Feb. 15, 1966 J. F. PROBST 3,234,827

SAFETY INTERLOCK

Filed July 24, 1963 5 Sheets-Sheet 1

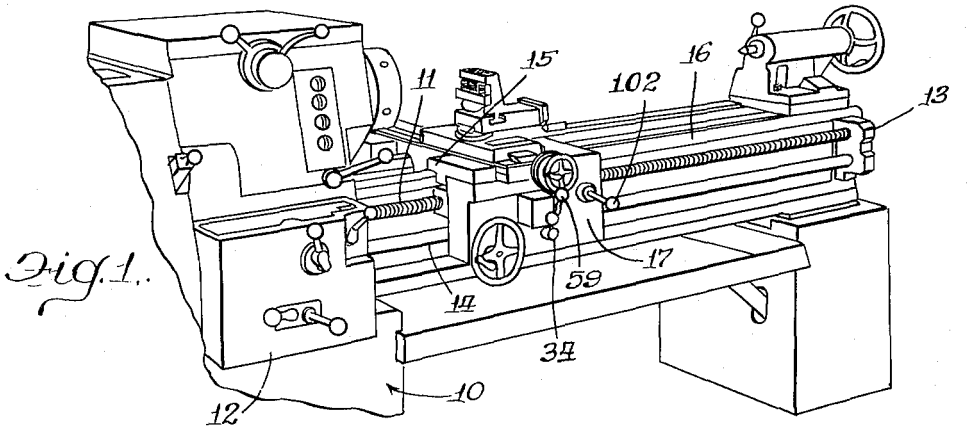

Fig. 1.

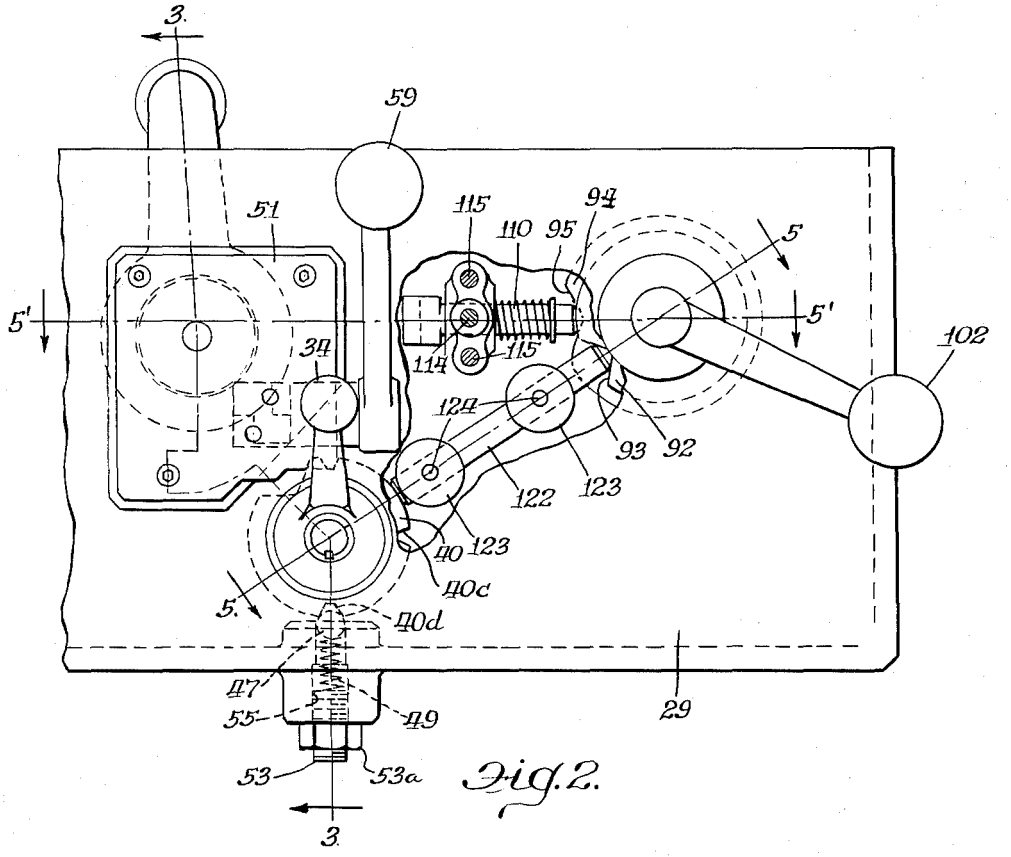

Fig. 2.

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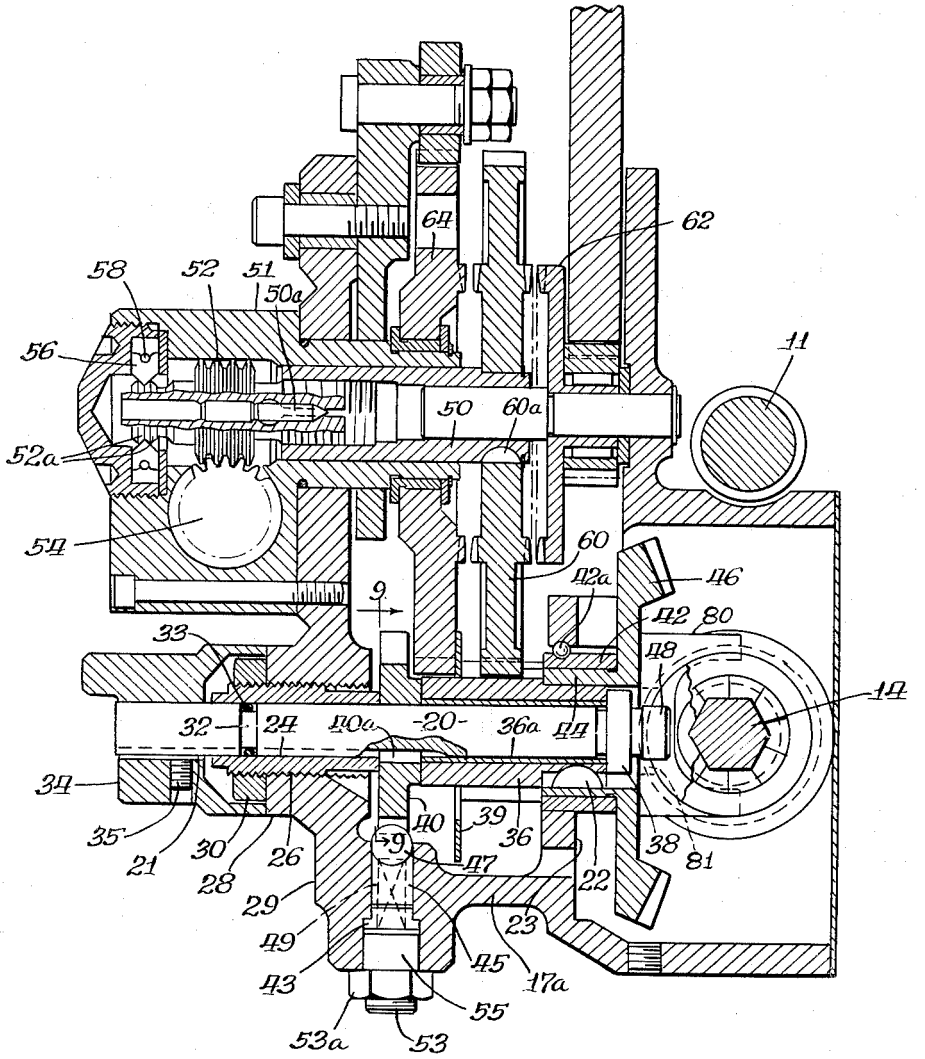
Fig. 3.



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SAFETY INTERLOCK

Filed July 24, 1963 5 Sheets-Sheet 3

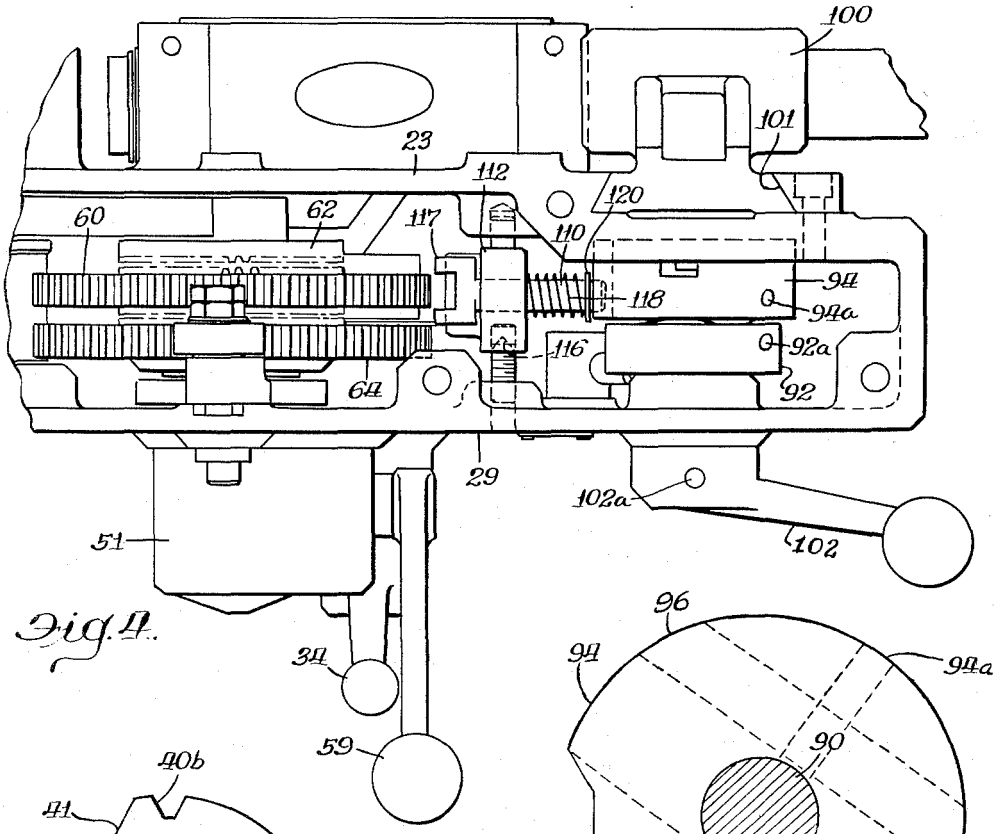

Fig. 4.

Fig. 10.

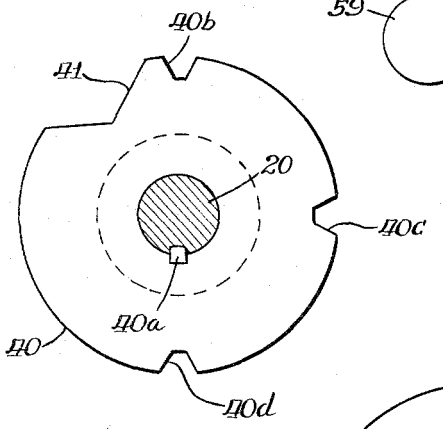

Fig. 9.

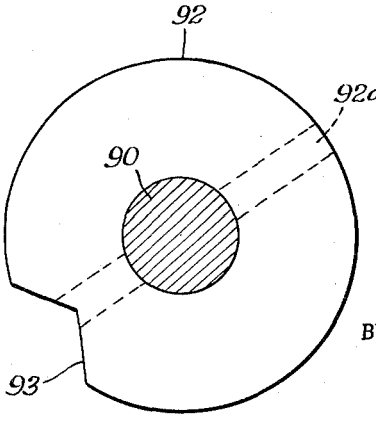

Fig. 11.

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Feb. 15, 1966 J. F. PROBST 3,234,827

SAFETY INTERLOCK

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Fig. 5.

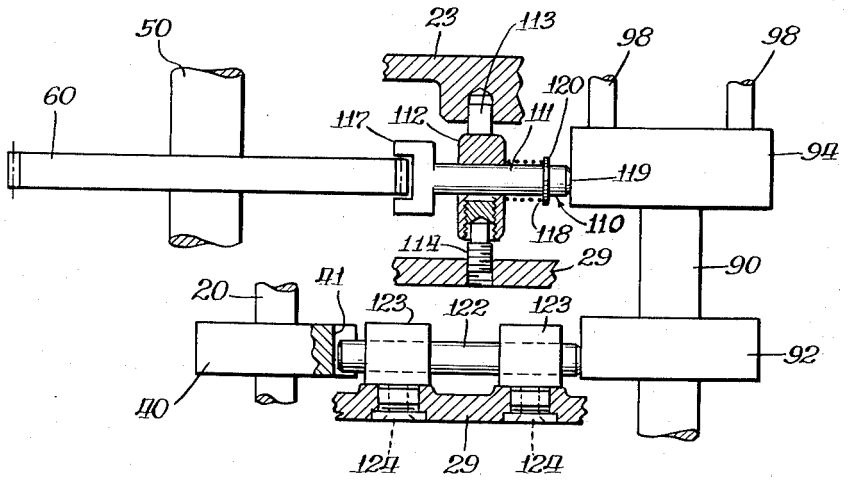
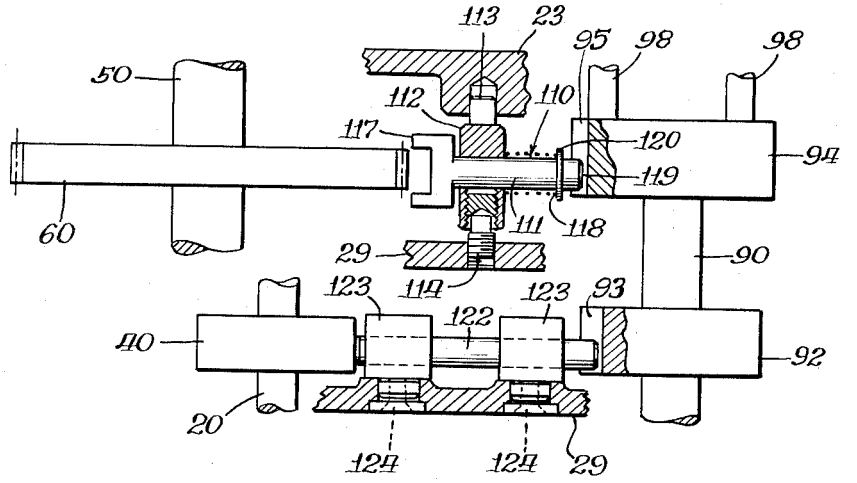


Fig. 6.



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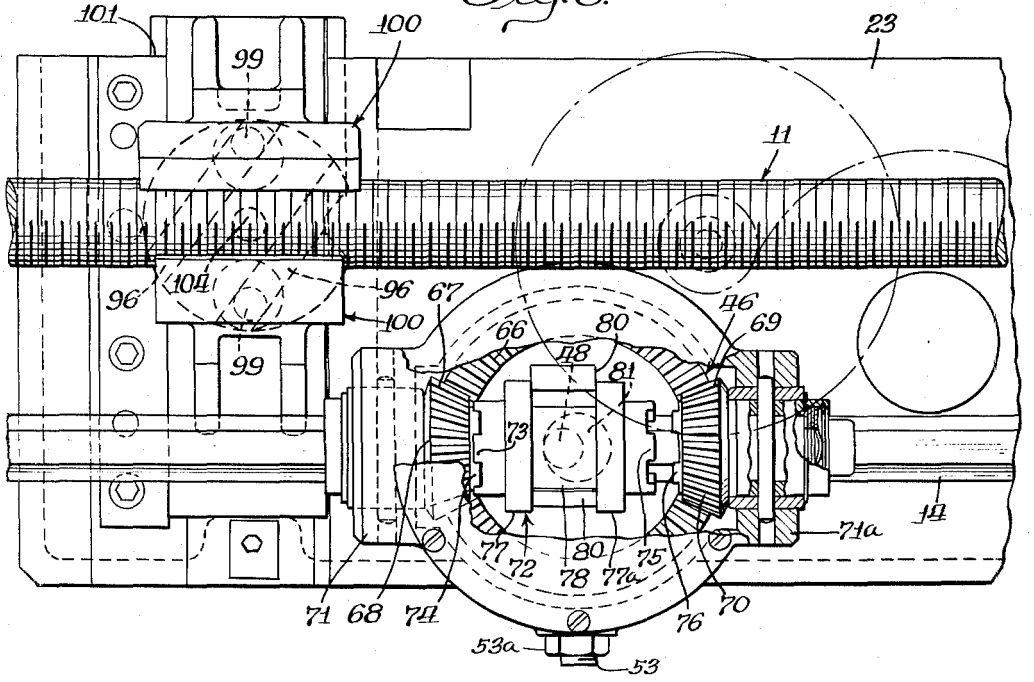
SAFETY INTERLOCK

Filed July 24, 1963 5 Sheets-Sheet 5

Fig. 8.



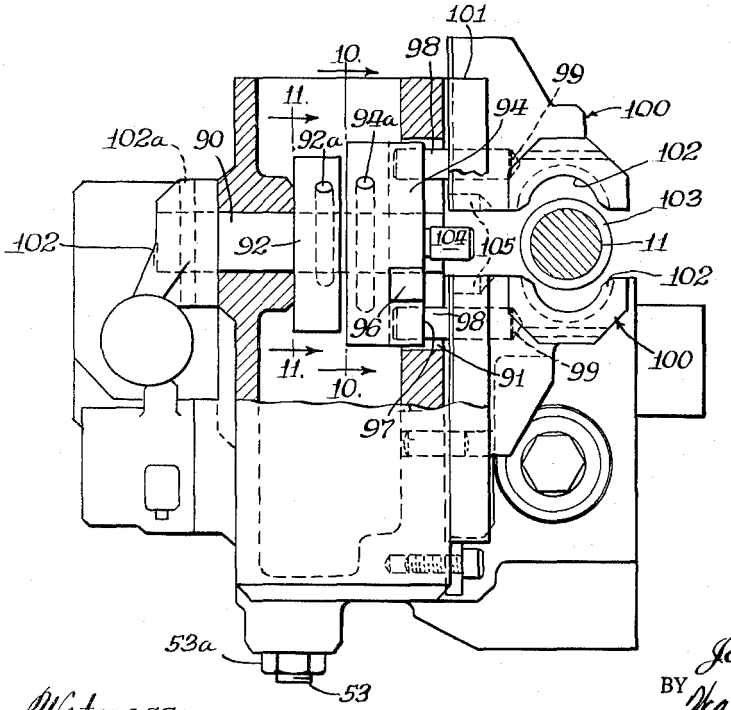


Fig. 7.

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United States Patent Office 3,234,827
Patented Feb. 15, 1966

3,234,827

SAFETY INTERLOCK

John F. Probst, South Bend, Ind., assignor to Amsted Industries Incorporated, Chicago, Ill., a corporation of New Jersey

Filed July 24, 1963, Ser. No. 297,292
7 Claims. (Cl. 82—22)

This invention relates to machine tools and more particularly to safety interlock arrangements which permit one gear actuating mechanism of a lathe apron to operate and at the same time prevent the operation of another lathe apron gear actuating mechanism.

The conventional lathe apron and carrying assembly at times employs two means of transferring motion from the gear box to the assembly so that the work tools mounted on the cross slide may be selectively moved to accomplish a desired machining operation. The primary means utilizes an hexagonal rotating feed rod extending the length of the lathe and rotated by internal gear mechanism located within the gear box. A first clutch arrangement located on the apron is releasably engageable with the feed rod and is effective to move the apron and carriage assembly along the bed of the lathe. The secondary means utilizes a threaded lead screw extending the length of the lathe and rotated by other internal gear mechanism located within the gear box. A second clutch arrangement located on the apron is releasably engageable with the lead screw and is effective to move the apron and carriage assembly along the bed of the lathe.

Obviously, it is necessary that the feed rod clutch be prevented from transferring motion to the apron from the feed rod when the lead screw clutch is engaged with the lead screw. Conversely, it is necessary to prevent the lead screw clutch from engaging the lead screw when the feed rod clutch is transferring motion from the feed rod.

It is therefore necessary to provide a safety interlock arrangement in order to prevent engagement of the feed rod clutch while the lead screw clutch is engaged and to prevent engagement of the lead screw clutch while the feed rod is engaged.

In the past it has been common practice to employ various cam and lever arrangements to accomplish this purpose. However, such attempts have failed to provide a satisfactory solution to the problem and have been slow acting, undependable and generally expensive to maintain.

Accordingly, it is an object of this invention to provide interconnected mechanism that alternately and optionally prevent operation of one power transfer arrangement while simultaneously permitting operation of another power transfer arrangement.

An additional object of this invention is to provide mechanism that will prevent engagement of a feed rod clutch with a pinion driving gear when a lead screw clutch is engaged with a lead screw.

A further object of this invention is to provide mechanism that will prevent engagement of a lead screw clutch with a lead screw when a feed rod clutch is engaged with a pinion driving gear.

A still further object of this invention is to provide a safety interlock arrangement that positively prevents a feed selector gear from engaging optionally selected driven gears while a lead screw clutch is engaged with a lead screw.

An additional object of this invention is to provide a safety interlock arrangement that positively prevents a lead screw clutch from engaging a lead screw while a feed selector gear is engaged with an optionally selected driven gear.

A further object of this invention is to provide a safety interlock arrangement that simultaneously prevents a feed rod clutch from engaging a pinion driving gear and a feed gear from engaging optionally selected driven gears while a lead screw clutch is engaged with a lead screw.

An additional object of this invention is to provide a safety interlock arrangement that simultaneously prevents a lead screw clutch from engaging a lead screw while a feed rod clutch is engaged with a pinion driving gear and a feed gear is engaged with an optionally selected driven gear.

Other objects and advantages of this invention will become apparent when reference is made to the following written description considered in conjunction with the accompanying drawings wherein:

FIGURE 1 is a fragmentary perspective view of a lathe showing the lead screw and feed rod extending from the gear box to the tail end, and with an apron and carriage assembly positioned on the bed;

FIGURE 2 is a fragmentary, partly sectional front view of the apron, showing portions of the interlock mechanism;

FIGURE 3 is a sectional view taken along line **3—3** of FIGURE 2 showing the operating shaft that receives motion from the feed rod and in turn transfers motion to other internal mechanism of the apron;

FIGURE 4 is a top plan view of the lathe apron with its cover removed showing the relative positions of the feed selector gear and the half nut cam shaft assembly;

FIGURE 5 is a combined sectional view taken along lines **5—5** and **5'—5'** of FIGURE 2 showing the feed reverse shaft and feed selector gear locked in non-operable positions, and the half nut cam shaft in operable position;

FIGURE 6 is essentially the same view as FIGURE 5, but showing the feed reverse shaft and feed selector gear in operable positions, and the half nut cam shaft in non-operable position;

FIGURE 7 is a side elevational view of the apron, partly in section, showing the half nut cam and half nut interlock disk assembled on the half nut cam shaft;

FIGURE 8 is an elevational view of the back of the apron illustrating the half nut clutch means for engaging the lead screw and the feed reverse clutch yoke for transferring motion from the feed rod to a pinion driving gear;

FIGURE 9 is a view taken along line **9—9** of FIGURE 3 showing circumferential detail of the feed interlock disk;

FIGURE 10 is a view taken along **10—10** of FIGURE 7 showing circumferential detail of the half nut cam; and

FIGURE 11 is a view taken along line **11—11** of FIGURE 7 showing circumferential detail of the half nut interlock disk.

Referring to FIGURE 1, a lead screw **11** is journaled at one end in a gear box **12** secured near the head end of a lathe indicated generally at **10**. The lead screw seletively receives rotative motion from an internal power source (not shown) through a conventional geared arrangement located within the gear box. The other end of the lead screw is journaled in a support bracket **13** secured near the tail end of the lathe. A feed rod **14** is journaled at one of its ends in the gear box **12** and selectively receives rotative motion from said internal power source through another conventional geared arrangement located within the gear box. The other end of the feed rod is journaled in a lower portion of the support bracket **13**.

A carriage **15** is supported in slideable contact by a bed **16** of the lathe. An apron **17** depends from the carriage and is disposed to move therewith. The apron has located thereon two clutch arrangements, hereinafter described, one for selectively engaging a feed rod pinion driving gear, the other for selectively engaging the lead screw. Whenever the feed rod or lead screw is engaged by its respective clutch arrangement, motion may be transferred to the apron and carriage to move this as-

sembly longitudinally of the lathe along the ways of the bed.

Referring to FIGURE 3, an operating shaft 20 has its inner end extending through an opening of a back wall 23 of the apron 17. The outer end of the shaft 20 is journaled in slideable and rotatable contact within a bore 24 formed through a generally cylindrical retainer collar 26 that threadably engages an opening of an extension 28 of a front wall 29 of the apron. A generally cylindrical spanner nut 30 is located about and threadably engages the outer periphery of the retainer collar 26 and when tightened against the front surface of the extension 28 serves to secure the retainer collar 26 in the front wall 29 of the apron.

A circumferential slot 32 is formed on a portion of the operating shaft 20 located within the bore 24 of the retainer collar 26. A radially expandable O ring 33 is mounted in the slot 32 and expands against the bore 24 of the retainer collar 26. The O ring serves as an oil seal between shaft 20 and retainer collar 26. A feed reverse lever 34 is located about the outer end of the operating shaft 20 and is secured thereto as by a set screw 35 engaging a keyway 21 formed in the operating shaft. The feed reverse lever 34 is thereby effective to rotate the operating shaft 20.

An assembly comprising an operating gear 36 has secured within its bore a plurality of internal bushings 36*a* and is located about the operating shaft 20 in rotatable and slideable contact therewith. The operating gear 36 is positioned on the operating shaft 20 so that an inner end of the operating gear abuts an outer surface of a generally cylindrical shoulder 38 having a diameter substantially larger than the nominal diameter of the operating shaft. A washer 39 having an inner diameter substantially larger than the outer diameter of the operating gear is located about an outer non-toothed portion of the operating gear and serves as an oil slinger during rotation of the operating gear.

A generally cylindrical feed reverse interlock disk 40 is located about and positioned on the operating shaft 20 in abutting contact with an outer end of the operating gear 36 and with an inner end of the retainer collar 26. The disk 40 is secured to the operating shaft 20 as by a key 40*a* so that the disk rotates as a unit with the operating shaft.

A generally cylindrical sleeve bearing 42 is located about an outer diameter of an extension 44 of a bevel gear 46 in slidable and rotatable contact therewith. A small steel ball 42*a* is located with the outer circumferential surface of the sleeve bearing 42 and the inner circumferential surface of the opening formed through the back wall 23 of the apron. The small steel ball 42*a* is effective to hold the sleeve bearing 42 stationary in the back wall opening so that the extension 44 of the bevel gear may rotate within the sleeve bearing 42. The bevel gear 46 has its extension 44 located about an inner non-toothed portion of the operating gear 36 and is secured thereto as by a key 22 so that the bevel gear 46 and the operating gear 36 may rotate as a unit about operating shaft 20. The bevel gear 46 has an inner bore somewhat larger than the diameter of shoulder 38 of operating shaft 20.

The operating shaft 20 has a generally cylindrical extension 48 engageable with feed rod clutch mechanism in a manner hereinafter described and is effective to cause feed rod 14 to selectively engage bevel gear 46 through an intermediary gear arrangement hereinafter described.

A generally cylindrical selector gear shaft 50 is journaled in rotatable and slideable contact with a shift rack housing 51 secured to an upper portion of the front wall 29 of the apron 17. The selector gear shaft 50 has secured at its outer end, as by a conventional expandable screw arrangement 50*a*, a shift rack 52 having a plurality of grooves formed thereon. A rack pinion gear 54 has a plurality of teeth engaged with some of the grooves of the shift rack 52 so that rotation of the pinion gear 54 causes shift rack 52 and selector gear shaft 50 to move as a unit in an axial direction.

The shift rack 52 has formed at its outer end a plurality of abutment members 52*a* that are formed to receive a plurality of segments 56 urged radially inwardly by a radially expandable O ring 58. The O ring 58 and segments 56 in conjunction with one or more of the abutment members 52*a* serve to maintain the selector shaft 50 in a desired axial position. A feed lever 59 (as best seen in FIGURE 2) is secured to an outer end of the rack pinion gear 54 and is effective to rotate the rack pinion gear 54 and thereby move the selector gear shaft 50 in an axial direction.

A feed selector gear 60 is secured to the inner end of the selector gear shaft 50 as by a key 60*a*. The feed gear 60 has a plurality of circumferential teeth engaged with a plurality of circumferential teeth of the operating gear 36 and is disposed to be rotated as determined by rotation of the operating gear 36. The feed gear 60 when moved axially by clockwise or counterclockwise rotation of the feed selector lever 59 engages either a longitudinal feed clutch 62 or a cross feed gear 64. Feed selector gear 60, after engagement with either the feed clutch 62 or cross feed gear 64, may be rotated as directed by the operating gear 36 and thereby causes motion to be transferred to either the feed clutch 62 or the cross feed gear 64. The feed clutch is connected to conventional longitudinal feed gear mechaninsm and the cross feed gear is connected to conventional cross feed gear mechanism. Therefore, motion from either the feed clutch or the cross feed gear is employed to provide either longitudinal movement to the apron and carriage assembly, or cross feed movement to the cross slide.

Again referring to FIGURE 3, a countersunk, substantially vertical aperture 43 is formed through a bottom wall 17*a* of the apron and is generally aligned with the feed disk 40. An upper portion 45 of said aperture slideably receives a steel ball 47. A coil spring 49 is located within the upper portion 45 of the aperture with one end abutting the steel ball 47. A hollow-headed set screw 53 is threadably received in a lower portion 55 of the aperture. The set screw has an inner end in abutting contact with the other end of the coil spring 49 and maintains the coil spring compressed against the steel ball 47 that in turn is urged against the circumferential surface of the feed disk 40. A jam nut 53*a* threadably engages set screw 53 and when urged against a boss of bottom wall 17*a* of the apron serves to maintain the set screw in any desired position within the lower portion 55 of aperture 43.

The steel ball 47 partially projects from the upper portion of the aperture 43 when urged against the circumferential surface of the feed disk 40 and is disposed to be received by any one of a plurality of truncated notches 40*b*, 40*c*, 40*d*, as best seen in FIGURE 9. The disk 40 also has a notch 41 formed in its circumferential surface for a purpose to be hereinafter described. The steel ball 47, whenever engaged with one of the truncated notches, serves to releasably hold the operating shaft 20 in a position so that the operating gear, as will be described, may transfer either forward or reverse motion to cooperating gear arrangements or the operating gear may be held in neutral position with no motion being transferred to cooperating gear arrangements.

As best seen in FIGURE 8, the bevel gear 46 has a plurality of teeth 66 that simultaneously engage teeth 67 of one pinion bevel gear 68 and teeth 69 of another pinion bevel gear 70. Pinion gears 68 and 70 are journaled in general alignment with each other in oppositely disposed walls 71 and 71*a*, respectively, of an extension of the back apron wall 23.

Each pinion gear 68 and 70 is disposed about the feed rod and has an inner diameter somewhat larger than the

width across corners of the feed rod to allow relative freedom of rotation therebetween.

A feed reverse clutch **72** is internally formed to be complementary to the hexagonally shaped feed rod **14** and when located about said feed rod is disposed to rotate as a unit therewith. The clutch **72** is comprised of teeth **73** at times engageable with teeth **74** of the pinion bevel gear **68** and teeth **75** at other times engageable with teeth **76** of the other pinion bevel gear **70**. The clutch is also comprised of two ridge-like portions **77**, **77***a*, adjacent to its toothed ends and has a generally cylindrical portion **78** formed intermediate the ends of the clutch between the ridge-like portions. A generally U shaped feed reverse clutch yoke **80** is located about the cylindrical portion **78** of the clutch in loosely rotational contact therebetween and also in abutting contact with ridges **77** and **77***a*.

The generally cylindrical extension **48** (FIGURE 3) has a smaller diameter than the diameter of the operating shaft **20** and is formed eccentrically on the inner end thereof. The extension **48** is received by an opening **81** formed in the clutch yoke **80**. Rotation of feed reverse lever **34** causes the operating shaft **20** to rotate and the extension **48** is thereby caused to move angularly, as a crank, about the axis of the operating shaft **20**. This movement in turn causes the yoke **80** to move axially of rod **14** against ridge **77***a* to move the feed clutch linearly so that teeth **73** are disengaged from teeth **74** of the pinion bevel gear **68** and teeth **75** become engaged with teeth **76** of the other pinion bevel gear **70**, with a midpoint whereby the feed clutch **72** is disengaged from both pinion bevel gears **68** and **70**. In this manner, unidirectional angular motion of the feed rod may be transferred into bidirectional rotation of the operating gear, or the feed rod may rotate without transferring any motion to the operating gear.

Now referring to FIGURE 7, a half nut cam shaft **90** is journaled near its outer end in the front wall of the apron and extends through an opening **91** of the back apron wall. A generally cylindrical half nut interlock disk **92** is located about the cam shaft **90** and is secured thereto as by a spring pin **92***a*. As best seen in FIGURE 11, the half nut disk **92** has at least one obtusely angled, triangularly shaped notch **93** formed in its circumferential surface.

Again referring to FIGURE 7, a half nut cam **94** is located about the cam shaft **90** and is secured thereto as by a spring pin **94***a*. As best seen in FIGURE 10, a generally triangularly shaped, obtusely angled notch **95** is formed in the circumferential surface of the half nut cam **94**. The half nut cam has a portion of its circumferential surface received in slideable and rotatable contact by the opening formed in a portion of the back apron wall and thereby serves to journal the inner end of the cam shaft **90** in the back apron wall. A plurality of generally rectangular grooves **96**, **96** are formed in a surface **97** of the half nut cam **94** and receive one end of a like plurality of half nut pins **98**, **98** in slideable contact therebetween. The other ends of the half nut pins are received in recesses **99**, **99** formed in half nuts **100**, **100** slideably confined in a vertical guide **101** formed rearwardly of the back apron wall (see also FIGURE 4).

A half nut lever **102** is located about the outer end of the cam shaft **90** and is secured thereto as by a taper pin **102***a*. Counterclockwise rotation of the lever **102** causes cam shaft **90** to rotate and is effective to move half nut disk **92** and half nut cam **94**, secured to the cam shaft **90**, in an angular direction. This rotation of the half nut cam causes the half nut pins to slide in their respective grooves and the resultant effect is that half nuts **100**, **100** are urged inwardly toward each other. As said half nuts **100**, **100** are continued to be urged toward each other, internal threads **102**, **102** formed in the half nuts engage complementary threads **103** formed on the lead screw **11**. In this manner, motion of the lead screw may be transferred into rectilinear motion whereby the apron and carriage are caused to move longitudinally along the bed of the lathe.

A generally cylindrical projection **104** is formed concentrically on the inner end of the half nut cam shaft **90** and when the half nuts are closed upon the lead screw, the projection engages recesses **105**, **105** formed in the half nuts and thereby prevents excessive inward travel of the half nuts and ensures proper engagement of the half nut threads **102**, **102** with the threads **103** of the lead screw.

It may be seen that clockwise rotation of handle **102** is effective to urge the half nuts **100**, **100** outwardly from each other, disengaging the threads of the half nuts from the threads of the lead screw and thereby preventing movement of the apron and carriage along the bed of the lathe.

As best viewed in FIGURES 5 and 6, a generally cylindrical portion **111** of a feed reverse interloc plunger **110** is slideably received by an opening formed through a feed selector interlock housing **112** positioned between the front and back apron walls. The location of the housing **112** is selectively determined by an extension **113** being received in an opening in the back apron wall, and a set screw **114** extending through the front apron wall and threadably received by the interlock housing **112**. The interlock housing **112** is secured in a substantially vertical position between the front and back apron walls by a plurality of set screws **115**, **115** (FIGURE 2), threadably extending through apron front wall openings and urged against inner surfaces of recesses **116**, **116** (FIGURE 4) formed in the interlock housing **112**.

The interlock housing **112** is disposed between the front and back apron walls so that a forked end portion **117** of the interlock plunger **110** may at times straddle and thereby restrain the feed selector gear **60** from any movement in its axial direction. An interlock spring **118** is located about the cylindrical portion **111** of the interlock plunger **110** so that one end abuts one side of the interlock houisng **112**. The other end of the interlock spring **118** is secured near the end **119** of cylindrical portion **111** as by a retaining ring **120**. The interlock spring **118** is effective to continually urge the interlock plunger forked end portion **117** out of straddling engagement with the feed selector gear **60** and, when the lever **102** is in the open position, simultaneously urge the plunger end **119** into the notch **95** formed in the circumferential surface of the half nut cam **94**.

A reverse interlock pin **122** is slideably received by openings formed through interlock bushings **123**, **123** secured to the inner surface of the front apron wall as by screws **124**, **124**. The openings of the bushings have their axes generally coaxially aligned between the operating shaft **20** and the half nut cam shaft **90**. The interlock pin **122** is thereby disposed between the circumferential surfaces of the feed reverse interlock disk **40** and the half nut disk **92**. Thus, when shaft **50** is in neutral position, rotation of cam shaft **90** by lever **102** will cause pin **122** to be urged out of notch **93** of half nut disk **92** into engagement with the obtusely angled triangular notch **41** in the circumferential surface of interlock disk **40** and thereby prevent rotation of the operating shaft **20**.

It shall be noted that one end of interlock pin **122** will engage notch **41** of the interlock disk **40** only when operating shaft **20** has been rotated to a neutral position at which time the extension **48** (FIGURE 8) of shaft **20** will maintain feed clutch **72** in a neutral position whereby neither teeth **73** nor teeth **75** of the feed clutch engage teeth **74** or teeth **76** of pinion bevel gears **68**, **70**, respectively.

It shall be noted further that when one end of interlock pin **122** engages notch **41** of the interlock disk **40**, the other end of the pin will not be received by the notch **93** formed in the circumferential surface of the

half disk 92. Thus, half nut disk 92 and half nut cam 94 secured to the cam shaft 90 are free to rotate as directed by lever 102, and half nuts 100, 100 may be closed about lead screw 11.

Furthermore, as half nut cam shaft 90 is rotated as explained heretofore, interlock plunger 110 is urged out of engagement with notch 95 of half nut cam 94 and the forked end portion 117 of the interlock plunger is moved into straddling engagement with the feed selector gear 60.

Therefore, when the half nuts are closed about the lead screw and motion is being transferred from the power source through the lead screw to the apron and carriage, operating shaft 20 is maintained in a neutral position by engagement of interlock pin 122 with notch 41 of interlock disk 40 and no motion will be transferred from the feed rod to the apron and carriage. Also, at the same time, feed selector gear 60 is maintained in a neutral position by having forked end portion 117 of interlock plunger 110 in straddling engagement with the feed gear 60.

Thus, whenever the lead screw is transferring motion to the apron and carriage, handles 34 and 59 are prevented from operating the shaft 20 and feed gear 60, respectively.

When handle 102 is rotated to the open position, the half nuts no longer engage the lead screw, and notch 95 of half nut cam 94 is in position to receive the end 119 of interlock plunger 110 which is being urged out of engagement with feed gear 60 by the interlock spring 118. Also, half nut disk 92 has been rotated so that its notch 93 is axially aligned with interlock pin 122. Rotation of handle 34 of the operating shaft will cause feed disk 40 to rotate, and interlock pin 122 is urged out of engagement with notch 41 of the feed disk. As interlock pin 122 is urged out of engagement with notch 41, it moves upwardly into engagement with notch 93 of the half nut disk 92, thereby preventing rotation of the half nut cam shaft 90. Interlock pin 122 is maintained in engagement with notch 93 of half nut disk 92 so long as one end remains in contact with the circumferential surface of the feed disk 40.

Feed selector gear 60 no longer being restrained by interlock plunger 110, is free to be axially moved by rotation of handle 59 into engagement with either longitudinal feed gear 62 or cross feed gear 64, (FIGURE 3).

Also, operating shaft 20 is free to rotate as directed by handle 34, and extension 48 of the operating shaft may move feed clutch 72 into engagement with either pinion gear 68 or pinion gear 70 thus imparting clockwise or counterclockwise motion to operating gear 36 and subsequently causing selective forward or reverse motion to be imparted to the tools secured on the carriage.

Therefore, when feed clutch 72 is engaged with either pinion gear 68 or pinion gear 70 and motion is being transferred from the power source through the feed rod to the apron and carriage, the half nut cam shaft 90 is prevented from rotation by the interlock pin 122 being engaged with the notch 93 of the half nut disk 92 and the half nuts 100, 100 remain in an open position about the lead screw so that no motion will be transferred from the lead screw to the apron and carriage. Also, at the same time, interlock spring 119 urges and maintains interlock plunger 110 in engagement with notch 95 of half nut cam 94 so that feed gear 60 may rotate as directed by operating gear 36.

Although but one embodiment of the invention is disclosed and described herein, it is apparent that other embodiments and modifications are possible within the scope of the appended claims.

I claim:

1. In a lathe including a longitudinal bed, power-driven means extending the length of said bed, and a carriage slideably supported on said bed and having an apron including mechanism for drivingly engaging said power-driven means with said carriage; said apron mechanism comprising first and second clutch means for effectuating the driving engagement, said first and second clutch means being controlled by the rotation of operating and cam shafts, respectively, pin means for selectively maintaining one of said shafts operable while the other one of said shafts is non-operable, a cam rotatable with said cam shaft and having a notch formed in its periphery, a rotatably-mounted selector gear axially movable between cooperating gear means, a plunger reciprocally movable between said selector gear and cam, said plunger having a first end portion receivable at times in said notch and a forked, second end portion straddling said selector gear when said first portion is not received in said notch, and yieldable means biasing said plunger out of straddling engagement with said selector gear, said plunger being movable by rotation of said cam shaft to straddle said selector feed gear with said forked portion to prevent rotation of said operating shaft.

2. In a lathe including a longitudinal bed, power-driven means extending the length of said bed, and a carriage slideably supported on said bed and having an apron including mechanism for drivingly engaging said power-driven means with said carriage; said apron mechanism comprising first and second clutch means for effectuating the driving engagement, said first and second clutch means being controlled by the rotation of operating and cam shafts, respectively, first and second cams rotatable with said cam shaft, an interlock disk rotatable with said operating shaft, each of said cams and interlock disk having a notch formed in its periphery, a pin reciprocally movable between said first cam and interlock disk, said pin having a first end portion receivable at times in said first cam notch and a second end portion receivable in said interlock disk notch when said first end portion is not received in said first cam notch, a rotatably-mounted selector gear axially movable between cooperating gear means, a plunger reciprocally movable between said selector gear and second cam, said plunger having a first end portion receivable at times in said second cam notch and a forked, second end portion straddling said selector gear when the first end portion of said plunger is not received in said second cam notch, and yieldable means biasing said plunger out of straddling engagement with said selector gear, said pin being movable by rotation of said operating shaft into said interlock disk notch and thereby permit operation of said operating shaft and selector gear while at the same time preventing operation of said cam shaft.

3. In a lathe including a longitudinal bed, power-driven means extending the length of said bed, and a carriage slideably supported on said bed and having an apron including mechanism for drivingly engaging said power-driven means with said carriage; said apron mechanism comprising first and second clutch means for effectuating the driving engagement, said first and second clutch means being controlled by the rotation of operating and cam shafts, respectively, first and second cams rotatable with said cam shaft, an interlock disk rotatable with said operating shaft, each of said cams and interlock disk having a notch formed in its periphery, a pin reciprocally movable between said first cam and interlock disk, said pin having a first end portion receivable at times in said first cam notch and a second end portion receivable in said interlock disk notch when said first end portion is not received in said first cam notch, a rotatably-mounted selector gear axially movable between cooperating gear means, a plunger reciprocally movable between said selector gear and second cam, said plunger having a first end portion receivable at times in said second cam notch and a forked second end portion straddling said selector gear when the first end portion of said plunger is not received in said cam notch, and yieldable means biasing said plunger out of straddling engagement with said se-

lector gear, said cams being positioned with respect to said cam shaft such that the first end portions of said pin and plunger are simultaneously received in the respective cam notches.

4. In a lathe including a longitudinal bed, first and second power-driven means extending the length of said bed, and a carriage slidably supported on said bed and having an apron including mechanism for drivingly engaging said power-driven means with said carriage; said apron mechanism comprising first and second clutch means for effectuating the driving engagement with said first and second power-driven means, respectively, rotatably-mounted operating and cam shafts, said first and second clutch means being controlled by the rotation of said operating and cam shafts, respectively, means for individually rotating said shafts, first and second cams rotatable with said cam shaft, an interlock disk rotatable with said operating shaft, each of said cams and interlock disk having a notch formed in its periphery, a pin reciprocally movable between said first cam and interlock disk, said pin having a first end portion receivable at times in said first cam notch and a second end portion receivable in said interlock disk notch when said first end portion is not received in said first cam notch, a rotatably-mounted selector gear axially movable between cooperating gear means, a plunger reciprocally movable between said selector gear and second cam, said plunger having a first end portion receivable at times in said second cam notch and a forked, second end portion straddling said selector gear when the first end portion of said plunger is not received in said second cam notch, and yieldable means biasing said plunger out of straddling engagement with said selector gear, said cams being positioned with respect to said cam shaft such that the first end portions of said pin and plunger are simultaneously received in the respective cam notches.

5. In a lathe including a longitudinal bed, a rotatably-mounted lead screw and a rotatably-mounted feed rod extending the length of said bed, power means for rotating said lead screw and feed rod, and a carriage slideably supported on said bed and having an apron incluidng mechanism for drivingly engaging said lead screw and feed rod with said carriage; said apron mechanism including a half nut gripping clutch means engageable with said lead screw, a cam shaft operatively connected to said half nut gripping clutch means for controlling the driving engagement thereof with said lead screw, a feed reverse clutch means engageable with said feed rod, an operating shaft operatively connected to said feed reverse clutch means for controlling the driving engangement therof with said feed rod, means for individually rotating said shafts, a selector gear operatively connected to said feed reverse clutch means for receiving rotative motion from said feed rod, said selector gear being axially movable between and engageable with cooperating gear means, first and second cams rotatable with said cam shaft, an interlock disk rotatable with said operating shaft, said cams and interlock disk each having a notch in its periphery, a pin reciprocally moveable between said first cam and interlock disk, said pin having a first end portion receivable at times in said first cam notch and a second end portion receivable in said interlock disk notch when said first end portion is not received in said first cam notch, whereby said pin maintains one of said shafts operable while the other one of said shafts is non-operable, a plunger reciprocally movable between said selector gear and second cam, said plunger having a first end portion receivable at times in said second cam notch and a forked, second end portion straddling said selector gear when the first end portion of said plunger is not received in said second cam notch, and yieldable means biasing said plunger out of straddling engagement with said selector gear, said cams being positioned on said cam shaft such that the first end portions of said pin and plunger are simultaneously received in the respective cam notches.

6. In a lathe including a longitudinal bed, a rotatably-mounted lead screw and a rotably-mounted feed rod extending the length of said bed, power means for rotating said lead screw and feed rod, and a carriage slideably supported on said bed and having an apron including mechanism for drivingly engaging said lead screw and feed rod with said carriage; said apron mechanism comprising a half nut gripping clutch means engageable with said lead screw, a rotatably-mounted cam shaft operatively connected to said half nut gripping means such that the rotation of said cam shaft controls the engagement and disengagement of said half nut gripping clutch means with said lead screw, a feed reverse clutch means engageable with said feed rod, a rotatably-mounted operating shaft operatively connected to said feed reverse clutch means such that the rotation of said operating shaft controls the engagement and disengagement of said feed reverse clutch means with said feed rod, hand-operated means for selectively rotating said shafts, a selector gear operatively connected to said feed reverse clutch means for receiving rotative motion from said feed rod, said selector gear being axially movable between and engageable with cooperating gear means, first and second cams secured to said cam shaft, an interlock disk secured on said operating shaft, said cams and interlock disk each having a notch in its periphery, a pin reciprocally movable between said first cam and interlock disk, said pin having a first end portion receivable at times in said first cam notch and a second end portion receivable in second cam notch when said first end portion is not received in said first cam notch, whereby said pin maintains one of said shafts operable while the other one of said shafts is non-operable, a plunger reciprocally movable between said selector gear and second cam, said plunger having a first end portion receivable at times in said second cam notch and a forked, second end portion straddling said selector gear when the first end portion of said plunger is not received in said second cam notch, and a spring biasing said plunger out of straddling engagement with said selector gear, said cams being positioned on said cam shaft such that the first end portions of said pin and plunger are simultaneously received in the respective cam notches.

7. In a lathe including a longitudinal bed, a rotatably-mounted lead screw and a rotatably-mounted feed rod extending the length of said bed, power means for rotating said lead screw and feed rod, and a carriage slideably supported on said bed and having an apron including mechanism for drivingly engaging said lead screw and feed rod with said carriage; said apron mechanism comprising a half nut gripping clutch means engageable with said lead screw, a rotatably-mounted cam shaft operatively connected to said half nut gripping means such that the rotation of said cam shaft controls the engagement and disengagement of said half nut gripping clutch means with said lead screw, a feed reverse clutch means engageable with said feed rod, a rotatably-mounted operating shaft operatively connected to said feed reverse clutch means such that the rotation of said operating shaft controls the engagement of said feed reverse clutch means with said feed rod, hand-operated means for selectively rotating said shafts, an operating gear rotatably mounted on said operating shaft and operatively to said feed reverse clutch means for receiving rotative motion from said feed rod, a selector gear engaged with said operating gear, said selector gear being axially movable between and engageable with cooperating gear means, first and second cams secured to said cam shaft, an interlock disk secured on said operating shaft, said cams and interlock disk each having a notch in its periphery, a pin reciprocally movable between said first cam and interlock disk, said pin having a first end portion receivable at times in said first cam notch and a second end portion receivable in

second cam notch when said first end portion is not received in said first cam notch, whereby said pin maintains one of said shafts operable while the other one of said shafts is non-operable, a plunger reciprocally movable between said selector gear and second cam, said plunger having a first end portion receivable at times in said second cam notch and a forked, second end portion straddling said selector gear when the first end portion of said plunger is not received in said second cam notch, and a spring biasing said plunger out of straddling engagement with said selector gear, said cams being positioned on said cam shaft such that the first end portions of said pin and plunger are simultaneously received in the respective cam notches.

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