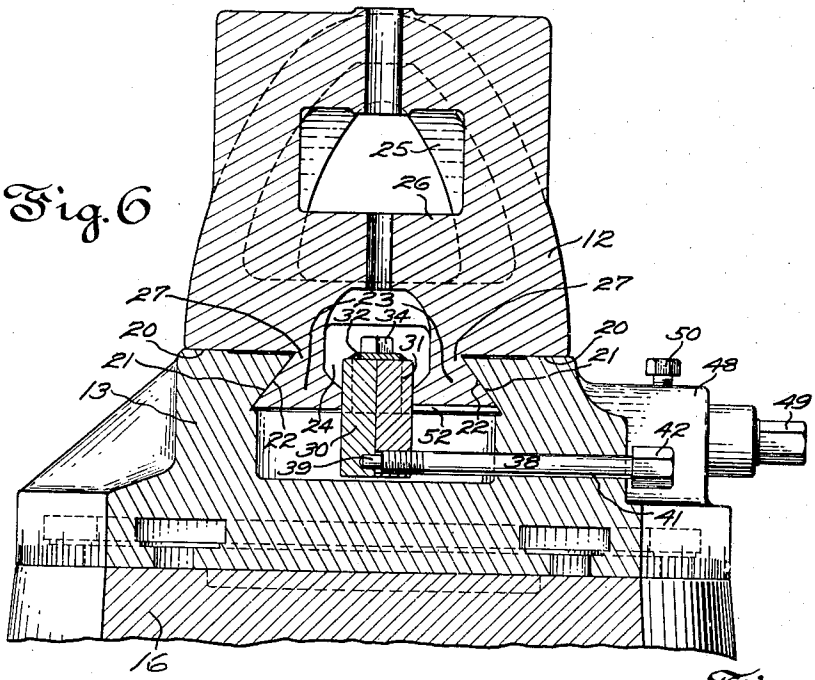


Fig. 8

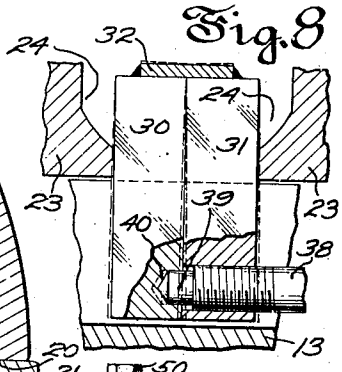


Fig. 9

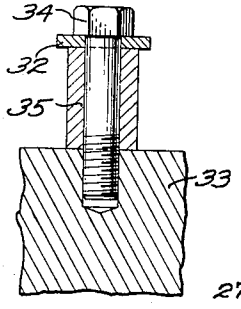


Fig. 7

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SLIDE LOCKING MECHANISM.

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Fig. 10

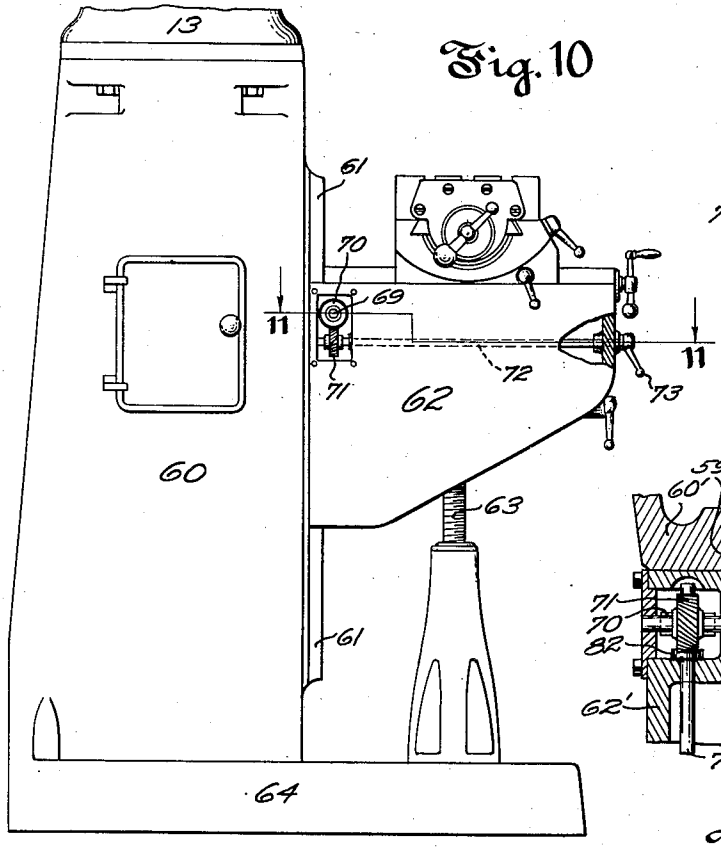


Fig. 14

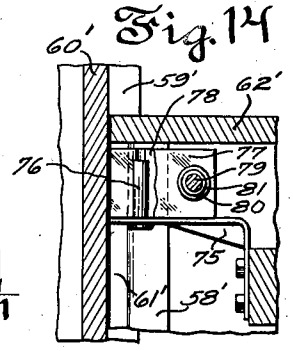


Fig. 13

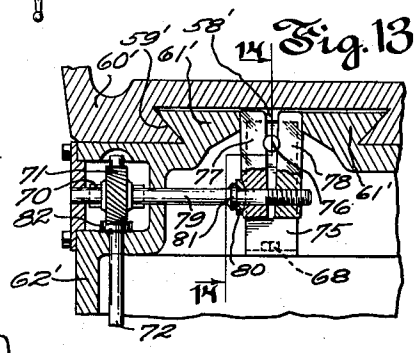


Fig. 11

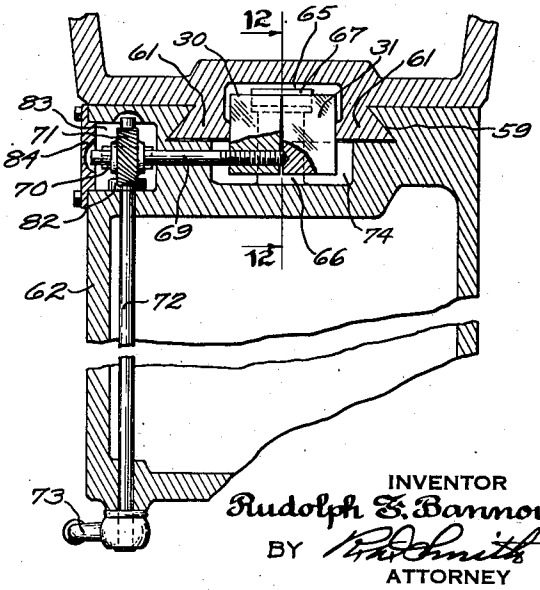
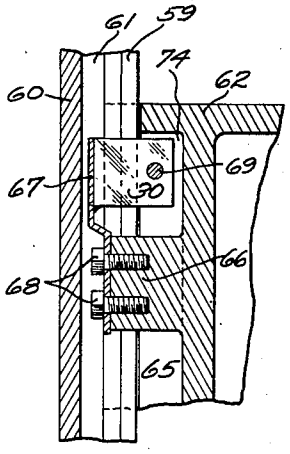


Fig. 12



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United States Patent Office 2,831,237 Patented Apr. 22, 1958

2,831,237

SLIDE LOCKING MECHANISM

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Application June 2, 1955, Serial No. 512,649

15 Claims. (Cl. 29—1)

This invention relates to devices for staying a machine member that is adjustable to different positions along support ways while guided by tongue and groove sliding engagement therewith, such as a horizontally adjustable overarm or a vertically adjustable knee in a milling machine. The new principles of construction underlying the present improvements may be incorporated in various other kinds of machines and machine parts.

Heretofore, constructions have been proposed for staying or locking together relatively slidable machine parts by causing externally related walls of a guide groove to hug and grip an internally related guide tongue, or by employing a gib between the groove wall and the tongue that can be tightened against the edge of the tongue to cause binding action.

An object of this invention is to provide means for forcibly staying a machine member in an unlimited number of positions along a path of movement with respect to supporting structure determined by sliding engagement of a guide tongue in a guide groove, and without distorting or springing any portion of the walls of groove containing structure to cause a hugging action against the guide tongue and without employing a gib as a binding spacer that can be clamped tight against the edge of the guide tongue.

Another object is to provide locking devices for preventing relative sliding movement between the tongue and the groove containing structure which require for exerting a slide locking force only the turning of a screw that has no threaded engagement either with the tongue or with the walls of the structure containing the groove.

Another object is to accomplish interlocking of elongate tongue-and-groove guided members by causing lateral expansion, into direct gripping contact with relatively external rigid walls in a groove containing structure, of a relatively internal guide tongue that is channeled to be bifurcate in cross section and therefore transversely spreadable.

A related object is then to utilize for widening the channel and thus spreading the tongue, one or more pairs of independently and laterally swingable force transmitting arms stationed in relation to the groove containing structure and in part occupying the channel in the guide tongue, and relative to which the channeled tongue is slidable, whereby to spread the bifurcate tongue laterally into tight binding contact with the walls of the groove containing structure.

Another object is to fashion the force transmitting arms as rigid blocks movably supported face to face in a manner to be tiltable relatively to each other about adjacent edges of the blocks which edges thus serve as a fulcrum while adjacent edges of the blocks at the opposite ends of the latter are forced to separate by screw exerted force.

These and other objects of the invention will appear

in fuller particular in the following description of several successful constructions of relatively slidable parts of a milling machine in which the invention may be embodied, the description having reference to the appended drawings wherein:

Fig. 1 shows in plan view the partial length of an overarm of a milling machine mounted to be slidable lengthwise across the turret head of the machine and partially broken away to expose interior slide locking parts embodying the invention.

Fig. 2 is a view of the parts in Fig. 1 in side elevation.

Fig. 3 is a fragmentary view taken in section on the plane 3—3 in Fig. 1 looking in the direction of the arrows.

Fig. 4 is a view similar to Fig. 3 showing a modified construction.

Fig. 5 is a fragmentary view taken in section on the plane 5—5 in Fig. 4 looking in the direction of the arrows.

Fig. 6 is a view drawn on an enlarged scale taken on the plane 6—6 in Fig. 2 looking in the direction of the arrows.

Fig. 7 is a view on a similarly enlarged scale taken in section on the plane 7—7 in Fig. 2 looking in the direction of the arrows.

Fig. 8 is a fragmentary view drawn on a further enlarged scale showing certain of the parts in Fig. 6 in section on the plane 8—8 in Fig. 3 looking in the direction of the arrows.

Fig. 9 is a fragmentary view drawn on the same further enlarged scale taken on the plane 9—9 in Fig. 3 looking in the direction of the arrows.

Fig. 10 is an elevation of the base, the standard and the knee of a milling machine showing the knee equipped with position locking mechanism incorporating the invention.

Fig. 11 is a plan view of the locking mechanism taken partially in section on the planes 11—11 in Fig. 10.

Fig. 12 is a fragmentary view taken in section on the plane 12—12 in Fig. 11 looking in the direction of the arrows.

Fig. 13 is similar to a portion of Fig. 11 showing a reversed placement of the fulcrum point in the locking mechanism in respect to the point at which spreading pressure is exerted against a split guide tongue that is carried by a stationary rather than a slidable member of the machine.

Fig. 14 is a fragmentary view taken in section on the plane 14—14 in Fig. 13 looking in the direction of the arrows.

The overarm 12 of these improvements is mounted on a rotatably adjustable turret head 13 so as to slide lengthwise in a horizontal direction across the turret head. By tightening nuts 14 on bolts 15 the turret head can be fixed in any rotary position about the vertical axis of its support column 16. Fuller details of a similarly mounted turret head are disclosed in U. S. Patent No. 2,275,291 granted to Rudolph F. Bannow.

In its herein shown construction the top of the turret head presents transverse horizontal ways 20 separated by a guide groove bordered by rigid walls underlying the ways and having tapering edges 21. These edges are directly contacted by dovetail edges 22 of a guide tongue 23 which forms a depending integral portion of the overarm casting and contains a channel 24 extending lengthwise of the overarm. The overarm may be hollow also at 25 in its upper portion throughout its length, and preferably is internally trussed for strength and lightness of weight by oblique internal webs or flanges 26. The upper or body portion of overarm 12 is thus rendered

rigid and rests slidably upon the flat ways **20** of the turret head. The tapering edges **21** and dovetail edges **22** fit each other nicely but without binding engagement.

In Figs. 6 and 7 it is seen that the channel **24** in the depending guide tongue **23** sufficiently reduces the thickness of the metal of the overarm casting at the narrowest points **27** of its cross section so that the spaced apart sides of the bifurcate guide tongue **23** can be sprung away from each other and thus cause the dovetail edges **22** to bind against the tapering edges **21** of the rigid walls of the structure that underlie the ways and border on the guide groove.

Having made rigid the guide groove bordering walls of the turret head and having made the tongue **23** of the overarm bifurcate in cross section by means of channel **24** throughout its length and therefore laterally spreadable, my improved construction for springing the dovetail edges **22** into tightly binding slide preventing engagement with the tapering groove edges **21** may take several forms. In the construction shown in Figs. 1 to 3 and 6 to 9, two relatively swingable blocks **30** and **31** are individually suspended face to face by welding their mutually touching top edges to the terminal portions of a metallic suspension strip **32** that is slightly flexible. Although occupying the channel **24** of the slidable overarm, suspension strip **32** itself is maintained stationary by mounting it on post abutments **33** upstanding from the base wall of turret head **13** whereto it is secured by bolts **34** and underlying spacer collars **35**. Thus the suspension strip **32** and the blocks **30, 31** remain in a stationary location while the overarm can slide freely over them along the ways **20**.

Block **31** has a screw threaded hole through it in which a block forcing element in the form of a tongue spreading bolt **38** is engaged. The pushing end **39** of bolt **38** is of reduced diameter and is received into a shallow socket **40** in block **30** (see Fig. 8). The shank of bolt **38** passes freely through a clearance hole **41** in the wall of the turret head and presents a flatted head **42** outside the turret head for being turned by means of a wrench handle (not shown). When the blocks **30, 31** are pushed apart at their bottom edges by the bolt **38**, their relative swinging movement will be permitted by minute flexure in the suspension strip **32**. Cavities **36** accommodate the blocks **30, 31**.

The overarm **12** is free to be impelled lengthwise and slidably along its ways **20** by the turning of a pinion **46** whose shaft **47** is journaled in a wall boss **48** of the turret head **13**. Outside the turret head, shaft **47** presents a flatted terminal **49** for engagement by a crank handle (not shown) for turning pinion **46**. A retaining screw **50** engages a circumferential groove **51** in shaft **47** to render the pinion **46** and shaft **47** removable at will from the turret head **13** when screw **50** is retracted. Pinion **46** engages rack teeth **52** formed on the under surface of the guide tongue **20** and impels the overarm to any desired longitudinal position with respect to the turret head.

The overarm may be locked in all positions to which it is impelled by pinion **46** by turning the spreader bolt **38** in block separating direction. When the bottom edges of blocks **30, 31** are thus forced apart their top edges remain together and serve as a fulcrum point about which simultaneous separating swing of the two blocks takes place. This swinging apart of the blocks springs the dovetail edges **22** of the bifurcate tongue **23** forcibly into firm binding contact with the rigid tapering edges **21** of the turret head against resilient resistance in regions **27** of the guide tongue. The mechanical leverage of binding force thus exerted will depend on the relationship of the vertical distance between the top edges of the blocks and their point of contact with the bifurcate tongue to the vertical distance from said top block edges to the spreader bolt **38**. By the dimensions shown in Fig. 6 the mechanical advantage is in the ratio of about 2 to 1.

In Figs. 4 and 5 there is shown a different way of suspending the blocks **30'** and **31'** wherein the suspension strip **32** is replaced by two short hinge rods **56** welded in place on the turret head **13** and preferably of flatted shape in cross section to provide corners. Each hinge rod **56** bridges a space **57** in the base wall of a turret head **13** occupied by the blocks **30'** and **31'**. Each of these blocks contains a flat sided groove that is receptive to rod **56** and sufficiently deep to enable the block to hang from the hinge post. Preferably there will be sufficient looseness of fit of the hinge posts in the grooves of the blocks to permit the blocks to come into direct mutual contact at their top edge when their bottom edges are thrust apart by spreading bolt **38**. Thus as in Figs. 1 to 3 and 6 to 9, the contacting top edges of the two blocks constitute the fulcrum point about which the blocks perform their relative swinging movement.

Figs. 10, 11 and 12 illustrate a reversal of movability as between the machine part that contains the guide groove and the machine part that contains the guide tongue. This is illustrated in the application of the invention to the knee of a milling machine wherein the spreading blocks are mounted on and travel vertically with the slidable member or knee of the machine while in part occupying a vertical channel in a guide tongue that is stationed on the support column of the machine.

In Fig. 10, **60** is the support column or standard of a milling machine which may serve to mount a turret head **13** carrying an overarm such as in Figs. 1 and 2. Column **60** carries on its front upright face the vertically extending dovetail guide tongue **61** which determines the path of vertical adjustive movement of knee **62**. The weight of the knee is mainly supported by and is raised and lowered by the conventional underlying screw post **63** that upstands from the base **64** of the machine.

In this form of the invention the stationary, column carried, guide tongue **61** is made hollow by a channel **65** while the guide groove **59** along which tongue **61** rides is formed in the casting of the knee in communication with a cavity **74** from which one or more mounting abutments **66** project into channel **65** and support therein a cantilever suspension strip **67** secured by bolts **68**. Suspension strip **67** supports two spreader blocks **30, 31** as in Figs. 1 to 3 and 6 to 9, while here the spreader bolt **38** is replaced by a screw threaded shaft **69** that is journaled in the knee **62** and fixedly carries a driven spiral gear **70**. The screw portion of shaft **69** has threaded engagement with spreader block **30** and its end bears against spreader block **31** so that the spreader blocks are forced to swing in separating direction about their mutually contacting top corners serving as fulcrum. Gear **70** is in mesh at right angles with a driving spiral gear **71** fixed on a long horizontal shaft **72** that runs forward through the knee and can be turned by a handle **73** outside the knee at the front face thereof. A thrust collar **82** is removably fixed on shaft **72** in the gear compartment **83** that is closed by a removable cover **84**.

In Figs. 13 and 14 there are shown two reversals in the relationship of parts as compared with Figs. 1 to 12. In contrast to Figs. 11 and 12 the milling machine knee **62'** in Fig. 13, instead of the frame column **60'**, is provided with a dovetail guide tongue **61'**, the entire working length of which is divided by a centrally extending slot **58'**. Tongue **61'** rides vertically in guide groove **59'** formed in the column **60'** of the machine frame. A support bracket **75** is secured to the knee **62'** in the hollow thereof and carries an upstanding post **76** which serves as a fulcrum about which the spreader blocks **77, 78** rock in opposite rotational directions. The rearwardly directed free ends of blocks **77, 78** occupy the slot **58'** in the guide tongue **61'** and can bear laterally outward against the split halves thereof to bind the latter lockingly in guide groove **59'**.

As distinguished from the constructions shown in the other figures of the drawings, the spreader blocks **77, 78** in Fig. 13 do not require a channel such as **24** in Fig. 7

to be formed in the machine member that possesses the guide groove. The slide locking pressure is applied to blocks 77, 78 by drawing their rear ends together instead of by forcing their rear ends apart as in the constructions shown in the other views of the drawings. This drawing together of the forward ends of the spreader blocks 77, 78 is accomplished by a pull screw 79, that may be substituted for the push screw 69 of Fig. 11, and which passes loosely through a clearance hole in block 77 while having threaded engagement with block 78. A thrust washer 80 between block 77 and a shoulder 81 on screw 79 has a spherical face in thrusting contact with block 77.

The manner of operation of these improvements will have become apparent as the description proceeded and need not be repeated here.

While I have illustrated embodiments of the invention wherein both branches 23 of a split or bifurcate guide tongue can be sprung deflectively in separating directions it will be appreciated that one of these tongue branches may be rigid, or more rigid than the other, so that the deflection of the tongue metal that widens channel 24 will take place wholly or mainly in a single one of the branches of the guide tongue. Also one of the blocks 30, 31 or 30', 31' can be immobilized by making it rigid with the machine member by which it is carried whereupon the other block alone will perform all of the rocking movement that is necessary for springing outward into slide locking binding engagement with taper guide groove edges 21 only a single one of the two branches of the guide tongue 23.

These and other departures from the precise arrangement of parts herein disclosed to explain preferred embodiments of the invention are possible within the intended coverage of the appended claims, which claims therefore are directed to all obvious substitutes and equivalents for the constructions shown that come fairly with a broad interpretation of their terms:

I claim:

1. Slide locking mechanism comprising in combination with a slidable member and a supporting member, a guide groove contained in one of said members, a guide tongue on the other of said members occupying and normally fitting said groove without binding therein, said guide tongue containing a split lengthwise thereof making it bifurcate in cross section, and tongue spreading devices deriving support from one of said members including a tongue spreading device swingably supported on one of said members and extending to between the branches of said bifurcate tongue and arranged to bear laterally outward thereagainst, together with manually operable means accessible to the outside of said members operatively related to said swingably supported device to swing the latter in tongue spreading direction.

2. Slide locking mechanism as defined in claim 1, in which the said guide tongue and the said supporting member have conforming tapering edges in direct mutual contact.

3. Slide locking mechanism as defined in claim 1, in which the said split in the said tongue reduces the cross sectional width of the latter to an extent permitting at least a portion of said tongue to be sprung laterally outward by said spreading devices within its elastic limit into binding engagement with the said groove containing member.

4. Slide locking mechanism as defined in claim 1, in which the tongue spreading devices are limited to the confines of the said member having the said guide tongue.

5. Slide locking mechanism comprising in combination with two relatively slidable machine members, a guide groove in one of said members, a guide tongue on the other of said members occupying and normally fitting said groove slidably without binding therein, said guide tongue containing a channel extending lengthwise thereof dividing the tongue into spaced apart branches, tongue spreading the tongue into spaced apart branches, tongue spreading devices at least one of which is swingable relatively to the other and at least partially occupies said channel while deriving support from one of said members, and a leverage multiplying force applying element carried by one of said members having operative engagement with said tongue spreading devices and extending to the exterior of the last said member to be reached for manipulation for staying or freeing said relatively slidable machine members.

6. Slide locking mechanism as defined in claim 5, in which the said tongue spreading devices include rigid arms supported for relative rocking movement about a fulcrum point located in the said channel, said arms extending out of said channel for operating engagement by said force applying element.

7. Slide locking mechanism as defined in claim 5, in which the said tongue spreading devices include rigid blocks having mutually abutting edges located in the said channel, together with means retaining said blocks in such alignment that they can be rocked relatively to each other about their said edges in a direction to spread the said guide tongue.

8. Slide locking mechanism as defined in claim 7, in which the said means for retaining the said blocks is a slightly flexible metallic strip secured to adjacent edges of both blocks and deriving support from the said groove containing member.

9. Slide locking mechanism as defined in claim 7, in which the said means for retaining the said blocks is a spanner rod in nested relation to mutually facing concave bearing surfaces in said blocks respectively and deriving support from the said groove containing member.

10. Slide locking mechanism as defined in claim 5, in which the said tongue spreading devices include rigid arms supported for relative rocking movement about a fulcrum point located in the said channel, at least one of said arms having threaded engagement with the said force applying element at a point outside of said channel.

11. Slide locking mechanism as defined in claim 10, in which the said force applying element extends through the said arm with which it has threaded engagement and into abutting contact with the other arm for forcing said arms to swing in separating directions wherefore to spread the said guide tongue.

12. Slide locking mechanism as defined in claim 11, in which the said force applying element passes through a clearance hole in the said groove containing member.

13. Slide locking mechanism as defined in claim 5, in which one of the said tongue spreading devices is a rocker block, together with a fulcrum post located between the said branches of the said bifurcate tongue and the said force applying element against which said spreading device bears and rocks in tongue spreading direction.

14. Slide locking mechanism comprising in combination with two relatively slidable machine members, a guide groove in one of said members, a guide tongue on the other of said members occupying and normally fitting said groove slidably without binding therein, said guide tongue containing a channel extending lengthwise thereof dividing the tongue into spaced apart branches, tongue spreading devices at least one of which is swingable relatively to the other and at least partially occupies said channel while deriving support from said groove containing member, and a device forcing element carried by one of said members having operative engagement with said tongue spreading devices and extending to the exterior of the last said member to be reached for manipulation for staying or freeing said relatively slidable machine members.

15. Slide locking mechanism comprising in combination with two relatively slidable machine members, a guide groove in one of said members, a guide tongue on the other of said members occupying and normally fitting said groove slidably without binding therein, said guide tongue containing a channel extending lengthwise thereof divid-

ing devices at least one of which is swingable relatively to the other and at least partially occupies said channel while deriving support from said tongue equipped member, and a device forcing element carried by one of said members having operative engagement with said tongue spreading devices and extending to the exterior of the last said member to be reached for manipulation for staying or freeing said relatively slidable machine members.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,831,237

Rudolph F. Bannow — April 22, 1958

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

Column 2, line 54, for "nuts" read -- nut --; column 5, line 75, strike out "ing the tongue into spaced apart branches, tongue spread-"; column 7, before line 1, insert -- ing the tongue into spaced apart branches, tongue spread- --.

Signed and sealed this 9th day of September 1958.

(SEAL)
Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents