May 23, 1939. L. E. GODFRIAUX 2,159,207

MACHINE TOOL

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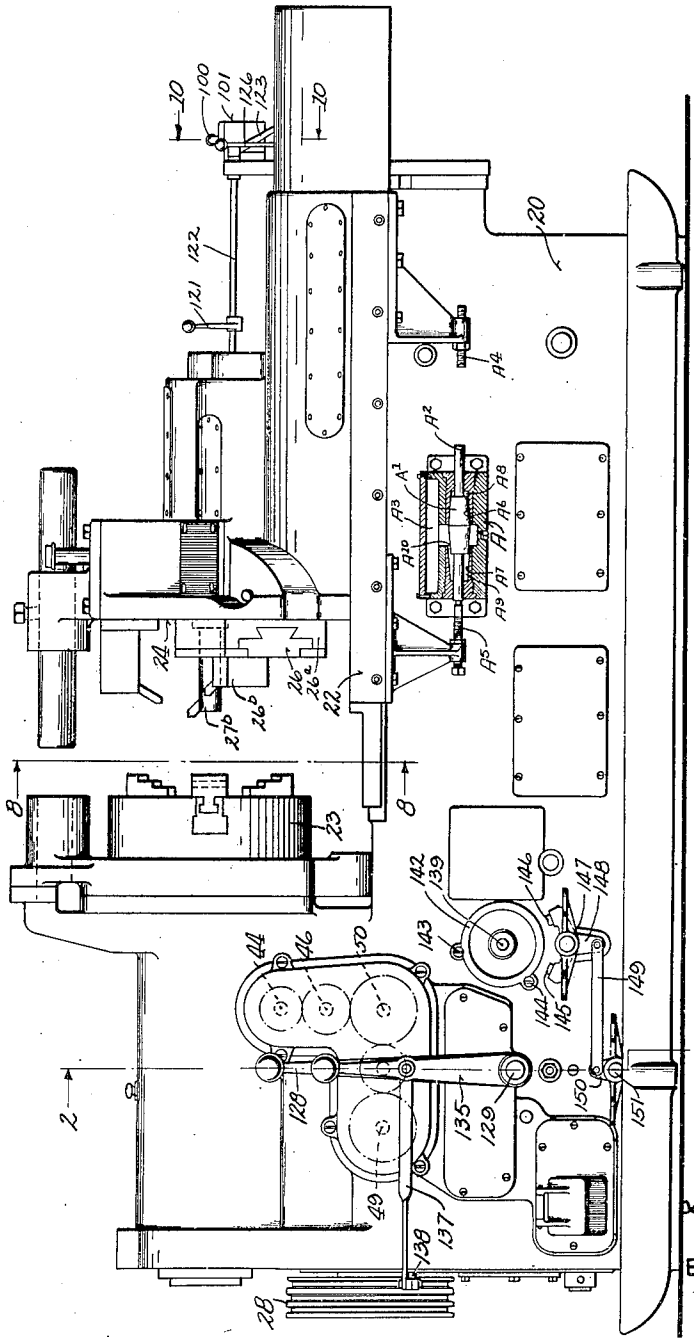

Fig. 1.

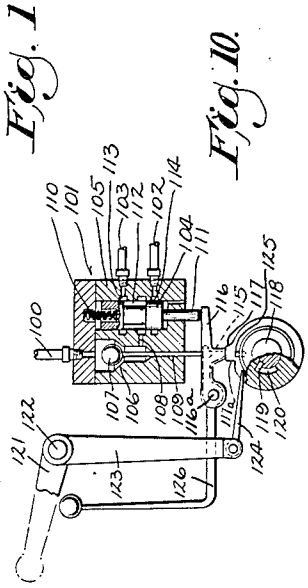

Fig. 10.

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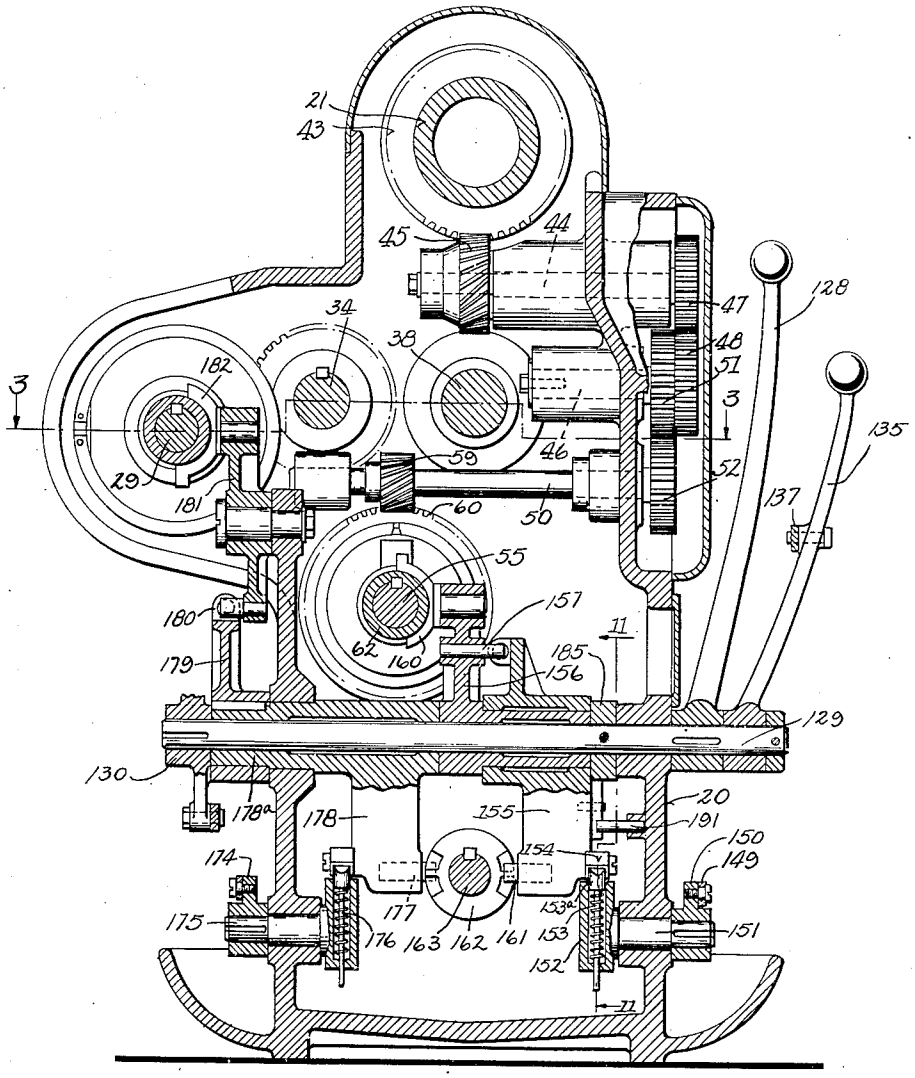

Fig. 2.

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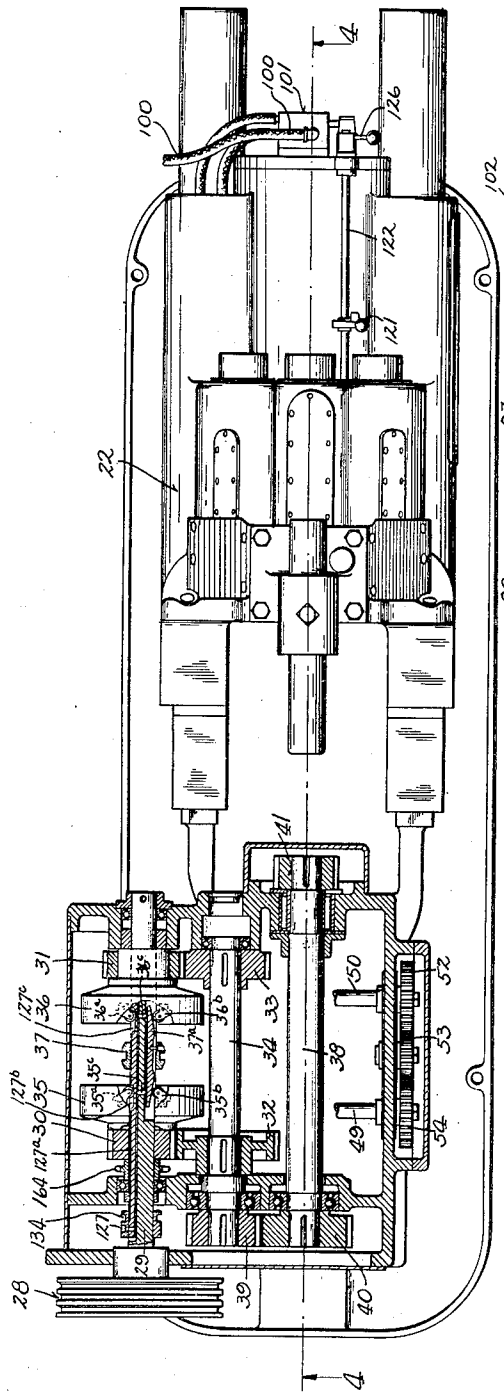

Fig. 3.

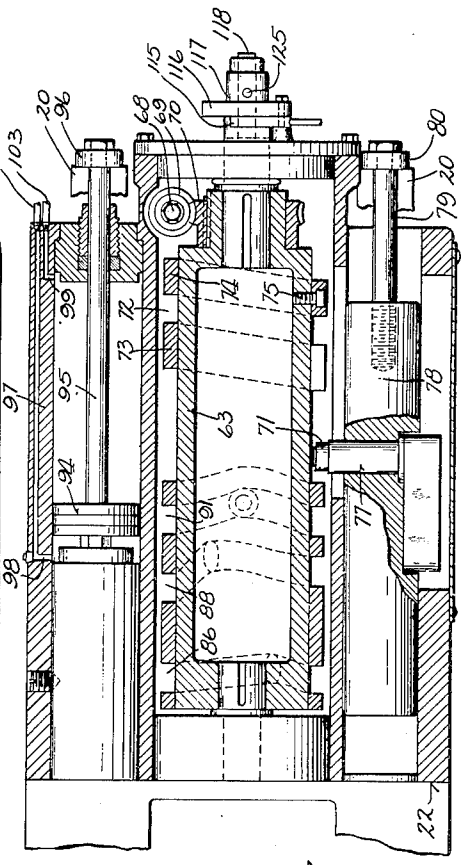

Fig. 7.

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Fig. 4.

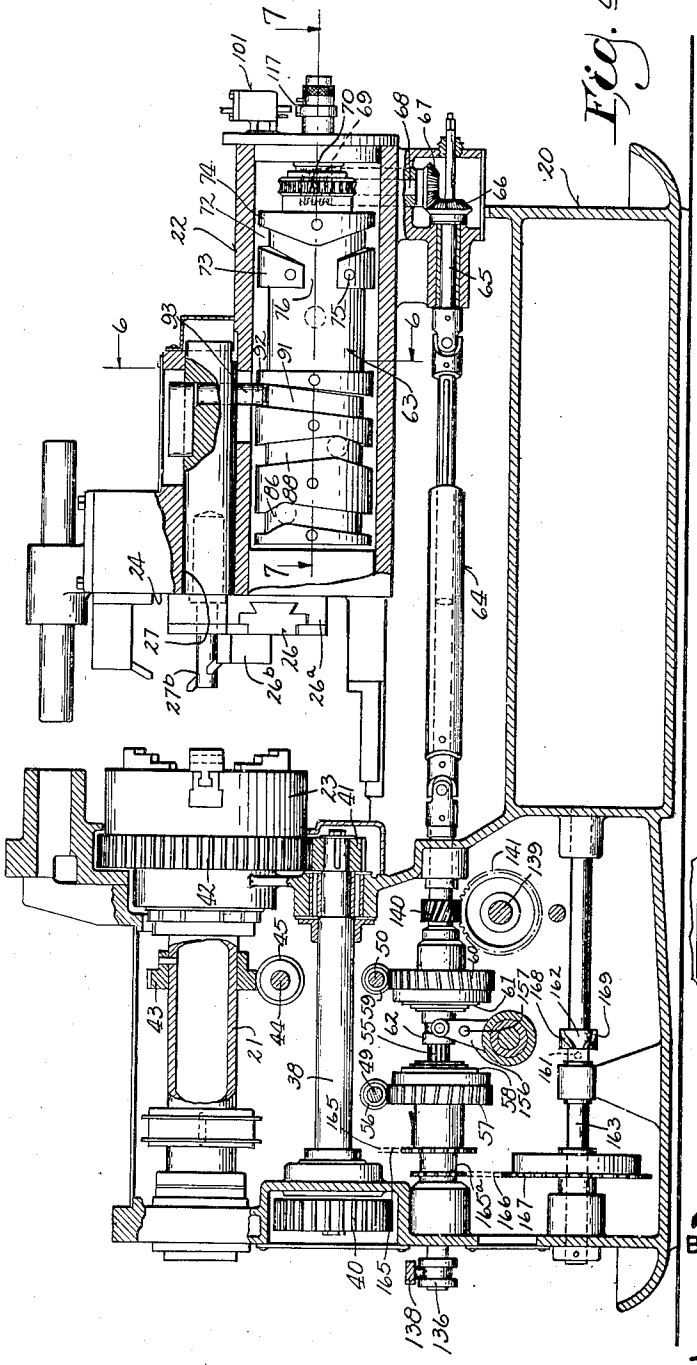
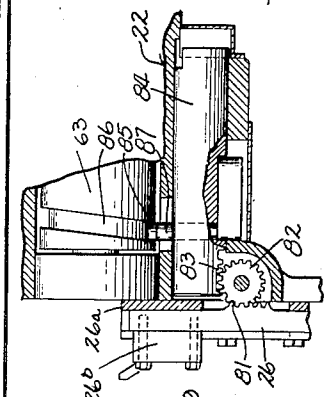


Fig. 9.



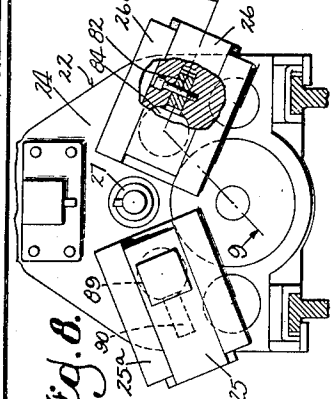


Fig. 8.

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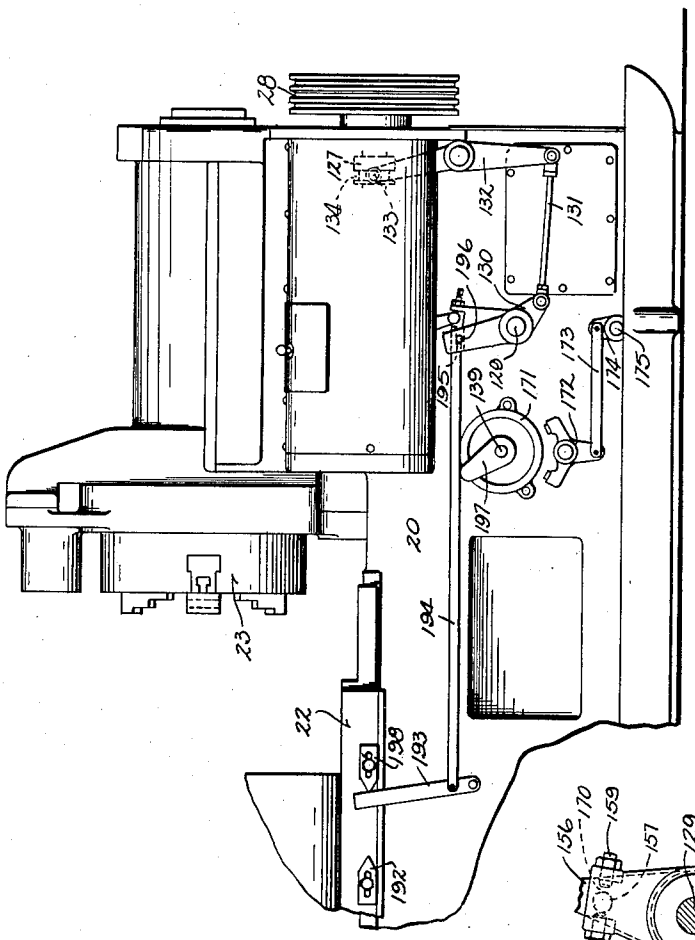

Fig. 5.

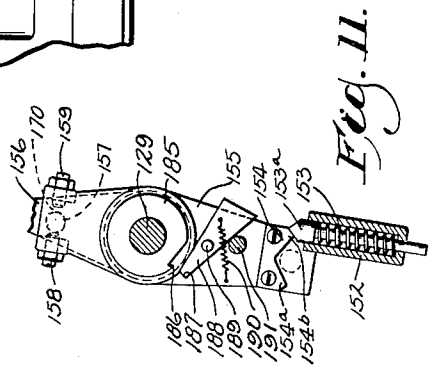

Fig. 11.

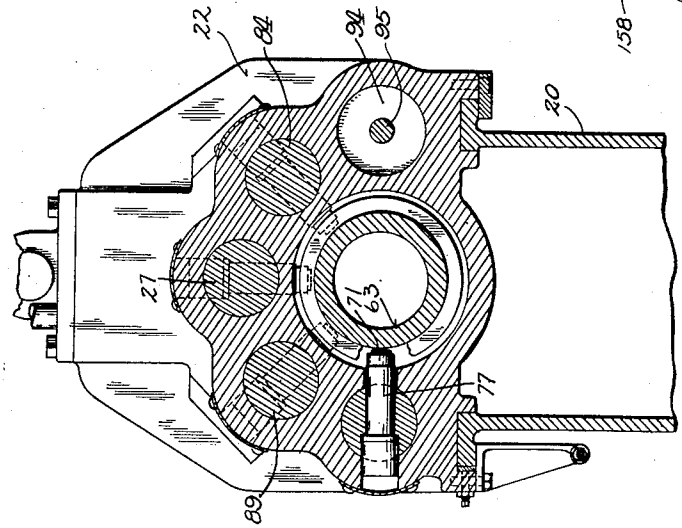

Fig. 6.

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2,159,207

UNITED STATES PATENT OFFICE

2,159,207

MACHINE TOOL

Louis Edward Godfriaux, Madison, Wis., assignor to Gisholt Machine Company, Madison, Wis., a corporation of Wisconsin

Application November 13, 1937, Serial No. 174,358

19 Claims. (Cl. 29—27)

This invention relates to machine tools, and more particularly to lathes of the type generally referred to as chucking lathes.

An object of the invention is generally to simplify and improve the construction and operation of machine tools, and especially of chucking lathes of the type shown in my former Patents No. 1,446,557, dated February 27, 1923, and No. 1,774,917, dated September 2, 1930. Other objects will be apparent to those skilled in the art from the accompanying description.

The invention consists of the construction and arrangement of parts as herein illustrated, described and claimed, and in such modification of the structure illustrated and described as may be equivalent to the structure of the claims.

Throughout the specification the same reference numerals have been applied to the same parts, and in the drawings:

Figure 1 is a front elevation of a lathe in which the invention is incorporated.

Figure 2 is a sectional elevation taken approximately along line 2—2 of Fig. 1, and enlarged.

Figure 3 is a plan view, partly in horizontal section taken approximately along line 3—3 of Fig. 2.

Figure 4 is a vertical section, taken approximately along line 4—4 of Fig. 3.

Figure 5 is a rear view of the head end of the lathe, which is the portion at the left in Fig. 1.

Figure 6 is a partial vertical section, taken approximately along line 6—6 of Fig. 4, and enlarged.

Figure 7 is a partial horizontal section, taken approximately along line 7—7 of Fig. 4, and enlarged.

Figure 8 is a partial elevation, viewed from line 8—8 of Fig. 1 and showing certain tool slides.

Figure 9 is a partial section along line 9—9 of Fig. 8.

Figure 10 is a semi-diagrammatic view of a control valve and certain operating mechanism therefor.

Figure 11 is a partial view and section taken along line 11, 11 of Fig. 2.

Referring to the drawings, a base or bed 20, Figs. 1, 4, carries a main spindle 21 rotatably journaled in the left or headstock end, and a carriage or main slide 22 suitably guided on bed 20 for reciprocatory movement parallel with the spindle axis. Spindle 21 carries a work holding chuck 23, and the carriage 22 has an end face 24 in the direction of the chuck, upon which are mounted tool slides such as 25, 26, Figs. 1, 8, 9, that are suitably guided for substantially radial reciprocatory movement in base portions, such as 25a, 26a, rigidly but removably and interchangeably fixed on end face 24. Tool slides 25, 26 may be provided with suitable tool holders, such as 26b, Fig. 9, for operating on work pieces held in chuck 23. Another tool slide 27, Fig. 4 is guided for reciprocatory movement parallel with the spindle axis and may carry various tool holders such as the boring tool holder 27b.

For the rotation of spindle 21 and chuck 23 there is provided transmission mechanism as follows: A drive pulley 28, Fig. 3, is driven from any suitable power source, such as a motor, not shown, and is fixed on a shaft 29. Rotatably mounted on shaft 29 are spaced gears 30, 31 of different diameter, respectively meshing with the gears 32, 33 fixed on a shaft 34. Associated with the different gears 30, 31 are clutches 35, 36 of any suitable construction, and alternatively operable by the shifting of a clutch spool 37 to drive the one or the other gear 30, 31 from shaft 29, whereby to drive shaft 34 at different speeds, except upon operation of certain interrupting mechanism, later described. Shaft 34 is connected to drive a shaft 38 through different diameter gears 39, 40 which are removably splined to the ends of shafts 34, 38, and may be reversed in position or replaced by other gear pairs, not shown, for effecting various changes of speed between the shafts. Shaft 38 drives spindle 21 through a pinion 41, Fig. 4, fixed on the shaft and a gear 42 fixed on the spindle. The clutches 35, 36 and the reversibly interchangeable gear pairs such as 39, 40 each provide rate change means for effecting various speeds of spindle 22 while the pulley 28 is driven at constant speed.

For the movement of the carriage 22 and of tool slides 25, 26, 27 there is provided transmission mechanism which includes the spindle transmission previously described and other transmission mechanism as follows: A helical gear 43, Figs. 2, 4, fixed on spindle 21, drives a shaft 44 through gear 45. Shaft 44 drives a shaft 46 through a rate changer comprising interchangeable and reversible gear pairs such as 47, 48 carried by the shaft ends. A pair of parallel shafts 49, 50, Figs. 3, 4, are each driven through the rate changer by a gear 51, Fig. 2, removably fixed on the shaft 46 to engage with a gear 52 on shaft 50, an idler 53 engaging gear 52, and a gear 54 removably fixed on shaft 49 and engaging the idler. The gears 52, 54, here shown of the same diameter, may be replaced by other gears having different diameters, whereby to drive shafts 49, 50 at different speeds, the idler

riage forward to cutting position by the following mechanism:

A hand lever 121, Figs. 3, 10, is fixed on a shaft 122, which has fast thereon a lever 123 carrying a pivoted latch 124. Latch 124 is normally maintained by gravity or by suitable spring means, not shown, in the position shown in Fig. 10, but upon manual movement of the hand lever 121 downwardly the latch 124 moves to the right in Fig. 10 to abut a pin 125 fixed in the hub of cam 117, whereupon the continued movement of the latch rotates the cam 117 sufficiently for the cam portion 117a to move past the complementary contact portion of the levers 115, 116 and the levers, together with the valve plungers 109, 111, move down to permit the seating of ball 107 and the movement of valve plunger 104 to its lower position. In this position of the parts the valve plunger 104 is positioned to effect the forward movement of carriage 22 to cutting position, as previously described, but so long as ball 107 remains seated no pressure fluid is available for such movement. The ball 107 may, however, be unseated by manual manipulation of a hand lever 126, Figs. 3, 10, and the carriage then immediately moves forward to cutting position.

The plurality of hand levers 121, 126 required to be manipulated in order to effect a forward movement of the carriage provides a valuable safety feature, particularly when the carriage is operated by compressed air, when the carriage movement is so rapid that if the operator had his hand between the chuck and the cutting tools he might not move quickly enough to avoid injury. The double lever control of the starting valve 101 requires both the operator's hands to be in a position, during the forward movement, where they cannot be injured.

Where the pressure fluid for movement of carriage 22 is air it is desirable to cushion the carriage at the end of the forward and reverse movement. For such purpose there is used a hydraulic cushioning device generally denoted as A, Fig. 1, which includes a piston A1 fixed on a piston rod A2 and reciprocable in a body of fluid supplied from a reservoir A3. Piston A1 moves between a right hand position, shown in Fig. 1, and a similar left hand position. For movement of piston A1 the piston rod A2 has exposed abutment ends which are respectively contacted by the adjustable abutment screws A4, A5 near the end of the fast reverse and forward movements. The piston A1, in this instance, has cone shaped ends, as shown in the drawings, which in the extreme right and left piston positions seat in complementary tapered bores A6, A7. At the start of the piston movement in either direction there is little resistance to the movement since the fluid within the chambers such as A8, A9 may pass freely out through comparatively large passageway such as A10, but as the piston approaches its seating position in the tapered bore the area of the passageway is decreased in such manner that the carriage movement is arrested without shock.

The shifter spool 37, Fig. 3, and spool 62, Fig. 4, are primarily for the alternative power engagement respectively of the clutch pairs 35, 36 and 58, 61, and each of these spools are normally in the one or the other clutch engaging position, as will be later explained, but there is, in addition, manual means for alternatively engaging or disengaging the clutches of either pair, irrespective of which clutch of the pair may be engaged.

For the clutch pair 35, 36 the means for manual engagement or disengagement is as follows: Referring to Figs. 3, 5, a shifter spool 127 is connected for shifting movement with a cam or operating bar 127a, which is housed in a suitable slot in the shaft 29 and extends to provide recesses 127b, 127c respectively for the roller ends of pivoted clutch levers, such as 35a, 36a, of the different clutches. The clutch spool 37 is connected for shifting movement with a cam or operating bar 37a which has wedge or cam shaped opposite ends respectively cooperative with pivoted clutch levers 35b, 36b. Interposed between the cam bar 127a and the respective ends of the cam bar 37a there are transversely slidable pressure transmitting or equalizing pins 35c, 36c. When the clutch spool 37 is shifted to the left in Fig. 3 the combined dimensions of the cam bar 37a, equalizing pin 35c and cam bar 127b are sufficient to outwardly pivot the clutch levers 35a, 35b sufficiently to engage the clutch 35, but only if the cam bar 127a has been shifted by shifter spool 127 to a position where the roller end of the lever 35a does not engage in the recess 127b. Similarly the clutch 36 may be engaged by a right hand movement, Fig. 3 of the shifter spool 37, but only if the shifter spool 127 has been shifted to a position where the roller end of lever 36a does not engage in the recess 127c. The recesses 127b, 127c are so spaced as to be simultaneously engaged or disengaged with the roller ends of their respective clutch levers 35a, 36a, and by the described construction it results that in one axial position of spool 127 the clutches 35, 36 may be respectively engaged in the left and right positions of spool 37, while another axial position of spool 127 neither of the clutches 35, 36 are engaged, whereby the transmission to the spindle 21 and the feed drum 63 is interrupted. Clutch spool 127 may be manually shifted to effect such alternative interruption or engagement of clutches 35, 36 by the means of a hand lever 128, Fig. 2, fixed on shaft 129, Figs. 2, 5, a lever 130, a pivoted connecting rod 131, a pivoted lever 132 and a member 133 engaging an annular groove 134 in the clutch spool 127.

For the clutch pair 58, 61, Fig. 4, the means for the manual engagement or disengagement of the clutches is similar to that just described, and therefore will not be described in detail. The manual operating lever for this clutch pair is the lever 135, Figs. 1, 2, which is rotatably supported on shaft 129 and connected for the shifting of a shifter spool 136, Fig. 4, by the means of a pivoted connecting rod 137 and a pivoted lever 138, Figs. 1, 4, the lever 138 having a dependent portion engaging an annular groove in the spool 136. Shifter spools 136 and 62, Fig. 4 are provided with cam or operating bars and associated mechanism, not shown, operatively the same as that previously described for the clutch spools 127, 37 whereby the manual shifting of clutch spool 136 will alternatively interrupt or engage the clutches 58, 61 irrespective of the position of clutch engagement of spool 62.

Control mechanism is provided for the alternative power engagement of the clutch pair 35, 36, Fig. 3, and also of the clutch pair 58, 61, Fig. 4, at selected points in the rotation of feed drum 63. The mechanism includes a control drum shaft 139, Figs. 1, 4, 5, transversely underlying the shaft 55 and connected to be driven therefrom through the spiral gears 140, 141, the ratio of the gearing being such that one revolution

of the drum shaft 139 takes place during one revolution of the feed drum 63. At its front end the control drum shaft 139 has fixed thereon a control drum 142, Fig. 1, having dogs such as 143, 144 adjustably arranged around its periphery and axially offset to travel in different paths to respectively shift similarly offset dog contact portions 145, 146 on a pivoted lever 147 having a dependent arm 148 connected by a pivoted rod 149 to a lever 150 fixed on a shaft 151, Figs. 1, 2. Shaft 151 has a head portion 152 carrying a spring pressed plunger 153, Figs. 2, 11, having an end 153a acting against a cam or detent 154, fixed on a pivoted lever 155 and providing a plurality of point portions 154a, 154b. The lever 155 is connected for movement with another pivoted lever 156, Figs. 2, 11, by the means of an abutment pin 157 and adjustable abutment screws 158, 159, the lever 156 being connected for movement of the clutch spool 62, Figs. 2, 4, by a pivoted fork member 160 engaging a suitable annular groove in the spool 62.

The lever 155 also carries a shifter pin 161, Figs. 2, 4, which may be operated by the dogs 143, 144 through the connections described to engage a clutch shifter cam member 162, Figs. 2, 4 fixed on a shaft 163 which is continuously driven from the main drive shaft 29, Fig. 3 through a sprocket 164, a chain 165, Fig. 4, a double sprocket 165a loose on the shaft 55, a chain 166 and a sprocket 167 fixed on shaft 163. The cam 162 has two sets of spiral grooves, each set consisting of two oppositely angular grooves such as the grooves 168, 169, Fig. 4. When the clutch shifter spool 62 is in the position engaging the clutch 61, the shifter pin 161 stands in a position slightly separated from cam 162, at the left thereof, as is indicated in Fig. 4, and the plunger 153a, Figs. 2, 11, stands outside the right hand point 154a of the cam 154, as shown in Fig. 11, the abutment screws 158, 159 being so adjusted that at this time there is lost motion between the abutment screw 159 and the pin 157 as indicated at 170. At this time, also, the detent cam 154 and plunger 153 have operated to rotate the connecting parts slightly whereby to move the dog abutment portion 146, Fig. 1, upwardly from the position there shown into the path of one of the dogs 143, 144. If the machine operation requires the shifting of clutch spool 62, Fig. 4 to engage clutch 58 instead of clutch 61, one of the dogs is used to shift the upwardly displaced dog abutment portion 146 downward whereby to rotate shaft 151 sufficiently for the point of the plunger 153 to move to the other side of the cam point 154b and the lost motion 170 then permits the cam 154 to quickly shift the lever 155 sufficiently for the pin 161 to enter one of the spiral grooves 168, 169 in the shifter cam 162. The shifter cam then continues the movement of lever 155 to disengage the clutch 61 and to engage the clutch 58, at which time the various parts will be then positioned for a similar power shifting in the other direction to be initiated at any desired time in the machine cycle by the other dog 143, 144, operating on the other dog abutment 145 to again disengage clutch 58 and engage clutch 61. By the means of dogs such as 143, 144, suitably positioned, clutches 58, 61 can be alternatively engaged at any point in the cycle of operation of feed drum 63.

The mechanism for alternative power engagement of the clutches 35, 36 at any time in the machine cycle is similar to that just described, there being for this purpose another dog drum 171, Fig. 5, fixed at the rear end of shaft 139 and operative through a lever 172, rod 173, lever 174 and shaft 175 to shift a detent plunger 176, Fig. 2, whereby to cause engagement of a shifter pin 177 with one of the cam grooves in the shifter cam 162, the pin 177 being carried on a lever 178 having a hub 178a upon which is fixed a lever 179 having a lost motion connection at 180 with a clutch lever 181 carrying a pivoted shifter fork 182 engaging a suitable annular groove in the clutch shifter spool 37, Figs. 2, 3.

The power shifter mechanism described for the shifting of the clutch pair 58, 61 is also utilized for the shifting of the clutch spool 127 to disengage the clutch pair 35, 36 whereby to stop rotation of spindle 21 and of the feed drum 63 upon completion of the operating cycle, that is to say at the completion of each revolution of the feed drum 63. The mechanism is as follows: A collar 185, Figs. 2, 11, is fixed on the shaft 129, which is connected for shifting the shifter spool 127 by the mechanism previously described. Collar 185 has a portion cut away to provide an abutment 186 which may be engaged by an abutment 187 on a pivoted latch or dog 188 carried on a pivot pin 189 which is fixed in the lever 155. Latch 188 is normally urged by a spring 190 to a position where abutments 186, 187 will engage and rotate shaft 129, whereby to shift clutch spool 127 to disengage the clutch pair 35, 36, during any clockwise rotation, Fig. 11, of the lever 155, such as is effected by the power shifter cam 162, Fig. 4, as previously described, during the dog controlled shifting of clutch spool 62 to a position to engage the clutch 61. The dogs on the control drum 142, Fig. 1, are set to effect the disengagement of clutches 35, 36, as just described, whereby to interrupt the spindle and drum transmission, at substantially the same time that the cam 117, Fig. 10, has rotated to the position where valve 101 is operative to return the carriage 22 to the loading position, as previously described, thereby completing the operating cycle of the machine.

It is desirable that, after the disengagement of clutch pair 35, 36, as just described, the abutment 186, Fig. 11 should be disengaged from the abutment 187, whereby the clutch pair 35, 36 may be again engaged by the reverse movement of shaft 129 without disturbing the engagement of clutch 61 as, for instance, for starting a new machine cycle, as later described, or during the setting up of the machine. To effect such disengagement of the abutments there is provided a pin 191, Figs. 2, 11, which is fixed with bed 20 to engage the latch 189 and turn it to the abutment disengaging position shown in Fig. 11.

The fast forward movement of carriage 22 to cutting position at the beginning of each operating cycle, as previously described, also shifts the spool 127 to the position engaging one or the other of cluthes 35, 36, according to which of these clutches was engaged at the end of the preceding cycle. For this purpose there is provided a dog 192, Fig. 5, adjustably fixed on carriage 22 and adapted, during forward movement of the carriage, to shift a pivoted lever 193, and thereby shift spool 127 through a pivoted rod 194, an abutment 195 and an abutment pin 196 fixed in the lever 130, which is connected to the spool 127 through the mechanism previously described. It is necessary to subsequently disengage abutment 195 from pin 196 in order that the spool 127 can be shifted, as previously de-

scribed, for clutch disengagement at the end of the operating cycle. For such disengagement there is provided a cam member 197, Fig. 5, rotatable with the dog drum 171 and adapted to lift the rod 194 sufficiently for such disengagement. If desired the cam 197 may be formed to disengage the abutment 195 immediately following the start of the operating cycle and to maintain such disengagement throughout the cycle, whereby the clutch spool 127 may be manually shifted by the hand lever 128 to interrupt the cycle at any point. A dog 198 adjustably fixed on carriage 22, shifts the lever 193 in the reverse direction during the return of the carriage to loading position to insure that the rod 194 is positioned to effect an operative position of the abutment 195 and pin 196 at the next forward movement of the carriage.

In the operation of the machine, assuming that the feed drum 63 is in the position shown in Fig. 4, and the carriage 22 is in its rear or loading position, which are the positions of these parts at the end of a cycle of machine movement, a new cycle is started by manually moving both the levers 121, 126, Fig. 3, downwardly, thereby admitting pressure fluid through valve 101 to quickly move the carriage 22 forward to working position, as previously described. During such movement the carriage dog 192 engages one of the clutches 35 or 36 and starts the rotation of the spindle 21 and of feed drum 63, and feed cam slot 72 then assumes control of the position of the carriage, giving to it such forward or reverse movement or dwell as may be necessary to the work piece being machined. During the feed drum rotation the cam grooves 86, 88, 91 similarly control the movement of tool slides 25, 26, 27. The time required for the rotation of the feed drum is determined by the setting of the various rate changers in the spindle and feed drum trains, but in any setting of the rate changers the clutch control drums 142, 171 will make one revolution during one revolution of the feed drum 63. At the completion of the rotation of feed drum 63 the control cam 117 for valve 101 operates the valve to quickly move the carriage back to loading position, and at the same time one of the dogs 143, 144 on dog drum 142 operates to disengage the clutches 35, 36 to stop the rotation of the spindle and feed drum. This completes the operating cycle of the machine.

What is claimed is:

1. In a lathe having a carriage reciprocable between loading and cutting positions and a reciprocable cross slide member carried thereon, the combination of a rotatable cam drum connected for movement of said cross slide member, a transmission for rotation of said drum, a power train for said carriage movement, manually operable control means for connection of said power train to effect carriage movement to said cutting position and substantially simultaneously to connect said drum transmission, and control means subsequently operative at a predetermined point in the rotation of said drum to connect said carriage train to effect carriage movement to said loading position and substantially simultaneously to disconect said drum transmission.

2. In a lathe having a carriage reciprocable between loading and cutting positions and a reciprocable cross slide member carried thereon, the combination of a rotatable cam drum connected for movement of said cross slide member, a transmission for rotation of said drum, a power train for said carriage movement, manually operable control means for conection of said power train to effect carriage movement to said cutting position and substantially simultaneously to connect said drum transmission, control means subsequently operative at a predetermined point in the rotation of said drum to connect said carriage train to effect carriage movement to said loading position and substantially simultaneously to disconnect said drum transmission, said manually operable control means including two spaced hand levers requiring simultaneous displacement for the connection of the power train.

3. In a lathe having a rotatable work spindle, a carriage reciprocable between loading and cutting positions, and a tool slide member reciprocable on said carriage, the combination of a rotatable cam drum connected for reciprocation of said slide member, a transmission for rotation of said spindle and drum including a clutch having engaged and disengaged positions, a power train for said carriage movement, manually operable control means for connection of said power train to effect carriage movement to said cutting position and to substantially simultaneously shift said clutch to engaged position, and control means subsequently operative at a predetermined point in the rotation of said drum to connect said power train to effect carriage movement to said loading position and to substantially simultaneously shift said clutch to disengaged position.

4. In a lathe having a rotatable work spindle, a carriage reciprocable between loading and cutting positions, and a tool slide member reciprocable on said carriage, the combination of a rotatable cam drum connected for reciprocation of said slide member, a transmission for rotation of said spindle and drum including a clutch having engaged and disengaged positions, a power train for said carriage movement, manually operable control means for connection of said power train to effect carriage movement to said cutting position and to substantially simultaneously shift said clutch to engaged position, and control means subsequently operative at a predetermined point in the rotation of said drum to connect said power train to effect carriage movement to said loading position and to substantially simultaneously shift said clutch to disengaged position, said manually operable control means including two spaced hand levers and connections requiring simultaneous displacement of said levers for the connection of the power train.

5. In a lathe having a rotatable spindle the combination of a carriage reciprocable in a path parallel to the spindle axis and having an end face in the direction of said spindle and transverse to the spindle axis, a cross slide unit removably fixed on said end face and including a reciprocable cross slide member and a driving member therefor, a complementary driving member on said carriage, said driving members being adapted for driving engagement during replacement of said unit following removal thereof, and transmission mechanism for rotation of said spindle and actuation of said complementary driving member.

6. In a lathe having a rotatable spindle the combination of a carriage reciprocable in a path parallel to the spindle axis and having an end face in the direction of said spindle and transverse to the spindle axis, a cross slide unit removably fixed on said end face and including a reciprocable cross slide member and a driving

member therefor, a complementary driving member on said carriage, said driving members being adapted for driving engagement during replacement of said unit following removal thereof, and transmission mechanism for rotation of said spindle and actuation of said complementary driving member, said transmission including cam means carried by said carriage for bodily reciprocation therewith.

7. In a machine tool having a movable support, the combination of transmission mechanism for movement of said support at a feed rate, power means for relatively fast movement of said support, and fluid cushioning means operative only for said relatively fast movement including a cylinder, a piston relatively reciprocable therein, and means altering the resistance to displacement of fluid in said cylinder in accordance with a change in the relative position of said cylinder and piston.

8. In a machine tool having a movable support, the combination of transmission mechanism for movement of said support at a feed rate, power means for relatively fast movement of said support in either of opposite directions between spaced positions, and fluid cushioning means operative only for said relatively fast movement including piston and cylinder means operative in each of said directions to cushion the support upon approach thereof to the spaced position for the corresponding direction.

9. In a machine tool having a base, a rotatable spindle and a reciprocable support, the combination of a rotatable feed cam drum, a transmission including main clutch means in serial driving relation with both said spindle and feed drum and shiftable to engaged and motion interrupting positions, a power train for relatively fast movement of said support in either direction exclusive of said clutch means, and shifter mechanism operable upon support movement from said power train for shifting said clutch means from one to the other of said positions.

10. In a lathe having a base, a rotatable work spindle and a reciprocable tool carriage, the combination of a rotatable feed cam drum, a transmission for rotation of said spindle and cam drum including a clutch shiftable to engaged and motion interrupting positions, a slide reciprocably carried by said carriage, a power train for movement of said slide including cam means rotatable with said feed drum, a power train for relatively fast movement of said carriage exclusive of said clutch, and shifter mechanism operable upon carriage movement from said power train for shifting said clutch from the one to the other of said positions.

11. In a lathe having a rotatable work spindle and a reciprocable tool carriage, the combination of a feed cam drum rotatably supported on said carriage, a transmission including main clutch means in serial driving relation with both said spindle and drum and shiftable to engaged and motion interrupting positions, a power train for relatively fast movement of said carriage exclusive of said clutch means, and shifter mechanism operable upon carriage movement from said power train for shifting said clutch means from the one to the other of said positions.

12. In a machine tool providing a tool support and a work support relatively reciprocable between loading and operating positions, the combination of a feed rate train for said relative support movement, a power train for relatively fast relative movement of said supports from said loading to operating position, and control means for connecting said power train including two hand levers, said control means requiring simultaneous displacement of said levers to connect said train.

13. In a lathe the combination of a bed, a carriage reciprocably carried by said bed and providing an end face in a plane transverse to the path of said reciprocatory movement, a plurality of cross slide units removably fixed on said end face and each providing a cross slide member reciprocable in a path transverse to the path of carriage movement, a rotatable cam drum axially parallel to the path of carriage movement, a plurality of cams on said drum and respectively connected for movement of different of said cross slide members, power means for rotation of said drum, and means for interruption of said power means at a predetermined point in the drum rotation.

14. In a lathe the combination of a bed, a carriage reciprocably carried by said bed and providing an end face in a plane transverse to the path of said reciprocatory movement, a cross slide unit removably fixed on said end face and providing a cross slide member reciprocable in a path transverse to the path of carriage movement, a rotatable cam drum axially parallel to the path of carriage movement, a cam on said drum and connected for movement of said cross slide member, a transmission for rotation of said drum, a power train for movement of said carriage between loading and operating positions, means for interruption of said transmission at a predetermined point in the rotation of said drum, and means for subsequently reconnecting said transmission during carriage movement between said positions.

15. In a lathe the combination of a bed, a carriage reciprocably carried by said bed and providing an end face in a plane transverse to the path of said reciprocatory movement, a cross slide unit removably fixed on said end face and providing a cross slide member reciprocable in a path transverse to the path of carriage movement, a rotatable cam drum axially parallel to the path of carriage movement, a cam on said drum and connected for movement of said cross slide member, a transmission for rotation of said drum, a power train for relatively fast movement of said carriage between loading and operating positions, manually operable control means for connection of said power train to effect carriage movement to said operating position and to substantially simultaneously connect said transmission for rotation of said drum, and control means operative at a predetermined point in the rotation of said drum for connection of said power train to effect carriage movement to said loading position and to substantially simultaneously disconnect said transmission.

16. In a lathe having a rotatable work spindle the combination of a carriage reciprocable in a path parallel with the spindle axis, a slide member movable on said carriage in a path transverse to said axis, a cam drum rotatably mounted on said carriage, a plurality of cams on said drum and respectively connected for carriage movement in said parallel path and for member movement in said transverse path, transmission mechanism for rotation of said spindle and of said drum, and other transmission mechanism for relatively fast movement of said car-

riage in said path between spaced loading and cutting positions.

17. In a lathe having a rotatable work spindle the combination of a carriage reciprocable in a path parallel with the spindle axis, a slide member movable on said carriage in a path transverse to said axis, a cam drum rotatably mounted on said carriage, a plurality of cams on said drum and respectively coonnected for carriage movement in said parallel path and for member movement in said transverse path, transmission mechanism for rotation of said spindle and of said drum, other transmission mechanism for relatively fast movement of said carriage in said path between spaced loading and cutting positions, and control mechanism for the control of each transmission in accordance with movement derived from the other transmission.

18. In a lathe having a rotatable work spindle the combination of a tool carriage reciprocable in a path parallel to the axis of said spindle, said carriage having an end face in the direction of said spindle and in a plane substantially perpendicular to said axis, a tool carrier unit removably fixed on said end face and including a tool slide member reciprocable in a path substantially parallel to said plane, and power means for movement of said carriage and tool carrier including a tool carrier transmission portion bodily reciprocable with said carriage.

19. In a machine tool having a carriage reciprocable between loading and cutting positions, the combination of a feed rate transmission for said carriage, power means for relatively very fast movement of said carriage from said loading to said cutting position, and control means for connection of said power means including two spaced hand levers requiring simultaneous displacement to effect said connection, the spacing of said hand levers being sufficient to require operation of the levers respectively by different hands of an operator.

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