April 14, 1953 A. H. JOBERT 2,634,645

CROSS SLIDE

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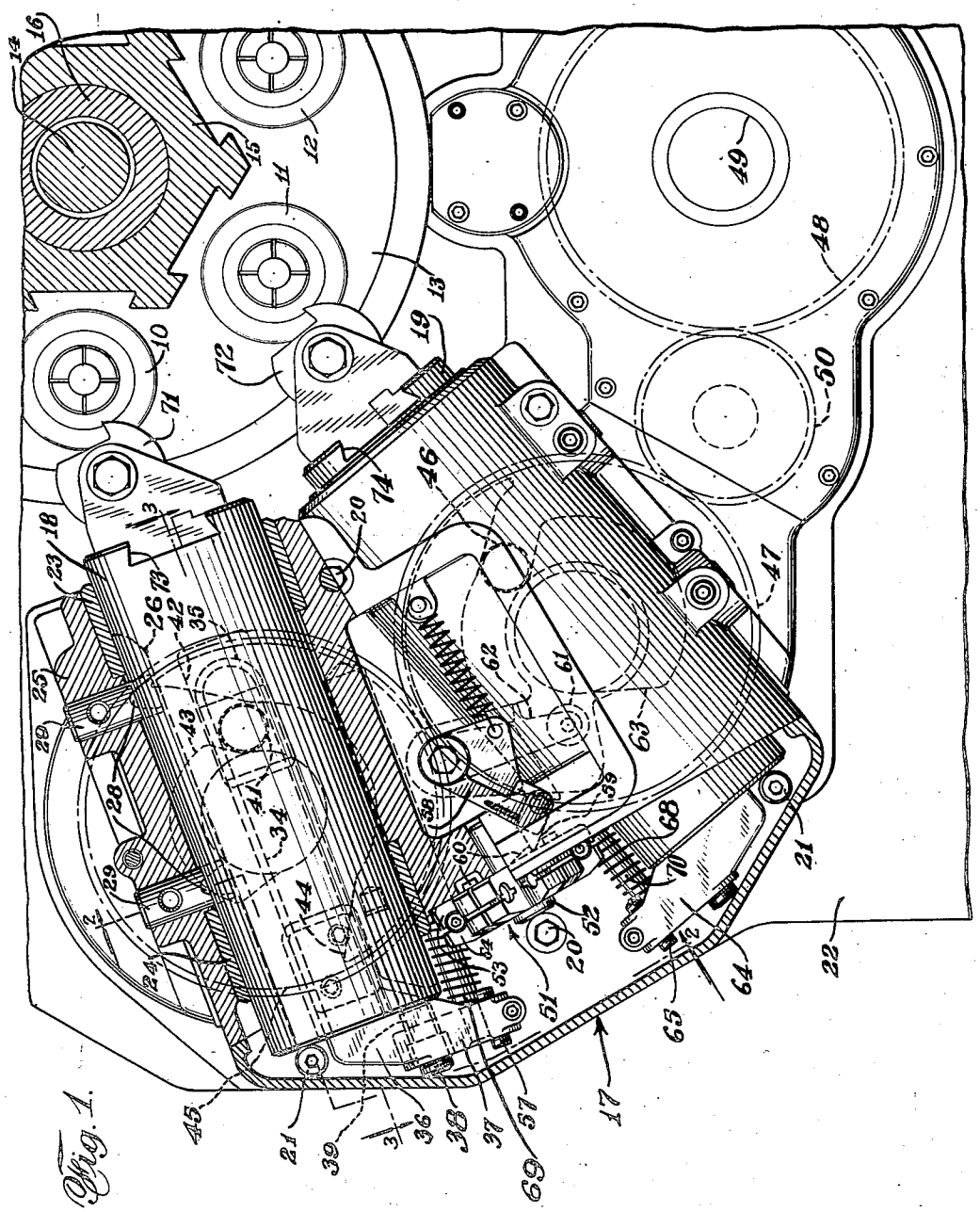


Fig. 1.

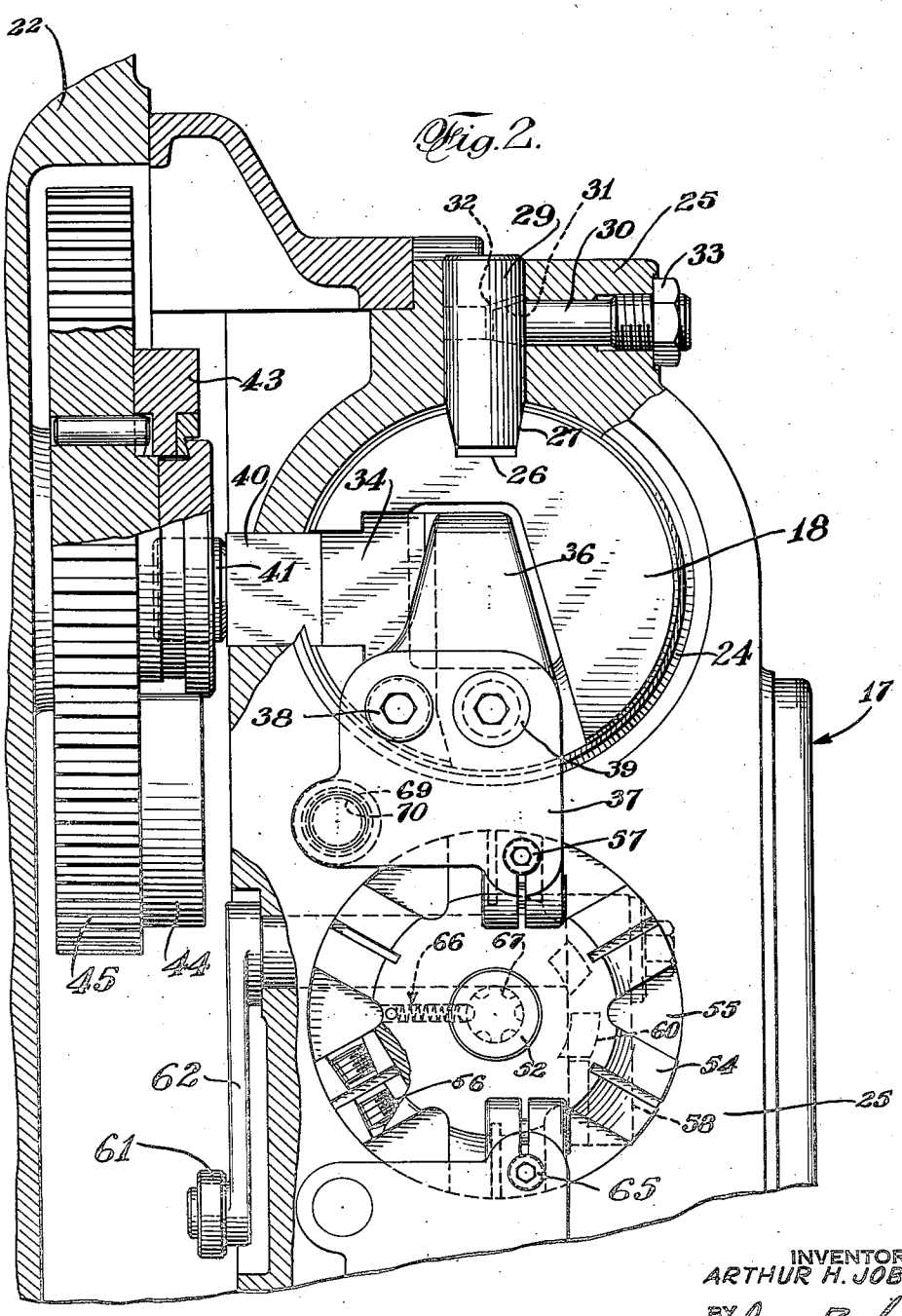
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Fig. 2.



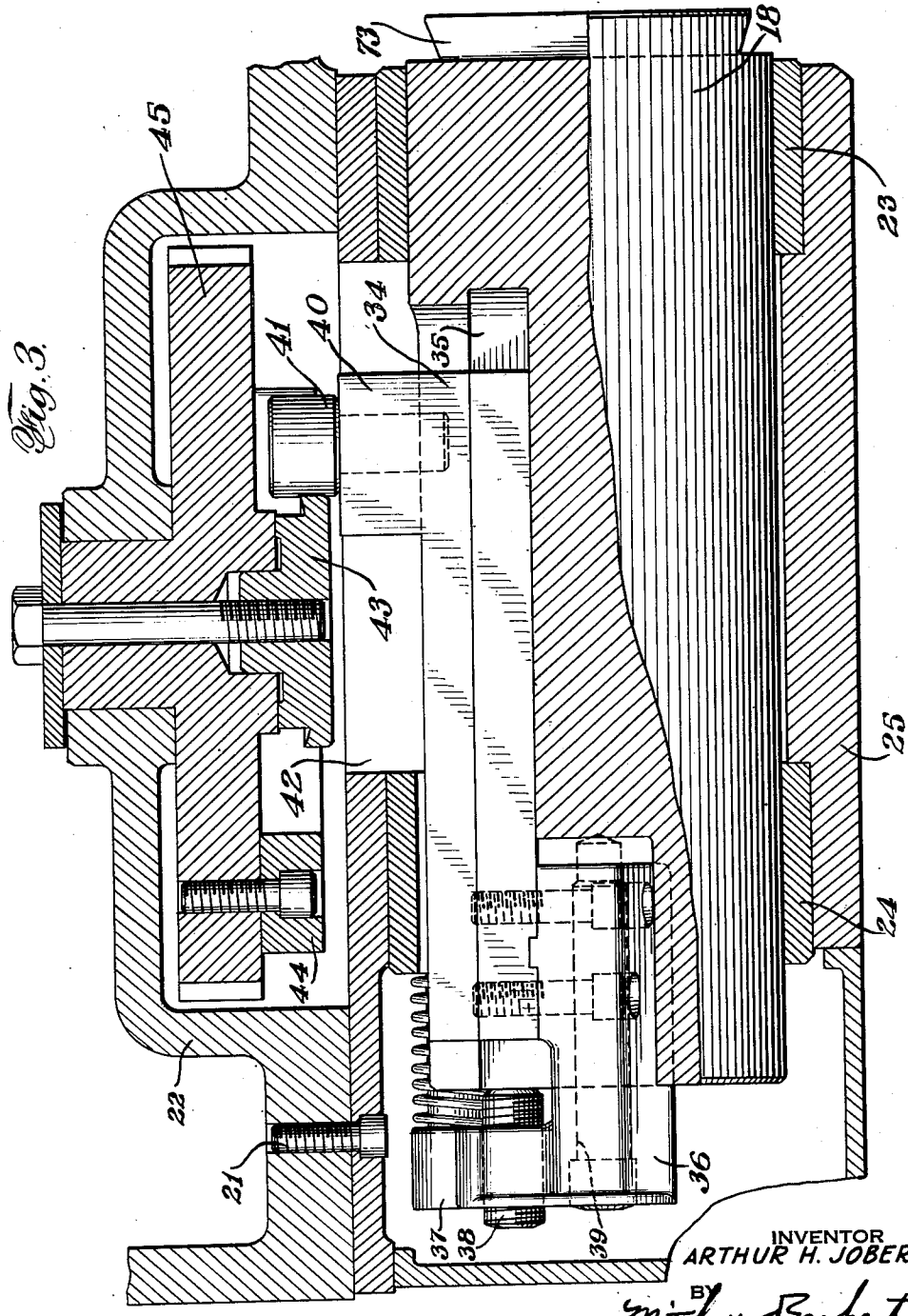
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Fig. 3.



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Patented Apr. 14, 1953 2,634,645

UNITED STATES PATENT OFFICE

2,634,645

CROSS SLIDE

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Application March 18, 1947, Serial No. 735,370

8 Claims. (Cl. 82—25)

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My invention relates to an improved tool slide for an automatic spindle machine and, in particular, for an indexing type of multiple-spindle machine.

It is an object of my invention to provide an improved tool slide of the character indicated.

It is another object to provide an improved cross-slide arrangement for a multiple-spindle machine, in which arrangement a plurality of cross slides may be carried in a single assembly for operating on work supported in a plurality of spindles.

It is a further object to provide improved means for supporting and for determining the limiting feed positions of a side-working tool for use on a multiple spindle machine.

It is also an object to provide an improved means for supporting and for determining limiting feed positions of a plurality of side-working tools for cooperation with a corresponding plurality of the spindles in an indexing type of multiple-spindle machine.

Still another object is to provide an improved tool holder and tool-feeding mechanism therefor, whereby a given tool may be advanced to the same relative desired position for working the stock carried by any spindle of a multiple-spindle machine.

Other objects and various further features of the invention will be pointed out or will occur to those skilled in the art from a reading of the following specification in conjunction with the accompanying drawings. In said drawings:

Fig. 1 is a side view in partial section of a cross-slide assembly according to the invention, shown mounted for cooperation with a plurality of the spindles of a multiple-spindle machine;

Fig. 2 is an enlarged fragmentary view in partial section, the section being taken substantially in the plane 2—2 of Fig. 1; and

Fig. 3 is another enlarged sectional view, but taken substantially in the plane 3—3 of Fig. 1.

Briefly stated, my invention contemplates an improved cross-slide assembly for use in an indexing type of multiple-spindle machine. Viewed in one sense, the invention provides a complete cross-slide unit supporting a plurality of cross-slides and feed mechanisms for said cross-slides. The slides are preferably cylindrical and are received in cylindrical bores in the assembly. The arrangement for supporting a tool at the tool-carrying end of the slide is preferably such that the direction of feed is generally radial with respect to the spindle-carrier axis, and the cutting edge of the tool is substantially in line with the tool-slide displacement axis.

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Viewed in another aspect, the invention provides novel means for determining a limiting feed position of a tool slide for use on a multiple-spindle machine. It is a fact that no matter how carefully the spindles of a multiple-spindle machine, or for that matter the working positions of any automatic indexing machine, may have been located, there may be sufficient error in their placement to cause a particular tool to produce different depths of cut upon stock supported in different spindles. By means of an indexible stop the invention provides for the employment of different calibrated abutments for variously limiting the feed of the tool slide, depending upon the spindle with which such tool slide is cooperating. In the novel unit-cross-slide assembly of the invention, it is possible to employ a single stop member to cooperate with two cross-slides for appropriately limiting the feed positions of each cross slide in accordance with the particular spindle locations with which said cross slides may be cooperating.

Referring to the drawings, my invention is shown in application to a multiple-spindle machine having a plurality of spindles 10, 11, 12 supported on a spindle carrier 13 which is indexible about a central axis 14. End-working tools for performing chamfering, recessing, boring, and other end operations upon work supported in spindles 10, 11, 12 may be mounted upon a so-called Gridley-type tool slide 15, which in turn is supported upon a central arbor or stem 16.

In accordance with a feature of the invention, a unitary structure 17 carrying a battery of cross slides 18—19 may be assembled as a unit and removably secured as by bolts and screws 20—21 to the frame 22 of the machine. The cross slides 18—19 are supported for sliding displacement preferably generally radially of the central axis 14 of the spindle carrier 13. Tool slides 18—19 are preferably generally cylindrical and may be supported at both ends by suitable bushings 23—24 pressed into or carried by appropriately bored portions of the frame member 25 of the cross-slide assembly 17.

To maintain angular alignment of the tool slide 18 there may be a longitudinally slidable key-and-slot engagement between the tool slide 18 and the frame member 25. In the form shown, the tool slide 18 is milled with a longitudinally extending slot 26 having tapered walls 27, for engagement with correspondingly tapered flats 28 on stud keys 29 carried by the frame member 25. The tightness of fit between the stud keys 29 and the walls of the slot 26 may

be adjusted by means of a pin member 30 extending transversely of the keys 29 and having a conical tip 31 to engage a transversely extending conical bore 32 in the key 29. The shank of the pin 30 may be threadedly engageable with the frame member 25, and a lock nut 33 serves to secure an adjusted position of the same. It will be clear that upon an advance of the pin 30 the key 29 will be cammed into tighter engagement with the tool slide 18 and that upon a retraction of the pin 30 this engagement will be relaxed. To prevent chips from entering the slot 26, I prefer that slot 26 should not extend the full length of the tool slide 18 but that it terminate (see dotted line in Fig. 1) sufficiently back of the tool-carrying end thereof to permit full strokes of the tool slide 18 without exposing slot 26 near the cutting or working area.

I prefer that the tool slides 18—19 be fed, particularly during the cutting portion of the feed cycle, by means applying feed forces as close as possible to the axes of the tool slides themselves. In the form shown, these feed forces are applied within the diametral limits of the tool slides and through the medium of a carrier piece 34, which may be formed with a generally T-shaped section fitting in a longitudinally extending T-slot 35, which may be cored out of tool slide 18. The carrier member 34 is preferably rigidly connected to the tool slide 18, and the nature of this connection is preferably such that there may be a relative longitudinal adjustment of the carrier member 34 and of the tool slide 18.

To facilitate this longitudinal adjustment, the back end of the carrier member 34 may carry a bracket 36 having a transversely extending portion 37 projecting beyond the peripheries of the tool slide 18. An adjustable screw 38, carried by the bracket 36 and abutting the tool slide 18 permits an initial setting of the relative longitudinal association of carrier member 34 and of tool slide 18. A tightening bolt 39 countersunk in the bracket 36 threadedly engages a tapered bore in the tool carrier 18 for securing the longitudinal adjustment made with the screw 38.

The carrier member 34 may be fed by a roll-carrying projection 40 carrying a cam-follower roll 41 projecting through a slot 42 in the cross-slide housing member 25. The cam-follower roll 41 is shown to be fed by a face cam having a feed element 43 and a drawback element 44, both of which are supported on a feed gear 45 immediately behind the tool slide 18.

In a similar manner, it will be understood that the cam-follower roll 46 for the tool slide 19 may engage corresponding feed and drawback elements supported by another feed gear 47. In the form shown, both feed gears 45 and 47 mesh, and one of them is directly driven from a gear 48 on the main cam shaft 49 through an idler 50. It will be clear that during the continuous rotation of the main cam shaft 49 the feed mechanisms for both tool slides 18 and 19 may be effective to produce concurrent feed and drawback strokes of both tool slides 18—19. It will further be clear that on another side of the machine and, if desired, geared to the drive gear 48, there may be a similar feeding mechanism for operating further tool slides to cooperate with spindle 12 and with other spindles of the machine.

In accordance with a feature of the invention, means are provided with each tool-slide unit to assure that tools carried by each of the tool slides in the unit will be carried to a predetermined limiting feed position (and no further), depending upon preadjustments made for each individual position. In accordance with this feature, a calibrated abutment is appropriately placed with each indexing of the spindle carrier 13 so as to assure a proper limitation of the feed for the tool slide 18 working on a first spindle 10, and a proper limitation of the feed for the tool slide 19, which may be simultaneously working on a second spindle 11. The same adjustable abutment or stop member may, if desired, serve a plurality of tool slides, and this is the case in the form shown.

In the form shown, the adjustable abutment or stop member 51 carries a plurality of generally circularly spaced abutment elements. The member itself is supported on a pivot pin 52 journalled in the frame member 25 of the cross-slide unit. Adjustment of the abutment or stop elements for any particular stop location involves essentially the adjustment of a wedge, whereby different abutment members are limited or positioned by variously thick parts of the wedge. In the form shown, this function is performed by having each stop comprise a fixed abutment 53 and a displaceable abutment member 54. The fixed abutment member 53 is flush with the base of the indexible stop 51 and may therefore always be supported by a relatively rigid or fixed face 55 of the cross-slide frame member 25. The wedge action that is utilized for adjustment purposes is, in the form shown, derived from tapered screws 56 set in tapped, tapered, arcuate segments of the fixed and displaceable abutment members 53—54. It will be understood that a threaded advance or retraction of the adjustable wedge element 56 will determine various positions of the displaceable abutment members 54. Depending upon the indexed position of the abutment or stop unit 51, an abutment screw 57 carried by the bracket extension 37 (associated with the tool slide 18) will home upon one of the displaceable abutment members 54 and thus limit the feed of the tool slide 18.

For successive indexing positions of the spindle carrier 13, I provide a novel mechanism for indexing the abutment or stop unit 51, whereby appropriate displaceable abutment members 54 will be set in position to intercept the abutment screw 57 for limiting working feeds of the tool slide 18. In the form shown, this indexing mechanism involves a ratchet mechanism 58 carrying a spring-urged pawl 59 for engagement with ratchet teeth 60 on the back side of the abutment unit 51. The ratchet mechanism 58 may be actuated by a cam-follower roll 61 and its supporting arm 62, which may follow one of the cam segments 63 actuating one of the tool slides 18—19. It will be clear that, in the form shown, wherein the feed gear 47 for the tool slide 19 rotates counterclockwise, the ratchet mechanism 58 will be actuated after a drawback of both tool slides 18—19, just prior to commencement of their working strokes.

It will be understood that if the bracket 64 carried at the end of the tool slide 19 is provided with an abutment screw 65 similar to the abutment screw 57 for tool slide 18, then the abutment screws 57—65 for both tool slides 18—19 may be brought to bear upon the abutment unit 51 with each working feed of both tool slides. By providing stops 54 in a plurality corresponding to the number of spindle positions times the number of cross slides to be served by the abutment or stop

unit 51, I show how the single abutment unit 51 may provide the required sequence of calibrated stops. In the form shown, there are six spindles on the machine and two cross slides 18—19 to be served by the single abutment or stop unit 51. The stop unit 51 therefore preferably carries twelve stops 54. By properly aligning the abutment members 57—65 with respect to the pivotal pin 52, every odd stop 54 may serve say the cross slide 18, and every even stop 54 may serve the cross slide 19. Various type keepers may be devised for holding indexed positions of the stop unit 51, particularly during intervals of stop indexing, and, in the form shown, I provide a spring-detent mechanism 66 to cooperate with detent recesses 69 in the pivot pin 62.

In accordance with a further feature of the invention, I provide means built into the cross-slide unit 17 for resisting (in the case of tools carried by the cross slides 18—19) tendencies of the tools to "dive into" the work. This function may be performed by hydraulic, pneumatic, or other means normally urging tool carrier 18 in a retracting direction. In the form shown, I employ separate compressional springs 68—69 for this purpose. Each of the springs 68—69 may act between a part of the frame member 25 and a part of one of the brackets 36—64 carried by a tool slide. In the form shown, the coil spring 68 is centered upon a locating spindle 70 carried by the bracket 64 and extending into a bore in the frame member 25. The spring 68 homes or seats on the bottom of this bore and may be accurately located thereby, concentric with the locating spindle or stud 70.

In accordance with a still another feature of the invention, I provide means whereby tools 71—72 may be carried by the respective tool slides 18—19 relatively close to the front ends of these tool slides and in such a manner that the cutting edges are between the diametral limits of the tool slides and preferably close to the axes thereof. This arrangement clearly permits a maximum assumption of working thrusts by both the front and rear bushings 23—24 for supporting the tool slide, and serves to reduce tendencies toward chatter. By providing the noses of the cross slides 18—19 with transversely extending dovetail slots 73—74, considerable freedom may be permitted for final lateral adjustment of the tools 71—72 with respect to the tool slide axes.

It will be clear that I have described a relatively simple unitary mechanism having features of extreme adaptability to multiple-spindle-type indexing machines. The novel mechanism is such that accurate work may be similarly performed by a plurality of tool slides in the unit, and that this work may be of an accuracy that is relatively independent of inaccuracies in spindle locations. In the preferred form described, a spindle mechanism requiring no further cams or other actuators serves to determine limiting feed positions for a plurality of cross slides, and these cross slides may clearly be cooperating with one or more of the spindles of the machine.

While I have described my invention in detail for the preferred form shown, it will be understood that modifications may be made within the scope of the invention as defined in the claims which follow.

I claim:

1. As an article of manufacture, a cross-slide unit for application to a machine with an indexible multiple-spindle carrier, said slide unit including a base removably securable to the frame of the machine and having two bores inclined with respect to each other for inclination generally toward the axis of the spindle carrier, cylindrical slides in said bores, an actuating member longitudinally slidable in each of said cylindrical slides, a cam-follower projection on each said actuating member, said projections being guided by slots alongside said bores, and projecting for coaction with cam means on the machine, means adjustably securing said actuating members to said cylindrical slides, and an adjustable stop for determining a limiting feed position of said cylindrical slides.

2. As an article of manufacture, a cross-slide unit for application to a multiple-spindle machine in which the slide and the spindles are to be unidirectionally indexed relatively to each other, said slide unit including a base removably securable to the machine, tool-slide means slidable in said base, rotatably indexible adjustable stop means with a plurality of stops severally and successively to determine a limiting sliding position of said tool-slide means, and unidirectional indexing means for said stop means and actuable upon a sliding movement of said tool-slide means relatively to the base.

3. As an article of manufacture, a cross-slide unit for application to a multiple-spindle machine in which the slide and the spindles are to be unidirectionally indexed relatively to each other, said slide unit including a base removably securable to the machine, two cross-slides slidable on said base for cooperation with two spindles on said machine, and rotatable unidirectionally indexible adjustable stop means with a plurality of stops severally and successively to determine limiting sliding positions of said cross slides.

4. An article according to claim 3, in which said stop means is positioned between said slides, with a first plurality of independently adjustable stops to cooperate with one of said slides and with a second plurality of independently adjustable stops to cooperate with the other of said slides.

5. An article according to claim 4, in which said stop means is mounted for indexed rotation about an index axis, and in which the stops of said first plurality and of said second plurality are alternately disposed about the index axis of said stop means.

6. As an article of manufacture, a tool stop for determining a limiting feed position of a tool, said stop including a body having a slot near a side thereof to be abutted, a tapered thread on both sides of said slot, and a threaded tapered member engaging said tapered thread, whereby upon adjustment of said threaded member said side to be abutted may be adjustably deformed.

7. As an article of manufacture, rotary indexible stop means for determining a limiting feed position of a tool holder and including mounting means for indexed rotation of said stop means about an index axis, a plurality of pairs of adjacent projections angularly spaced about said axis, and adjustable wedge means between adjacent projections of said pairs.

8. As an article of manufacture, rotatable indexible multiple-abutment stop means to be indexed about an index axis, comprising a body integral with a plurality of angularly spaced pairs of axially spaced radial projections, one projection of each said pair including a substantially flat circumferentially extending surface in a single radial seating plane, whereby said surfaces

may be seated uniformly regardless of the index position, and independently adjustable wedges between the projections of each said pair.

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