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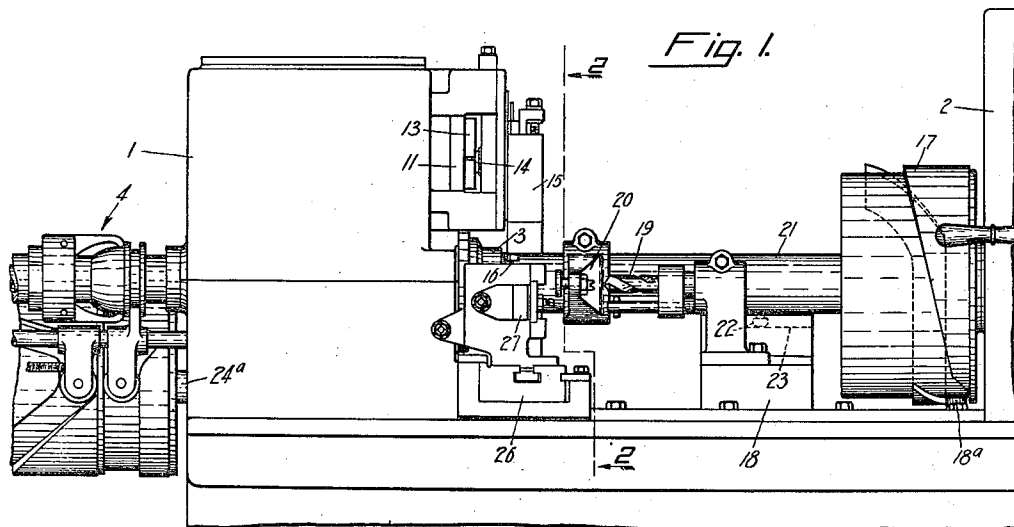
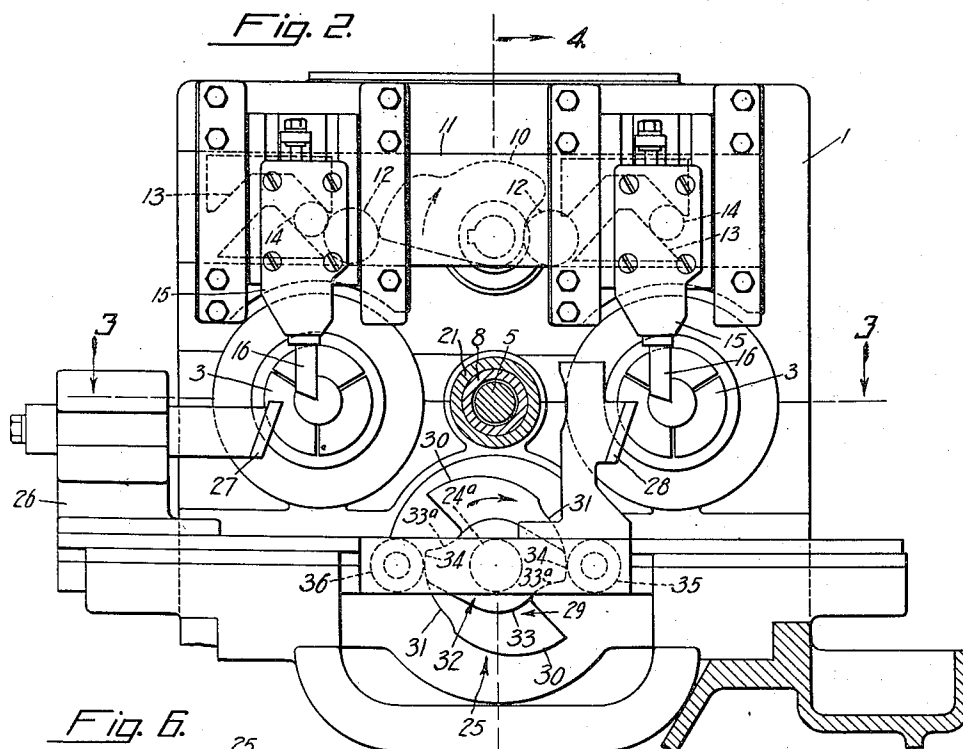
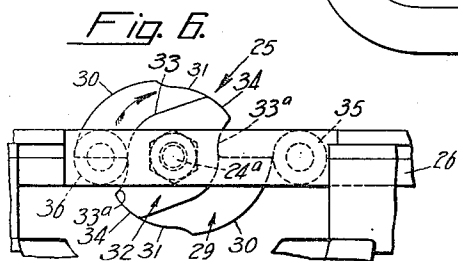
E. E. KELLEY

2,255,170

MACHINE TOOL

Filed Sept. 15, 1939

2 Sheets-Sheet 1



INVENTOR
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Sept. 9, 1941.

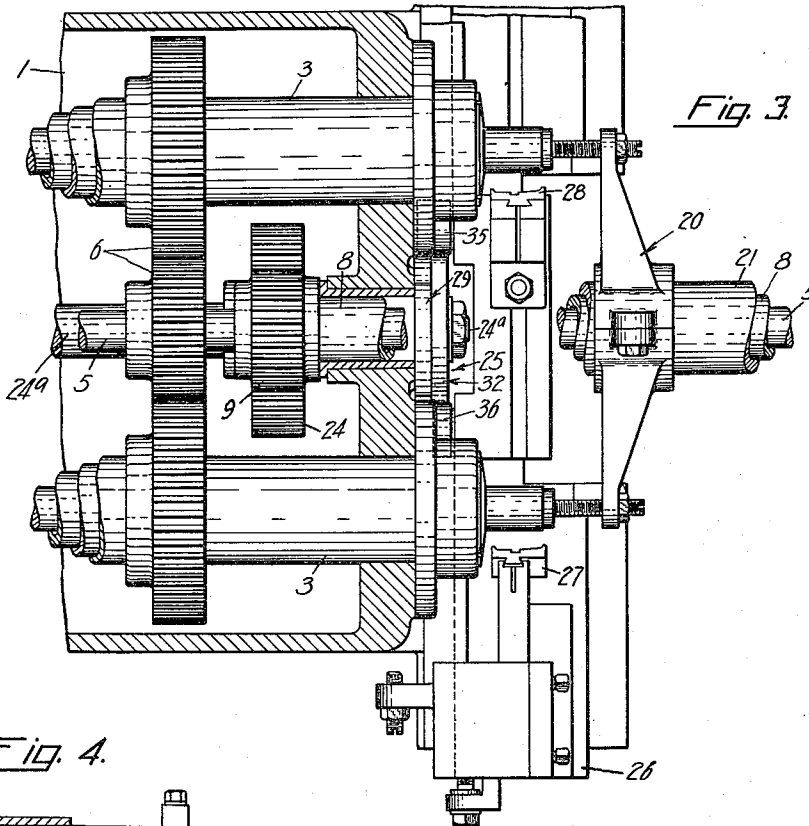
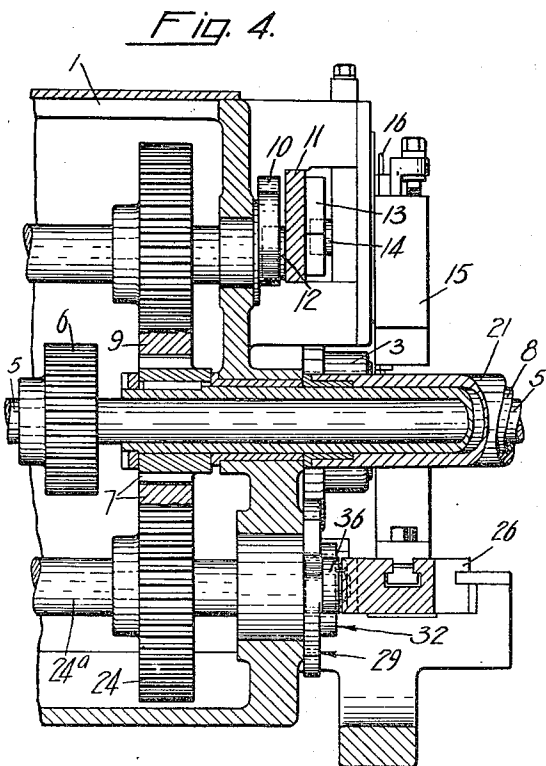
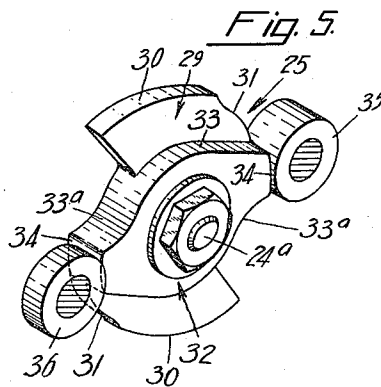
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MACHINE TOOL

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,255,170

MACHINE TOOL

Elmer E. Kelley, Hartford, Conn.

Application September 15, 1939, Serial No. 294,991

17 Claims. (Cl. 29—52)

My invention relates to machine tools.

It has among its objects to provide an improved machine tool of the parallel spindle, so-called "two-at-a-time" type, described and claimed in my Patent No. 2,201,182, issued May 21, 1940. A further object of my invention is to provide improved timing means for the transverse tool slide of such a machine and an improved arrangement of tools thereon, whereby it is made possible, while halving the number of tools required on this slide and consequently minimizing difficulty with the cuttings, to maintain the same production as previously obtained with four tools. Still further objects of my invention are to provide improved operating mechanism for the cross slide, and, more particularly, to provide improved cross slide operating cam mechanism whereby the above results are obtained while enabling the drive cam to be driven at the same speed as heretofore. Other objects of my invention include the provision of an improved timing relation between this mechanism and the vertical cut-off mechanism, as well as the longitudinal tool carrier, whereby these cooperating mechanisms function in an improved sequence with respect to the new movement of the transverse tool slide during the operation of the machine. These and other objects and advantages of my improvements will, however, hereinafter more fully appear.

In the accompanying drawings, I have shown for purposes of illustration one embodiment which my invention may assume in practice.

In these drawings—

Figure 1 is a side elevation of a portion of a two-at-a-time machine equipped with my improvements;

Fig. 2 is a section on line 2—2 of Figure 1;

Fig. 3 is a section on line 3—3 of Figure 2;

Fig. 4 is a section on line 4—4 of Figure 2;

Fig. 5 is a detail perspective view of my improved double-lobed cam, and

Fig. 6 is a detail view showing this cam in slide projecting position.

In this illustrative construction, I have shown my invention applied to a machine of the two-at-a-time construction of my patent mentioned, and also provided with vertical cut-off mechanism of the type described and claimed in my Patent No. 2,201,183, issued May 21, 1940; this machine being provided with improved cross slide operating mechanism whereby two tools carried on the cross slide are enabled to perform the functions of the four previously provided, while

the cross slide operates in a new timed relation with the longitudinal tool carrier and the vertical cut-off tools, all as hereinafter more specifically described.

In this construction, a machine is shown having a head stock 1 and a gear box 2 and parallel spindles 3 projecting from the former toward the latter and having usual cam operated work gripping and feeding mechanism, generally indicated at 4. Further, as in my first mentioned application, the spindles 3 are driven from the gear box by a shaft 5 connected to the spindles through gearing 6, while the feeding mechanism 4 is driven through gearing 7 from a drive sleeve 8 enclosing the shaft 5. As in my second mentioned application, this sleeve 8 also drives through a central gear 9, the actuating cam 10 of an upper transverse slide 11 so that as this cam engages cooperating rollers 12, this slide 11 is operated to actuate generally V-shaped cams 13, having rollers 14 movable therein to raise and lower vertical cut-off slides 15 carrying cut-off tools 16. As in my patent hereinbefore mentioned, a main cam 17 disposed coaxially with the drive shafts 5 and 8 and fixed to the tube or sleeve forming the shaft 8, is also utilized to reciprocate a longitudinally reciprocable tool carrier 18 through a cam follower 18a on this carrier, in such manner that suitable tools 19, herein drills, on this carrier are operated in timed relation to the other mechanisms heretofore described. Herein, as described and claimed in my co-pending application Serial No. 294,990, filed September 15, 1939, the carrier 18 also acts to control swinging stock stop means 20 carried on a sleeve 21 enclosing the sleeve 8, this stock stop means herein being swung about the axis of this sleeve into and out of stock stopping position as the carrier 18 is moved backward and forward, respectively, the reverse swinging movements being effected by a depending cam follower 22 on the sleeve 21 and which is actuated by a cam slot 23 fixed to the top of the longitudinal tool carrier between the tools thereon. Herein also, the sleeve 8 drives through the lower gear of the gearing 9 previously mentioned, a gear 24 which, in turn, through a shaft 24a operates a cam mechanism, generally indicated at 25, which operates a cross slide 26 carrying the shaping tools which cooperate with the tools 19 and 16 in acting on the stock rods fed by the feeding mechanism 4 and stopped in the desired position by the stock stop mechanism 20. Herein, however, although the gear 24 is still

rotated through one revolution for each two revolutions of the shaft 8 and cam 17, the tool arrangement on the transverse tool slide 26 and the cam mechanism 25 which forms the operating mechanism for the latter, as well as the timing of the slide 26 relative to the other mechanisms, are all improved as hereinafter described.

Referring more particularly to my improvements herein, it will be observed that two tools 27 and 28 are provided on the slide 26, each on the same side, herein the left side as viewed in Figure 2, of the work pieces carried by the different spindles 3, the other set of oppositely disposed tools on the right hand sides of the spindles, taught in my prior construction, being eliminated. Further, it will be observed that the gear 24 drives improved operating mechanism for this slide 26, herein an improved double lobed cam mechanism, generally indicated at 25. Referring more particularly to this cam mechanism 25, it will be observed that the same includes a large cam 29 which is provided with a plurality of lobes 30 of like construction and oppositely disposed, as distinguished from the single lobe cam previously used. Further, each of these lobes 30 is provided with a dwell surface 31 leading thereto and slightly shorter than the working face on the lobe. The cam 29 is rotated in the direction of the arrow shown in Figure 2. Moreover, it will be observed that this cam 29 also carries fixed thereto a smaller double lobed cam 32 which is generally diametrically disposed between the ends of the dwell surfaces 31 on different lobes 30. This cam 32 has like oppositely disposed side cam tracks or portions 33 extending throughout the length of each side thereof and having dished portions 33a at opposite ends thereof, while end portions 34 form lateral extensions of the peripheries of the extremities of the dwell surfaces 31. It will further be noted that different cooperating rollers 35 and 36 are provided in the slide 26 for cooperation with the cams 29 and 32 thus provided. Of these, the roller 35 is longer than the roller 36 and of such length as to engage both the dwell portions 31 on the cam 29 and the end portions 34 on the cam 32, while the roller 36 is so narrow as only to ride over the end portions 34 and the cam tracks 33 on the smaller cam 32.

As a result of the provision of this improved cam mechanism 25, the transverse tool slide 26 is operated in a new manner. Thus, during each revolution of the shaft 24a, each lobe 30 of the cam 29 successively engages the long roller 35, and as soon as each lobe passes out of engagement with this roller, one of the working portions 33a on the cam tracks 33 successively engages the short roller 36. As a result, the entire cam mechanism 25, comprising the cams 29 and 32, rotating continuously in a clockwise direction as shown in Figure 2, the slide 26 will be moved to the right by the engagement of the lobes 30 with the long roller 35, and to the left by the engagement of the short roller 36 with the cam portions 33a, these right and left movements thereof alternating, and the movement to the left being a relatively quick movement. Consequently, during each half revolution of the shaft 24a and cam mechanism 25, the tools 27 and 28 will be moved slowly to the right (Fig. 2) into operative engagement with the work carried by the spindles, and maintained therein until their work shaping function is completed, whereupon they will then be quickly moved out of engagement with the work and to the left to the inop-

erative position of the slide 26. Further, each cycle of operation of the slide 26 and the tools thereon 27, 28, will occur during each revolution of the shaft 8. Further, it will be evident that, by reason of the provision of the dwell surfaces 31, a dwell will be provided before the tools 27 and 28 move into cutting position.

Attention is further directed to the new timing relation between this movement of the cross slide 26 and the longitudinal tool slide 18, feeding mechanism 2, and stock stop mechanism 20. Here, it will be observed that since the shaft 24a moves through one revolution for each two revolutions of the tubular shaft 8, the slide 26 is moved to the right and back again to the left, i. e. in such manner as to move through a complete reciprocatory cycle, during forward and back movements, i. e. a complete cycle of the longitudinal tool carrier 18 and the tools 19 carried thereon. It will also be observed that the timing relation with the cut-off mechanism is such that, through the cam 10 and its associated mechanism controlling the operation of the cut-off tools 16, the latter will move down to cut off the finished work as the same is being finished by the tools 27 and 28; the work being severed after the tools 27 and 28 move to the left into the position shown in Figure 2 and the cut-off tools 16 again being raised as each lobe 30 moves clockwise from the position shown in Figure 2, to bring the tools 27 and 28 again into cutting position. Thus, for each cycle of movement of the tools 27 and 28, the cut-off tools 16 will move through a complete cycle, i. e. into cutting off position and back to inoperative position. Moreover, it will be observed that since the stock stop means 20 is also moved through a complete cycle as the carrier 18 moves through its cycle, the relationship of the movement of the transverse tool slide 26 to the stock stop means 20 and the stock feeding means 4 is such that as the tools 27 and 28 are moved during each cycle thereof, the stock rods are fed forward by the feeding mechanism 2 after each cutting-off operation of the cut-off tool 16, while the stock stop means 20 is moved into position to stop the rods at the proper point, and is then moved out of the path of the rods to permit the tools 19 on the longitudinal tool carrier 18 to function.

As the operation of the mechanism will, it is believed, be clear from the above, it is believed to be unnecessary to review the same in detail. It will, however, be observed that as a result of the new cam mechanism 25 and the new timing relation between the transverse slide 26 and the longitudinal tool carrier 18, it is made possible not only to move the transverse slide through a complete cycle for each cycle of movement of the carrier 18 and thus enable a single pair of tools to perform the function of the two pair of tools previously provided, but also to maintain the desired sequence of operation of the tool slide with all the cooperating mechanisms of the machine, despite this fundamental change in timing of the transverse tool slide. More particularly, it will be apparent that while my improved cam mechanism will operate the transverse tool slide through two complete cycles of movement thereof for each revolution of the shaft 24a, as distinguished from moving this slide through one complete cycle for each revolution of this shaft, the several other mechanisms will continue to function as before in their predetermined relation to one another, despite the fact that the longitudinal tool slide now moves through a com-

plete cycle for each cycle of movement of the transverse tool slide, as distinguished from a full cycle for each half cycle of movement of the latter, and despite the further fact that the vertical cut-off tools now move to cutting-off position once for each cycle of movement of the transverse tool slide, as distinguished from once for each half cycle of movement thereof.

As a result of my improved construction, it is made possible to halve the number of transverse tool slide tools provided, thereby substantially reducing the expense by eliminating both the tool supports and the tools. At the same time, it is made possible very materially to increase the space available for cuttings. Further, the number of tools having to be kept under the supervision of the operator is similarly halved, as well as the number of tools required to be dressed and kept in condition. Moreover, these results are obtained while enabling the same production to be maintained. Also, these results are obtained without in any way objectionably affecting the operation of any part of the machine and while maintaining the other mechanisms thereof operating as heretofore, all while requiring only simple and inexpensive changes in the transverse tool slide and its operating mechanism. These and other advantages of my improved construction will, however, be clearly apparent to those skilled in the art.

While I have in this application specifically described one embodiment which my invention may assume in practice, it will be understood that this form of the same is chosen for purposes of illustration, and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. In a machine tool, work rotating means including a spindle, longitudinally reciprocable tool carrier means having a tool operative on work in said spindle, a rotatable cam shaft having a cam reciprocating said carrier through one complete cycle of operation with each rotation thereof, tool slide means movable transversely of said spindle and likewise operative on said work, a cam shaft rotatable at half the speed of said first mentioned cam shaft, and cam means on said second mentioned cam shaft for reciprocating said transversely movable tool slide positively through one complete cycle of operation for each corresponding cycle of operation of said tool carrier means.

2. In a machine tool, work rotating means including a spindle, longitudinally reciprocable tool carrier means operative on work in said spindle, transverse tool slide means likewise operative thereon, means for actuating said transverse tool slide through a cycle of operation for each cycle of operation of said tool carrier means, and cut-off means including tool slide means movable in a direction transverse to the paths of said carrier means and transverse tool slide means and movable through a cycle of operation for each cycle of operation of said transverse tool slide means.

3. In a machine tool having a plurality of spindles, longitudinally reciprocable tool carrier means having tools thereon simultaneously cooperating with work in said spindles, a rotatable cam shaft reciprocating said carrier through one complete cycle of operation with each rotation of said shaft, tool slide means movable transversely of said spindles including a single tool for each spindle operative simultaneously on

the work in said spindles, a second cam shaft rotatable at half the speed of said first mentioned cam shaft, and cam means on said second mentioned cam shaft for reciprocating said transversely movable tool slide positively in both directions through one complete cycle of operation for each corresponding cycle of operation of said tool carrier means.

4. In a machine tool having a plurality of spindles, longitudinal tool carrier means simultaneously cooperating with work therein, transverse tool slide means including single tools on the same side of different spindles, means for moving said transverse tool slide means through a cycle of operation for each cycle of operation of said longitudinal tool carrier means, and cut-off means cooperating with the work in each spindle including tool slide means movable in a direction transverse to the paths of said carrier means and transverse tool slide means and movable through a cycle of operation for each cycle of operation of said transverse tool slide means.

5. In a machine tool, a plurality of spindles, reciprocable tool carrier means movable longitudinally of said spindles and carrying tools simultaneously cooperating with work in said spindles including a driving shaft driving said carrier means through a complete cycle of movement for each revolution of said shaft, a tool slide movable transversely of said spindles having a tool for each of said spindles, and double-lobed cam mechanism rotatable at half the speed of said driving shaft and moving said transversely movable slide positively in both directions through a cycle of operation for each cycle of operation of said longitudinal tool carrier means.

6. In a machine tool, a plurality of spindles, longitudinally reciprocable tool carrier means carrying tools simultaneously cooperating with work in said spindles, a main cam shaft driving said carrier means through one cycle of movement for each revolution thereof, a transverse tool slide having a tool for each of said spindles, double-lobed cam mechanism rotatable at half the speed of said main cam shaft and moving said transverse slide positively in both directions through one cycle of operation for each cycle of operation of said longitudinal tool carrier means, and cut-off mechanism for the work in each spindle including tool slide means movable in a direction transverse to the paths of said carrier means and transverse tool slide means and movable through one cycle of operation for each cycle of operation of said transverse tool slide means.

7. In a machine tool, a plurality of spindles, longitudinally reciprocable tool carrier means means carrying tools simultaneously cooperating with work in said spindles, a main cam shaft driving said carrier means through one cycle of movement for each revolution thereof, a transverse tool slide having single tools on the same side of the work in said spindles, double-lobed cam mechanism rotatable at half the speed of said main cam shaft and moving said transverse slide through a cycle of operation for each cycle of operation of said longitudinal tool carrier means, and work feeding mechanism movable through a cycle of operation for each cycle of operation of said transverse tool slide means.

8. In a machine tool, a tool slide having a tool thereon, and double-lobed cam mechanism operatively connected to said tool slide and including two double-lobed cams moving said slide through two complete cycles of operation for each revolution of said cam mechanism.

9. In a machine tool, a tool slide having a tool thereon, and double-lobed cam mechanism operatively connected to said tool slide and including two double-lobed cams moving said slide positively in both directions through two complete cycles of operation, for each revolution of said cam mechanism, and cooperating rollers on said slide cooperating with said cams.

10. In a machine tool, a tool slide having a tool thereon, and double-lobed cam mechanism operatively connected to said tool slide and including a double-lobed cam having each lobe thereof moving said slide positively in one direction, said mechanism also including a second double-lobed cam having its lobes intermediate the lobes on said first mentioned cam and having each lobe thereof moving said slide in the other direction, and cooperating rollers on said slide cooperating with said cams and including a long roller engaging both cams and a short roller engaging only said second mentioned cam.

11. In a machine tool, a tool slide having a tool thereon, and double-lobed cam mechanism operatively connected to said tool slide and including a cam having each lobe thereof moving said slide positively in the same direction, said mechanism also including a second double-lobed cam having its lobes intermediate the lobes on said first mentioned cam and having each lobe thereof moving said slide positively in the same direction, and cooperating rollers on said slide cooperating with said cams, said first mentioned cam constituting means for feeding said slide to the work and said second mentioned cam constituting means for returning said slide and tool to inoperative position.

12. In a machine tool, a tool slide having a tool thereon, and double-lobed cam mechanism operatively connected to said tool slide and including a double-lobed cam having each lobe thereof moving said slide positively in one direction and a second double-lobed cam having its lobes intermediate the lobes on said first-mentioned cam, and cooperating rollers on said slide cooperating with said cams, said mechanism also having dwells on said first-mentioned lobes and between working faces of the latter and working faces at the opposite ends of the lobes on said second mentioned cam.

13. In a machine tool, parallel spindles, a transverse tool slide having a single tool disposed in the same side of the work in each spindle, and a double-lobed cam mechanism below and between said spindles and said tools and operatively connected to said tool slide including two double-lobed cams and having adjacent lobes of different cams moving said slide positively through a complete cycle of operation.

14. In a machine tool, parallel spindles, a

transverse tool slide having a single tool disposed in the same side of the work in each spindle, a double-lobed cam mechanism below and between said spindles and said tools and operatively connected to said tool slide, said cam mechanism including two double-lobed cams and having adjacent lobes of different cams moving said slide through a complete cycle of operation, and longitudinally reciprocable tool carrier means having tools adapted simultaneously to operate on the work in said spindles and movable through a cycle of operation for each cycle of operation of said transverse tool slide.

15. In a machine tool, parallel spindles, a transverse tool slide having a single tool disposed in the same side of the work in each spindle, a double-lobed cam mechanism below and between said spindles and said tools and operatively connected to said tool slide, said cam mechanism including two double-lobed cams and having adjacent lobes of different cams moving said slide through a complete cycle of operation, and vertical cut-off means for the work in each of said spindles including a tool slide movable in a direction transverse to the path of movement of said transverse tool slide and movable through a complete cycle of operation for each cycle of operation of said transverse tool slide.

16. In a machine tool, parallel spindles, a transverse tool slide having a single tool disposed in the same side of the work in each spindle, a double-lobed cam mechanism below and between said spindles and said tools and operatively connected to said tool slide, said cam mechanism including two double-lobed cams and having adjacent lobes of different cams moving said slide through a complete cycle of operation, and stock feeding means for each spindle movable through a complete cycle of operation for each cycle of operation of said transverse tool slide.

17. In a machine tool, parallel spindles, a transverse tool slide having a single tool disposed in the same side of the work in each spindle, a double-lobed cam mechanism below and between said spindles and said tools and operatively connected to said tool slide, said cam mechanism including two double-lobed cams and having adjacent lobes of different cams moving said slide through a complete cycle of operation, and cooperating longitudinally reciprocable tool carrier means, vertical cut-off means, and work feeding means each cooperating with the work in said spindles and each movable through a complete cycle of operation for each cycle of operation of said transverse tool slide.

ELMER E. KELLEY.

CERTIFICATE OF CORRECTION.

Patent No. 2,255,170.

September 9, 1941.

ELMER E. KELLEY.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, second column, line 57, claim 7, strike out the word "means"; line 59, same claim, for "carirer" read --carrier--; page 4, first column, line 6, claim 9, after "operation" strike out the comma; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 28th day of October, A. D. 1941.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.