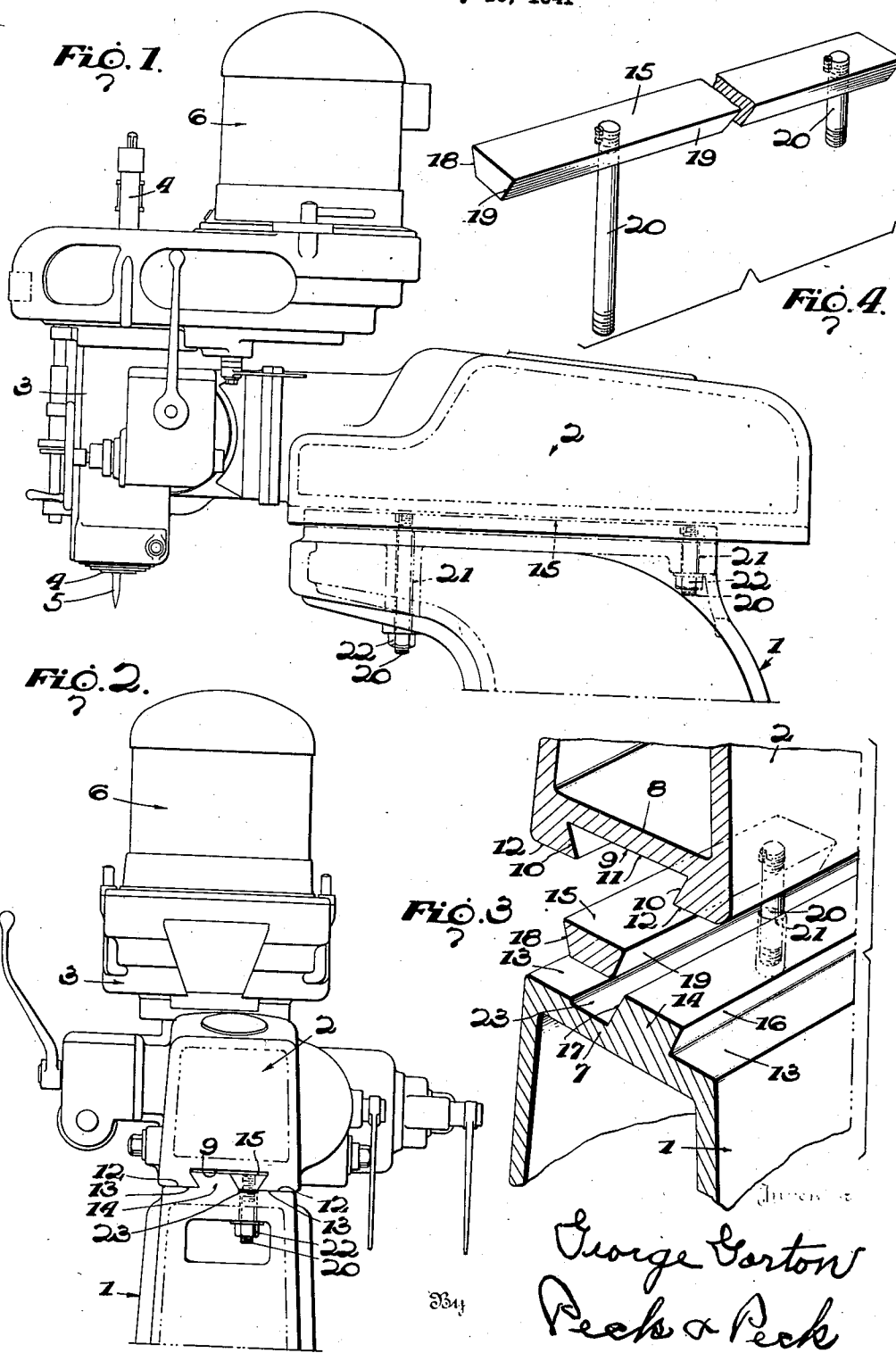


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MACHINE TOOL

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MACHINE TOOL

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This invention relates to machine tools; and the objects and nature of the invention will be apparent to those skilled in the art in the light of the following explanations of the accompanying drawing disclosures of a preferred mechanical expression or example embodiment of the invention from among other formations, arrangements or organizations within the spirit and scope of the invention as defined by the following claims.

The invention more particularly concerns machine tools and other machines wherein a rigid frame, base, column, pedestal or other proper support carries a removable or replaceable slide, ram or head that is provided with the cutter or other means to operate on the work, and that is rendered longitudinally slidable or adjustable with respect to the support, means being provided whereby the ram can be released for relative adjustment and whereby the ram can be rigidly locked in the position to which adjusted, and whereby the ram is rendered removable and replaceable with respect to the support.

For example, the invention, more particularly, relates to machines of the general type disclosed by my Patent No. 1,862,052, issued June 7, 1932, without intending to so limit all features of my invention.

An object of the invention is to provide improved means for rigidly locking an adjustable removable ram of so-called box-like construction having a closed or rigid bottom floor or wall, to its complementary supporting column or other base, and, preferably, but not necessarily in all instances, to render such ram applicable to and removable from such column or other support and slidably adjustable with respect thereto.

And a further object of the invention is to so improve the locking and releasable dovetail slidable operative connection between the removable ram and the complementary portion of the column or other support, as to gain increased rigidity of the ram against relative movements when locked, as well as increased structural strength and ease of operation, and to gain increased accuracy tolerance between the complementary dovetail portions and thus reduce machine production costs by reducing accurate close fit requirements between the dovetail portions, and also to permit successful application of selected replaceable rams to and locking and release from the complementary dovetail portion of the column or other support, where the dovetail portions of such replaceable rams differ slightly in cross sectional dimensions from each other

and from said column complementary dovetail portion.

With the foregoing and other objects in view, brought out by the following description, my invention consists in certain novel function-performing features, structures and combinations as more fully hereinafter explained and specified, whether or not the ram is removable and/or replaceable.

Referring to the accompanying drawing forming a part hereof;

Fig. 1 shows in side elevation, the upper portion of an example machine tool that includes one from among other example embodiments of the instant invention; the remaining portions of the machine tool base frame and column and the knee and work table and adjusting means, are for example, disclosed broadly by my hereinbefore identified patent.

Fig. 2 shows in rear elevation, the structure disclosed by Fig. 1.

Fig. 3 is a detail sectional perspective, illustrating in part the ram, the upper or deck portion of the column or other support, and the double-wedge clamping bar or movable section of the tenon or male dovetail portion, with such parts shown in abnormal separated positions.

Fig. 4 is a broken detail perspective of the movable clamping tenon or male section of the dovetail connection.

Merely for purposes of explanation of an example embodiment of the invention and its application, the drawing illustrates a type of machine tool from among others, to which the invention is adaptable, and reference is made to my above identified patent for illustration of the portions of an example machine tool, not disclosed by the instant drawing.

The problem solved by the instant invention concerns those machine tools and the like, wherein a cutter-head-carrying ram or elongated slide is operatively coupled to a usually rigid part of the machine frame, by a dovetail connection, and the invention more particularly involves improvements in the structure and organization of such dovetail connection, to gain substantially maximum rigidity and other advantages more particularly pointed out hereinafter.

Referring to the example machine tool, illustrated by the accompanying drawing, the rigid usually hollow upstanding column is usually rigid with or forms part of the machine base or frame, and at its upper end receives the elongated ram or slide 2, that usually extends horizontally from rear to front across the upper

end of said support or column 1, with its front end usually extending forwardly beyond the column to overhang the work table.

The function of the ram 2, is to carry the cutter head 3, and hold the same at the required position overhanging the work on the work table.

The cutter head 3, can, if so desired, be located in front of the ram and mounted to the forwardly projecting front end thereof.

This cutter head can be of any suitable structure and organization, and usually provides a suitable driven rotary spindle 4, driving any suitable cutter 5, to operate on the work on the work holder or table. If so desired, the cutter head or the ram can carry a motor 6, for driving said spindle through the medium of any suitable power transmission. The cutter head can be of the type of the vertical spindle milling disclosed by the hereinbefore identified patent, or can be of the universally adjustable type to present the driven cutter spindle at various angular positions, or of any other type adaptable to the sliding ram organization.

The top wall 7, of the column 1, and the cross floor or bottom wall 8, of the ram 2, provide the complementary longitudinal tenon or male and female or mortise portions of a dovetail operative connection holding the ram down on the column for longitudinal sliding adjustment, and for locking the ram against relative movements or looseness in the position to which adjusted.

In the example illustrated, the slidable elongated ram 2, is of rigid stiff preferably, hollow box-like construction with its rigid bottom floor or cross wall 8, rigidly connecting its vertical side walls and extending, preferably unbroken, longitudinally throughout the front to rear length of the ram. In this example, the undercut or female portion 9, of the dovetail connection is provided at the under side of the ram floor. This under-cut groove or slideway 9, extends approximately centrally throughout the length of the ram floor and opens through the front and rear ends of the ram, and is open at the bottom of the ram throughout its length, between the lower parallel longitudinal laterally-spaced edges of the opposite-side parallel upwardly and outwardly inclined edge walls 10, that meet the longitudinal horizontal top surface 11, of the groove 9, formed by floor 8, of the ram.

The bottom of the ram 2, provides longitudinal parallel flat supporting runners or slide surfaces 12, between which the groove 9, is located. These surfaces 12, are in a common horizontal plane and extend throughout the front to rear length of the runner.

The cross wall 7, throughout the length of the front to rear top of the column 1, forms a rigid horizontal elongated supporting deck and slideway for the ram 2. The top surface of this deck provides laterally-spaced parallel opposite side flat smooth longitudinal slide surfaces in a common longitudinal horizontal plane, to receive the slide surfaces 12, of the runners of the ram. These slide rails or surfaces 13, of the column deck extend throughout the length of the column deck.

The portion of the dovetail connection between the ram and column, that connects the ram to the column is located on the column deck between the column slide rails or surfaces 13.

Thus, where the dovetail groove, such as 9, is

located in the ram, the complementary tenon or male portion of the dovetail and the clamping means are located on the column.

According to my invention, the male portion of the dovetail, that is complementary to the female portion, for example, groove 9, is made up of two longitudinal partial sections, one partial section 14, being rigid with the column deck 7, with the other and complementary longitudinal partial section, consisting of a separate stiff normally-non-flexible longitudinal double-wedge-forming clamping bar 15, provided with clamping and releasing means.

By reference to Figs. 2 and 3, it will be noted that the fixed male or tenon section 14, of the dovetail, is integral or rigid with the column deck, and occupies only a fraction or portion of the transverse width of the groove 9, say, only about one-half, more or less, of the transverse dimensions of the groove, while the remaining width of said groove is occupied by the separate section of said male portion; namely, the separate clamping bar 15, and that when the two sections 14, 15, are brought operatively together they are complementary to and operatively fill the groove, and provide the necessary inclined longitudinal edges to cooperate with the inclined groove edge walls 10, 10, to lock the ram to the column deck.

Referring to Fig. 3; the male section or portion 14, rigid or integral with the column deck forms the right section of the full width male portion required, and this partial portion 14, at its upstanding right hand longitudinal edge provides the upwardly and outwardly inclined longitudinal wall 16, that is complementary to and overhangs and fits the right hand downwardly and inwardly inclined longitudinal edge 10, of groove 9.

The left hand longitudinal edge wall 17, of this rigid partial male portion presents an upwardly and laterally inclined surface that is parallel to the opposite edge surface 16, and also parallel to the right hand inclined edge surface of groove 9.

The separate movable partial male portion composed of the stiff clamping bar 15, provides a downwardly and inwardly inclined longitudinal edge wall 19, that is complementary to and parallel with the left hand inclined longitudinal edge wall 17, of the rigid partial male section 14, referring to Fig. 3.

The opposite left hand longitudinal inclined edge wall 18, (Fig. 3) is complementary to and parallel with the left hand longitudinal inclined edge wall 10, of groove 9.

The clamping bar 15, is thus of double wedge formation in end elevation as its edge flat walls 18, 19, extending throughout the length of the bar, are both inclined downwardly and inwardly from the substantially flat top face of the bar to the substantially flat relatively narrow bottom face of the bar.

The longitudinal edge walls 18, 19, of the clamping bar, the longitudinal edge walls 16, 17, of the rigid partial male portion 14, and the longitudinal edge walls 10, 10, of groove 9, are all transversely inclined at such substantially like angle of inclination, as will require functioning of the parts as herein described.

The clamping bar or separate male section 15, is of substantial width and thickness to render the same stiff and substantially rigid against objectionable flexible or bending under clamping

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and other transverse and vertical stresses and strains.

When the parts making up the dovetail connection between the ram and column deck, are operatively assembled (Fig. 2), with the ram runners 12, resting on the column rails 13, and the right hand longitudinal edge wall 10 (Fig. 3) of the ram closely fitting the longitudinal edge wall 16, of rigid male portion 14, the clamping bar 15, snugly fills in the gap between the longitudinal left hand edge wall 10, of the ram and the longitudinal edge wall 17, of the rigid male portion 14, with the longitudinal edge walls 18, 19, of bar 15, closing down on the complementary longitudinal edge walls 10, and 17, of the ram and portion 14, respectively, with down clamping and laterally expanding pressure.

The bar 15, when locked in operative clamping position, is firmly held against lateral or endwise relative movements and against normal vertical movements by suitable clamping and releasing means. For example, I show the bar 15, provided with several stiff or rigid parallel depending studs or rods 20, preferably longitudinally screw threaded at least at their lower portions. These studs are at their upper ends rigidly secured to the bar 15, preferably, at spaced intervals remote from the bar ends and preferably, along the longitudinal axis of the bar, preferably, without forming projecting portions at the top surface of the bar.

The top deck 7, of the column 1, is formed with vertical holes or bores 21, for the passage of the depending studs 20, with these holes extending down through exposed transverse portions of the column to form abutments for accessible nuts 22, screwed on the downwardly projecting screw threaded ends of the studs, whereby the clamping bar 15, can be drawn down and held in rigid clamping position, or can be loosened to the slight extent necessary to permit the ram to be pushed or propelled in either direction on the column deck by hand or otherwise, to bring the cutter means in the desired position with respect to the work. When the ram has been moved to the desired position, it can be easily and quickly rigidly clamped to the column deck by manipulation of the accessible nuts 22.

The vertical thickness of the clamping bar 15, may approximate the vertical thickness of the rigid partial portion 14, above the horizontal plane of the rail surfaces 13, although my invention is not so restricted. However, when the bar is in rigidly held clamping position, clearance is provided between the top surface of the bar 15, and the top wall surface 11, of the female groove 9, and preferably between the relatively narrow bottom surface of said bar and the top surface of the column deck between the rigid male portion 14, and the adjacent rail 13, see slight longitudinal depression 23, Fig. 3.

The one piece or single elongated clamping bar 15, of substantial width and thickness, extends substantially throughout the front to rear length of the column deck, i. e. throughout the length of the dovetail rigid portion 14. This clamping bar 15, when in operative clamping position, is held against relative lateral movements by the stiff bars or studs 20, vertically slidable in the frame, and requires but slight bodily vertical movements for rigidly clamping the ram and for releasing the ram, for sliding adjustment, by reason of the fact that the bar forms a double wedge with its upwardly and outwardly flaring smooth inclined opposite longitudinal edge walls always over-

hanging and contacting the correspondingly upwardly and outwardly flaring smooth inclined longitudinal complementary edge walls 17, and 10. Thus, by manipulation of the nuts 22, the clamping bar 15, can be quickly pulled down to rigidly lock the ram down on the column deck, and by slight loosening of said nuts, said bar can be loosened to the extent necessary to permit sliding adjustment of the ram. The bar 15, when being drawn down, performs a double lateral wedging action, both on inclined edge 10 (Fig. 3) to force the right hand inclined edge 10, (Fig. 3) tightly against inclined edge 16, of rigid part 14, while the inclined edges 18, 19, of said bar 15 tightly close down on inclined edges 17, and adjacent 10, to rigidly lock the ram down on the column deck against relative movements.

This simple and effective organization is of particular advantage in machines doing heavy duty where the cutter spindles must be accurately maintained against relative lateral movements, and where the rams are adjusted to advanced forward positions on the columns or supports.

In many machines of this general character, the rams are detachable from and applicable to the columns, which in my instant embodiment is rendered possible by loosening the clamping bar 15, and sliding the ram forwardly on the column free from the dovetail connection.

As different rams are removable and replaceable, on the one column, advantages are gained where my invention is employed, because of its capacity to receive and lock different rams that vary within limits in the transverse dimensions of their female grooves 9. This is possible because the bodily vertically movable double wedge clamping bar 15, of substantial width, cooperating with rigid male section 14, and the adjacent inclined edge wall 10, of the ram, functions to take up variations in the transverse width of the grooves 9, of different rams, by reason of the ample clearance provided at both the top and bottom of bar 15, to permit an extended range of vertical movements of said bar with the inclined edges 18, 19, contacting only the inclined edges 17, and the adjacent inclined edge 10. This fact extends the range of accuracy tolerance and reduces the need for extreme accuracy in certain dovetail surfaces and dimensions heretofore believed to be necessary.

The clamping bar 15, during a ram locking or clamping operation, will move down to final clamping position wherein the bar fully and fixedly fills the transverse space from rigid edge wall 17, to the adjacent edge wall 10, of the ram groove 10. Where the transverse distance between rigid wall 17, and wall 10, of a particular ram, is normal or comparatively short, the downward movement of the bar 15, to final clamping position will be relatively short.

When another ram is substituted, on the column deck, its groove 9, may be over wide, making the distance from fixed edge wall 17, to the adjacent edge wall 10, of groove 9, overlong. In such event, the wedge and clamping bar 15, will move down a greater distance, than where the ram groove 9, is not so wide, before it reaches the final rigid clamping position wherein said bar rigidly occupies the transverse distance from wall 17, to the adjacent groove edge wall 10.

This capacity of the peculiar wedge clamping bar 15, to thus take up variations in the widths of grooves 9, of different rams where used at different times on the same column deck and its male dovetail portion, is increased by so mount-

ing the bar as to render the same bodily shiftable laterally, within limits, when loosened and not in clamped locking position.

When the bar is thus loose, it is free within limits, to shift laterally while being drawn down to clamping position, to center itself between the rigid wall 17, and the adjacent groove edge wall 10, to properly perform its lateral wedging and down clamping functions, particularly where the variations in ram grooves 9, are near the maximum permitted.

However, the bar mounting and clamping means are such that the bar is rigidly held against relative lateral looseness when locked in clamping position.

The desired limited lateral looseness of the bar 15, when not in clamped position, where the bar is provided with the rigid depending studs 20, is in the example embodiment disclosed, provided for by the relatively enlarged internal cross dimensions of the vertical slideways or holes 21, with respect to the cross dimensions of the studs 20, that are slidably confined in said holes. The desired limited lateral looseness of the bar, when not fixedly clamped by nuts 22, and studs 20, is thus attained.

The bar, when loose, can within limits thus bodily slide laterally, during the clamping operation, to adapt and center itself on the edge walls 17, 10, in taking up variations in the widths of different grooves 9.

Thus, in the disclosed embodiment of my invention, it is not essential to accurately scrape and finish the inclined edge wall 17, of the rigid portion 14, the inclined edge walls 18, 19, of the clamping bar, and the left hand inclined edge wall 10, (Fig. 3) as smooth planing is sufficient. It is desirable to scrape and accurately finish the slide surfaces 12, 12, and the rail surfaces 13, 13, and the surfaces of the inclined edge wall 10, and its complementary inclined edge wall 16.

The disclosure hereof is for purposes of explanation of an example embodiment of the invention, and not for purposes of limitation except where so required by the prior art.

What I claim:

1. In a machine tool of the type having a normally-fixedly-clamped ram member removably and longitudinally-slidably confined to a supporting deck member by a longitudinal dovetail connection; said dovetail connection comprising a female open-end groove extending longitudinally of one of said members and having opposite-side parallel wedging edge walls; the other member provided with the longitudinal male tenon extending through said groove and having opposite-side parallel wedging edge walls complementary to and transversely overlapping the edge walls of the said groove, said male tenon including a double wedge longitudinal relatively laterally and vertically movable clamping bar for varying the transverse width of the tenon to operatively fit the different internal widths of the female grooves of removable replaceable rams interchangeably employed on said supporting deck, means being provided rendering said bar relatively bodily-movable laterally in either direction for self-centering and relatively movable bodily vertically to and from ram clamping and releasing positions.

2. A machine tool comprising a supporting deck member; a ram member slidable on said deck member; one of said members providing the female groove of a dovetail longitudinally-slidable connection between said members; the other member providing the male tenon arranged lon-

gitudinally in said groove, said groove and said tenon at their opposite longitudinal sides having complementary parallel slidably contacting transversely-overlapping wedging edge walls; said tenon including a fixed longitudinal partial-width portion providing one of the aforesaid wedging edge walls of the tenon and also providing a second fixed longitudinal parallel edge wall located intermediate the overall width of said tenon, and a longitudinal clamping bar in said groove between said second edge wall of said fixed tenon portion and the adjacent transverse wedging edge wall of said groove, said bar having a longitudinal wedging edge for laterally wedging contact with said adjacent edge wall of the groove, and another longitudinal wedging surface for laterally wedging contact with said second edge wall of said fixed tenon portion; said bar having an extended range of relative vertical movements toward ram clamping positions; said bar, while being propelled toward ram locking positions, being relatively bodily laterally movable toward the adjacent groove edge wall under the lateral wedging action of said second edge wall of said fixed tenon; and means for propelling said bar through its extended clamping movements and for releasably locking the same in ram clamping positions.

3. In a machine having a normally rigidly clamped ram member longitudinally adjustable on a supporting deck member, one of said members having the female groove of a dovetail connection, and the other member having the complementary male tenon extending through said groove, with the tenon and groove having opposite side complementary longitudinal laterally wedging slide surfaces; the provision of mechanism for releasably clamping the ram member to the deck member, said mechanism including an elongated stiff clamping bar arranged longitudinally through said female groove and having a longitudinal transversely wedging surface complementary to and overlapping one of said longitudinal side surfaces of said groove, said bar also having a second longitudinal transversely wedging surface, spaced laterally from its said first named surface and overlapping and complementary to a longitudinal laterally wedging fixed surface of said tenon; and means for relatively moving said bar vertically on its ram clamping movements and for releasably locking the bar in its ram clamping positions, said means rendering said bar laterally movable for self-centering within said groove between said groove side surface and said fixed tenon surface, during bar movements toward ram clamping positions.

4. In a machine of the type having a normally fixedly-clamped ram member longitudinally slidable on a supporting deck member for adjustment and confined to the deck by a dovetail connection, the female groove of said connection being provided by one of said members and the longitudinal male tenon by the other member, said groove and tenon having opposite side longitudinal overlapping lateral wedging surfaces; the provision of a tenon capable of expanding in width to transversely occupy a slightly wider or narrower female groove, said tenon on one longitudinal side having a longitudinal surface laterally overlapping the complementary longitudinal surface of the internal adjacent side face of said groove, said tenon providing a relatively fixed intermediate longitudinal laterally wedging surface, and a longitudinal clamping bar in the space between said relatively fixed intermediate longitu-

dinal surface and the adjacent longitudinal internal side surface of said groove, said clamping bar having longitudinal lateral wedging surfaces complementary to said intermediate and adjacent groove side surfaces respectively, said bar being relatively vertically movable and laterally self centering; screw threaded operating means for drawing said bar vertically to and for releasably maintaining the same in ram locking positions, said operating means comprising a rotary threaded nut, the member carrying said tenon providing an abutment for said nut.

5. A machine tool having a supporting deck provided with vertical guide means and a part providing transverse abutment means; a normally-fixedly clamped ram longitudinally slidable on said deck; said deck having a longitudinal male tenon portion; said ram providing a

female longitudinal groove receiving and longitudinally slidable on said tenon, said groove having longitudinal downwardly converging opposite edge surfaces, said tenon providing complementary longitudinal upwardly diverging opposite edge surfaces, and a longitudinal elongated clamping bar providing one of the longitudinal upwardly diverging edge surfaces of said tenon, and constituting a cooperative partial-width longitudinal portion of said tenon, said bar being relatively vertically movable to and from ram clamping positions, and provided with pull-down means fixed thereto and loosely laterally confined by said guide means; and stop means having elongated screw-threaded connection with said pull-down means, and operatively cooperating with said abutment means.

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