No. 615,146. Patented Nov. 29, 1898.

W. DONALDSON.

LATHE.

(Application filed Oct. 18, 1897.)

(No Model.) 4 Sheets—Sheet 1.

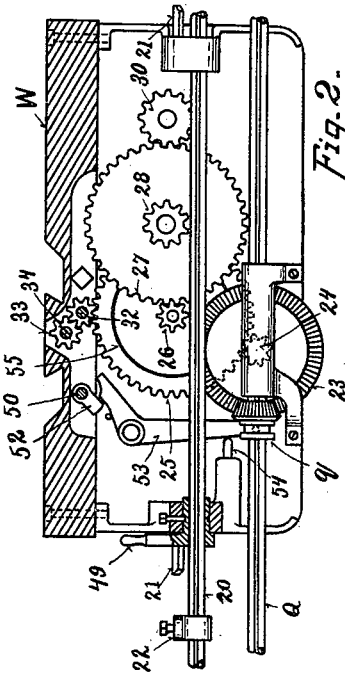

Fig. 2.

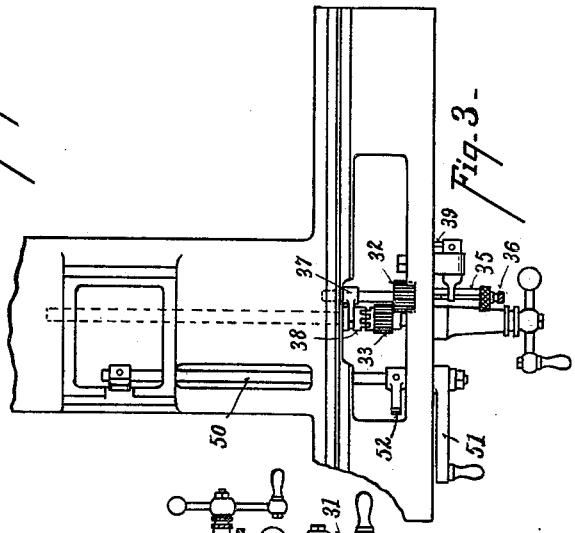

Fig. 3.

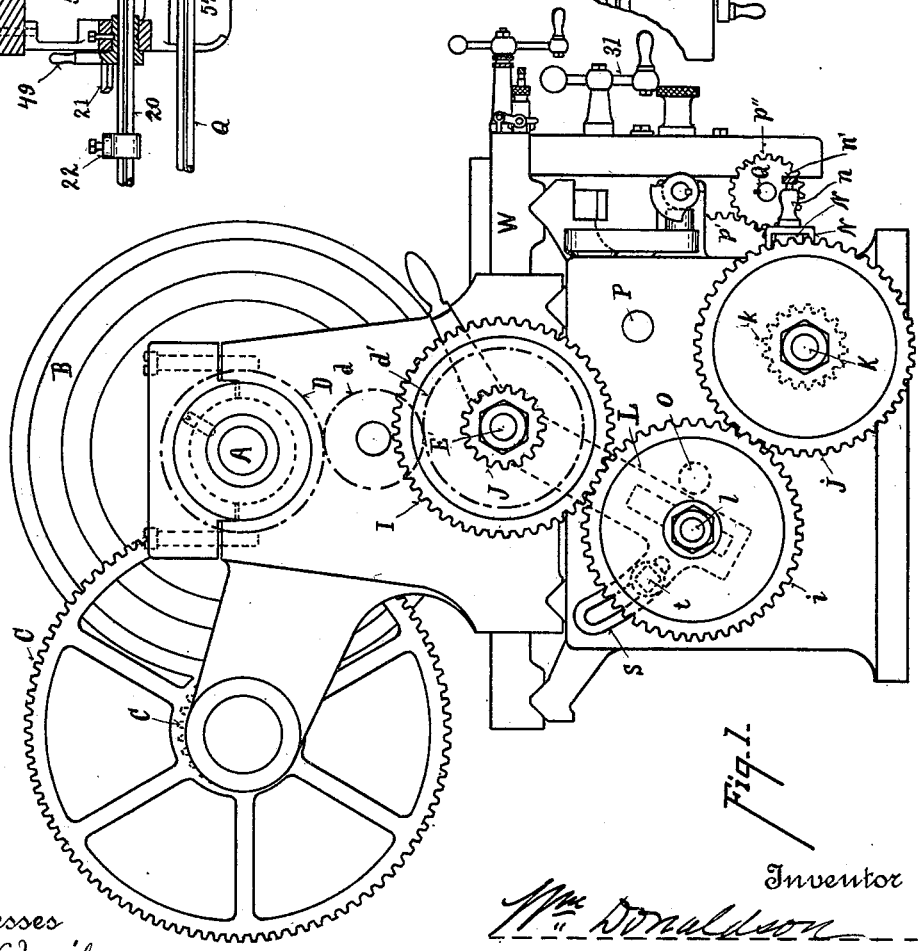

Fig. 1.

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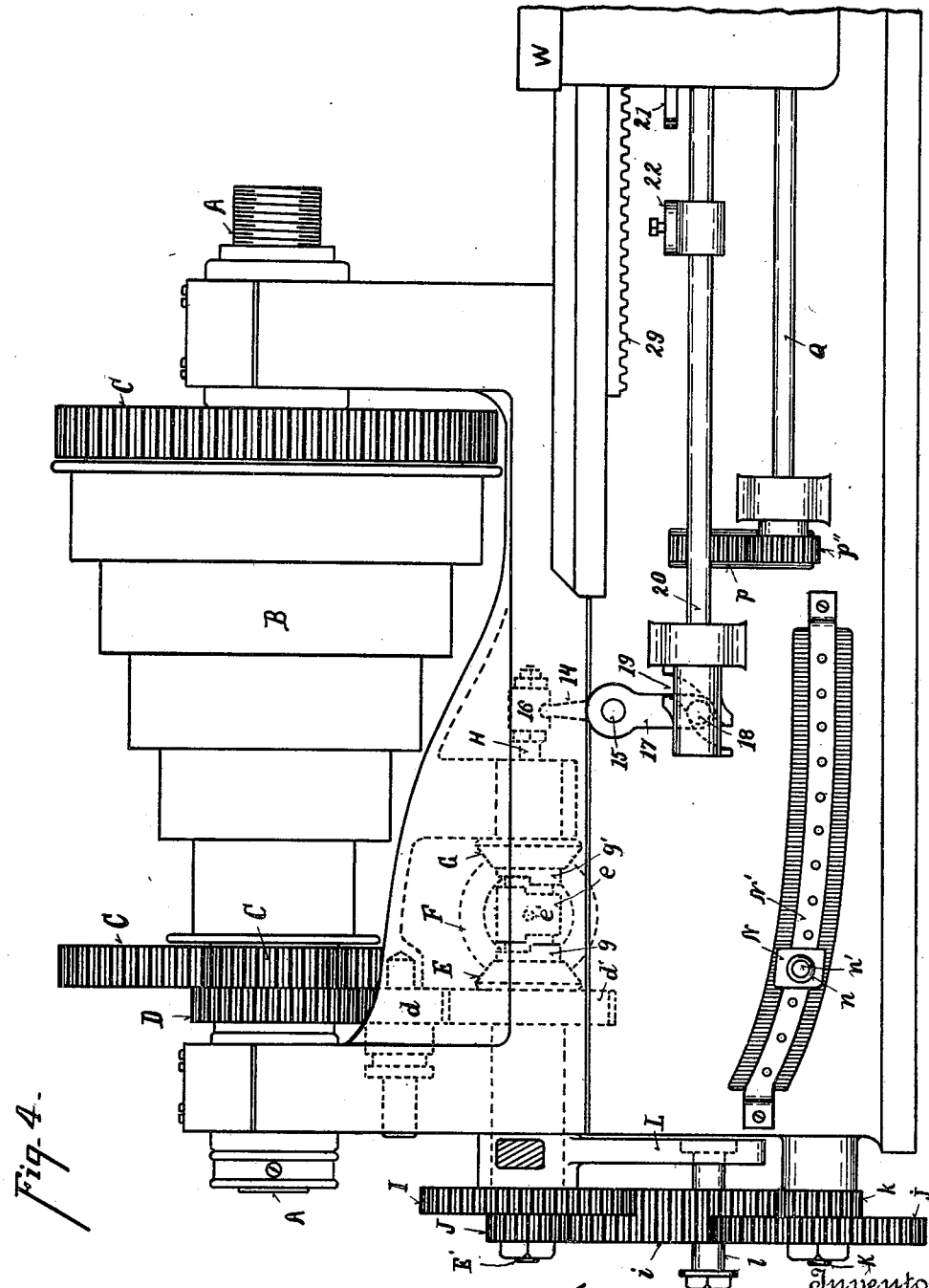

Fig. 4.

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(No Model.) 4 Sheets—Sheet 3.

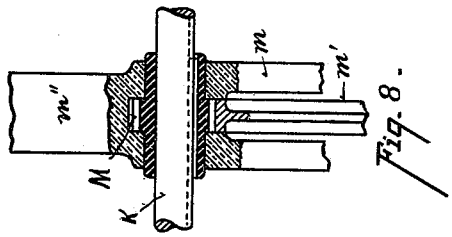

Fig. 8.

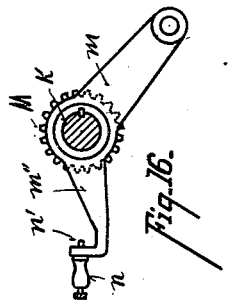

Fig. 16.

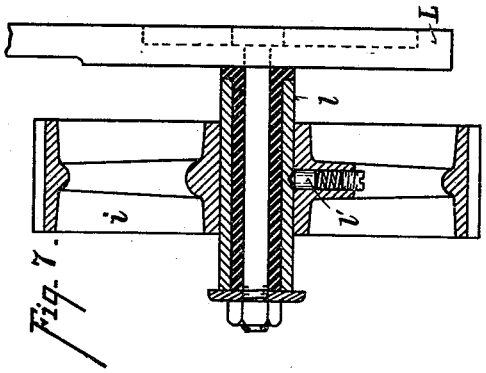

Fig. 7.

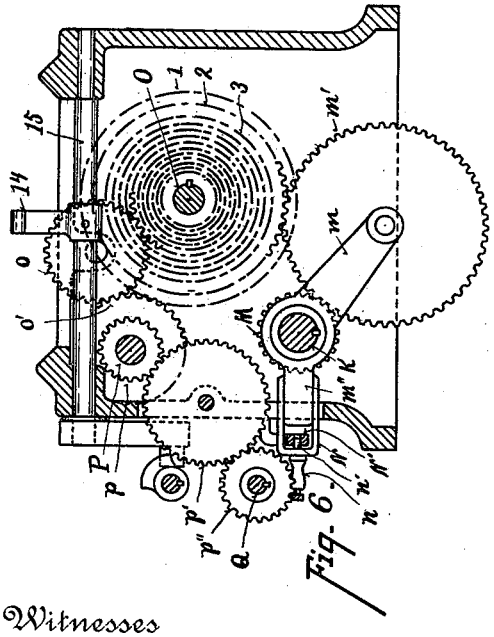

Fig. 6.

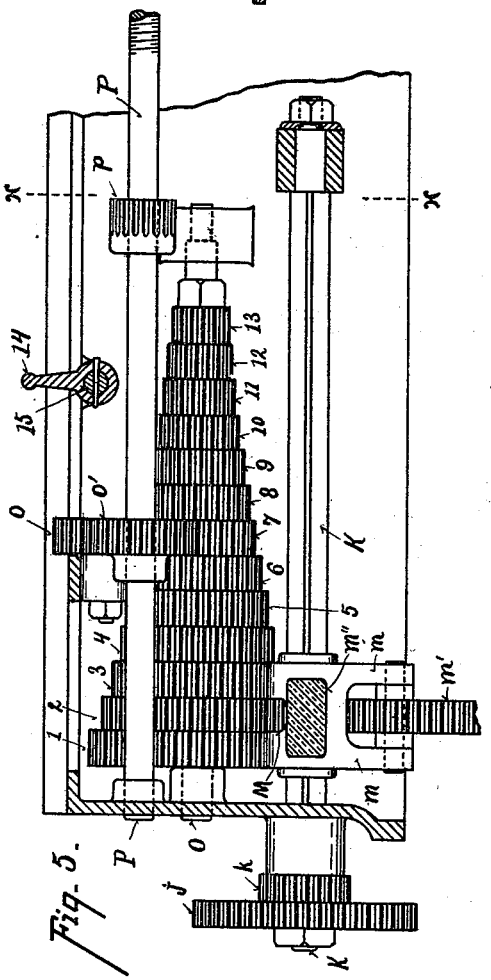

Fig. 5.

Witnesses

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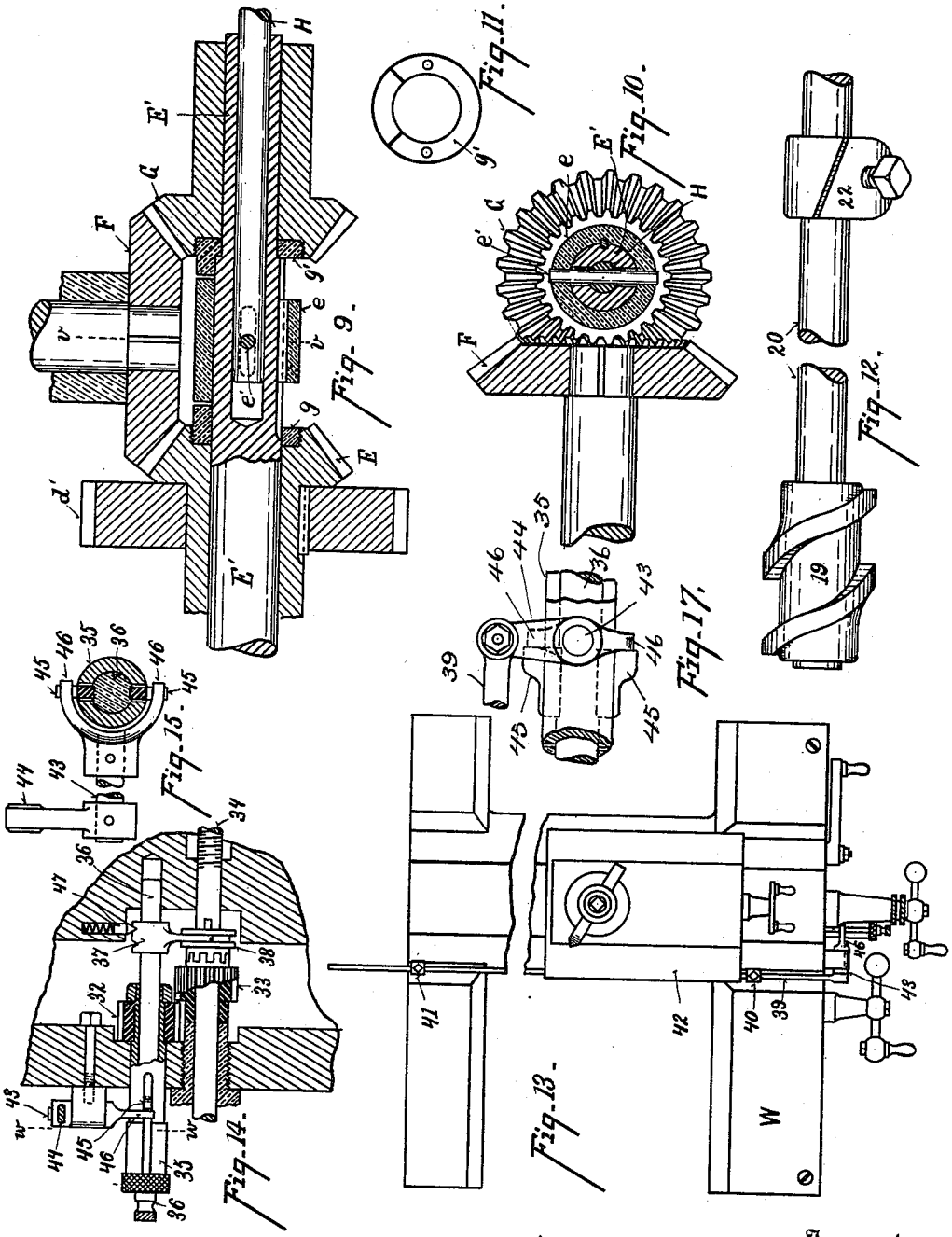
(Application filed Oct. 18, 1897.)

(No Model.) 4 Sheets—Sheet 4.



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UNITED STATES PATENT OFFICE.

WILLIAM DONALDSON, OF LUDLOW, KENTUCKY, ASSIGNOR TO THE AMERICAN TOOL WORKS COMPANY, OF CINCINNATI, OHIO.

LATHE.

SPECIFICATION forming part of Letters Patent No. 615,146, dated November 29, 1898.

Application filed October 18, 1897. Serial No. 655,574. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM DONALDSON, residing at Ludlow, in the county of Kenton and State of Kentucky, have invented certain new and useful Improvements in Lathes, of which the following is a specification.

My invention relates to an improvement in lathes.

One of the objects of my invention is to provide a power-transmitter which can be readily adjusted to produce varying speeds of the driving mechanisms.

Another object of my invention is to provide mechanisms whereby said changes of speed can be readily transmitted to the longitudinal feed of the tool-carriage whether the same is driven through the apron mechanism or through the lead-screw.

Another object of my invention is to provide mechanism for transmitting said changes of speed through the apron mechanism to the transverse feed of the tool-holder when desired.

Another object of my invention is to provide mechanism for stopping the feed of the carriage either automatically at any desired point or by hand.

Another object of my invention is to provide mechanism for performing similar functions with regard to the transverse feed of the tool-holder.

Another object of my invention is to provide mechanism for disengaging the apron mechanism when throwing in the lead-screw when it is desired to use this feed.

The features of my invention are more fully set forth in the description of the accompanying drawings, making a part of this specification, in which—

Figure 1 is an end elevation of my improved lathe. Fig. 2 is an inside plan view of the tool-carriage and apron, partly in section. Fig. 3 is a bottom plan view of the tool-carriage with the apron removed. Fig. 4 is a side elevation of the lathe head-stock and bed-plate. Fig. 5 is a side elevation of the tool-feeding mechanism, one side of the bed-plate being removed. Fig. 6 is a section on line *x x*, Fig. 5. Fig. 7 is a detailed view of the change-gear on the head of the lathe. Fig. 8 is a detailed view of the shifting mechanism to engage the cone-gears. Fig. 9 is a detailed view of the reversing-clutch. Fig. 10 is a section on line *v v*, Fig. 9. Fig. 11 is a plan view of one of the clutch members. Fig. 12 is an enlarged detailed view of the automatic stop mechanism. Fig. 13 is a top plan view of the tool-carriage. Fig. 14 is a detailed sectional view through the tool-carriage. Fig. 15 is a section on line *w w*, Fig. 14. Fig. 16 is a modification of the sliding segmental arm. Fig. 17 is a detail view of the means for automatically throwing out of gear the mechanism for feeding the tool-carriage transversely.

A represents the spindle of the head-stock; B, the cone-pulley; C, the usual back gear for slow speed. D represents a gear also mounted on the spindle A, meshing with gear *d*, which in turn drives gear *d'*, mounted upon the hub of bevel-gear E. Bevel-gear E drives gear F, and through gear F drives bevel-gear G in the reverse direction. Gears E G are loosely mounted upon shaft E'.

e represents a clutch member revolving with the shaft E' by means of a pin *e'*, passing through slots in the shaft E' and also passing through shaft H, by means of which the revolving clutch member *e* is shifted to engage either of the revolving clutch members *g g'*, which are secured, respectively, to the reversing-gears E G.

K represents an intermediate shaft to which power is transmitted from the shaft E' by means of the following instrumentalities: I J represent compound spur-gears mounted upon and driven by shaft E', and *j k* represent similar compound spur-gears mounted upon and driving intermediate shaft K. *i* represents an adjustable transmitting-gear which is adjusted to various positions to engage different members of said compound spur-gears, transmitting motion from shaft E' to intermediate shaft K. In order to secure the adjustments of the transmitting-gear with the said compound gears, I provide the following devices: Gear *i* is mounted upon a stud-shaft *l*, carried by the quadrant L. *s* represents a slot in said quadrant, and *t* a bolt passing through said slot and tapping into the lathe-frame to hold the quadrant to its adjusted position. This quadrant L may be shifted so as to bring gear *i* into engage-

ment with gears I *j*, or into engagement with gears J *j*, or into engagement with gears I *k*, the different members of the compound spur-gears, and so three changes of speed may be transmitted to the intermediate shaft K, the gear *i* sliding on its stud-shaft *l* to make these different engagements. It is necessary to have the transmitting-gear *i* twice the width of the separate members of the compound gears to accomplish this result. *l'* represents a spring-actuated stud for holding gear *i* in its central position.

In order to transmit motion from the intermediate shaft K to any one of the cone of gears, I provide the following devices: M represents a gear splined upon shaft K. (See Figs. 5, 6, and 8.) *m* represents a forked lever-arm journaling upon the hub of gear M and carrying gear *m'* between its forked ends. Said gear *m'* meshes with gear M and also with any one of the cone of gears. In order to provide for such various adjustments, I provide a yoke N, secured to the arm *m* at its outer end. Said yoke engages with a locking-bar N' to lock the lever-arm in the desired position. *n* represents a handle attached to said yoke, and *n'* a spring-actuated pin which engages with holes in the locking-bar N' to secure the arm to its adjusted position. 1 2 3, &c., represent a cone of gears mounted upon the shaft O, with any one of which gears the gear *m'* may be brought into engagement by shifting arm *m*, carrying gear *m'*, along the shaft K and locking it to the bar N' to secure the desired adjustment. *o* represents an idler-gear engaging with one of the cone of gears—say 7—and transmitting motion through gear *o'* to the lead-screw P. *p* represents a gear driving the idler-gear *p'*, which transmits motion through gear p^2 to the feed-rod Q, which in turn drives the tool-carriage through the apron-gear mechanism.

In order to automatically stop the feed of the carriage at any desired points, I provide the following devices: 14 represents a crank-arm on rock-shaft 15. The upper end of said arm engages with a collar 16 on shaft H for shifting the clutch member *e*. 17 represents a crank-arm on rock-shaft 15, the lower end of which arm carries a roller 18, traveling in a spiral cam-groove 19, formed in the hub upon the controlling-shaft 20. 21 represents a beveled stud secured to the apron of the tool-carriage and engaging with the shipping-collar 22 to partially rotate the controlling-shaft 20, which unships the gears and stops the feed. A similar stud 21 and collar 22 are employed upon the opposite side of the tool-carriage, so as to unship the feed at the end of the reverse travel of the carriage. 49 represents a hand-lever journaled in the apron and also splined upon the controlling-shaft 20, by means of which the said shaft may be partially rotated at any time to either stop, start, or reverse the direction of the feed.

The tool-carriage is driven by means of the rod Q in the following manner: *q* represents the bevel-gear upon rod Q, driving the bevel-gear 23, on the shaft of which is a spur-gear 24, driving gear 25, and through gear 26 driving gear 27, which carries the gear 28, meshing with the rack 29 on the bed-plate of the lathe. 55 represents a friction-clutch member to engage gear 25 with gear 26. 30 represents a gear upon the shaft of the hand-lever 31, by means of which the gear 28 may be turned when it is desired to feed the carriage by hand. When it is desired to transmit power from rod Q, so as to feed the tool-holder across the carriage, the clutch member 55 is shifted to throw gear 25 out of engagement with gear 26. Mounted upon a sleeve 35, sliding upon the shifting pin 36, is a gear 32, which can be slid upon said pin into engagement with the gear 25, transmitting power from the same to a gear 33, journaled upon the cross-feed screw-shaft 34. Gear 33 drives shaft 34 by means of the sliding-clutch member 38, splined upon shaft 34. 37 represents an arm connecting said sliding-clutch member 38 to the shifting pin 36. This pin is shifted by hand to engage the said clutch with gear 33 for stopping or starting the transverse feed of the tool-holder. In order to stop said transverse feed at any desired predetermined point, I provide the following instrumentalities: 39 (see Fig. 13) represents a tripping-rod extended along the path of travel of the transverse feed of the tool-holder. 40 41 represent adjustable stops mounted upon said rod adapted to be engaged by the tool-holder 42, thereby rocking the rock-shaft 43, to the arm 44 of which the rod 39 is pivoted. 45 represents lugs projecting from the pin 36, which are engaged by one or the other of the yoke-arms 46 on the rock-shaft 43, which shifts the pin 36 to disengage the clutch 38. Stop 41 is obviously for the purpose of stopping the feed at any desired point of the reverse travel of the tool-holder, for whichever way the shaft 43 is rocked one of its yoke-arms will engage with one of the lugs on pin 36 to move the pin inwardly, disengaging the clutch 38. It is obvious that the feed can be controlled by hand by shifting the pin 36 for engaging or disengaging the clutch member.

It is sometimes desirable to feed the tool-carriage by means of the lead-screw P, instead of through the apron-gear mechanism driven from rod Q, and to accomplish this I provide the following devices: 52 represents a tripping-arm upon shaft 50, provided with a hand-lever 51. When said shaft is rotated the tripping-arm will engage with the bell-crank lever 53, the upper face of which is provided with a cam-surface. The lower end of said bell-crank lever engages with a groove on the hub of the gear *q* on rod Q, the same rotation of the shaft serving to throw the lead-screw P into engagement with half-nuts, (not here shown,) by which means the tool-carriage is then fed. 54 represents a spring-actuated pin engaging the lower end of the bell-crank lever 53 to hold the gear *q* normally in engage-

ment with gear 23, and also for returning the same into position, as it is desired to feed the carriage by means of the apron-gear mechanism for all ordinary purposes.

It will be seen that by the construction herein shown and described a great variety of changes of speed for either the travel of the tool-carriage or for the transverse feed of the tool-holder is obtained, the power being derived from the same source; also, that said parts can be readily engaged and disengaged either automatically or by hand and the different adjustments of the parts to produce the desired changes of speed easily and quickly made.

Having described my invention, I claim—

1. In a lathe, the combination with the parallel shafts E′ and K, the compound spur-gears I, J, on the shaft E′, and the compound spur-gears *j*, *k*, on the shaft K, of a quadrant L journaled on one of said shafts, means for adjusting said quadrant in the arc of a circle, a shaft *l* carried by said quadrant and adjustable radially thereon, and an intermediate transmitting-gear journaled on the shaft *l* and arranged to slide thereon, whereby said gear may be placed in engagement with the different members of said compound gears, substantially as described.

2. In a lathe, the combination with the parallel shafts E′ and K, the compound spur-gears I, J, on the shaft E′ and the compound spur-gears *j*, *k*, on the shaft K, of a quadrant L journaled on one of said shafts and having a longitudinal slot, means for adjusting the quadrant about its pivotal point, a shaft *l* adjustably secured in the slot in the quadrant, and an adjustable transmitting-gear *i* journaled on the shaft *l* and arranged to slide thereon, said gear being twice the width of the separate members of either of the compound gears, whereby said transmitting-gear may be adjusted to engage the larger and smaller members of the compound gears in different horizontal and vertical planes, substantially as described.

3. In a lathe, the combination with a reversible driving-shaft E′ and a compound gear mounted on one end thereof, of a shaft K and a compound spur-gear mounted on one end thereof, a pivoted quadrant, a transmitting-gear *i* radially adjustable on said quadrant, means for adjusting the quadrant about its pivot to place the transmitting-gear into engagement with the larger and smaller members of the spur-gears, a gear M splined on the shaft K, a lever-arm journaled on the hub of said gear, a gear *m′* carried by said lever-arm and meshing with the gear M, a shaft O, a cone of gears mounted on said shaft, an apron, gear mechanism for driving the apron and meshing with one of said cone-gears, and means for adjusting the gear M longitudinally on the shaft K, whereby the variations of feed of the said cone of gears are multiplied by the variations of feed of said compound gears and intermediate transmitting-gear, substantially as described.

4. In a lathe, the combination of a reversible driving-shaft E′, a compound spur-gear mounted on one end thereof, a shaft K, a compound spur-gear mounted on one end thereof, a quadrant L pivotally mounted on the shaft E′, an intermediate transmitting-gear radially adjustable on the quadrant L and double the width of either of the compound spur-gears, means for adjusting the quadrant about its pivot, a gear M splined upon the shaft K and arranged to slide thereon, a lever-arm journaled upon the hub of the gear M, a gear *m′* journaled in one end of the lever-arm and in mesh with the gear M, a handle on the other end of said arm, a guide-bar, apron-driving mechanism, a shaft O, a cone of gears mounted on the shaft O and arranged to transmit power to the apron-driving mechanism, and means for locking the said lever-arm at any desired point on the said guide-bar whereby the gear *m′* may be placed in engagement with any one of the cone-gears, substantially as described.

5. In a lathe in combination with the reversible driving-shaft E′, a compound spur-gear splined upon the end of said shaft, a compound spur-gear splined upon the end of the intermediate shaft K, and in the same axial plane, as the first-named gear, an adjustable transmitting-gear *i* mounted upon a stud-shaft radially adjustable upon a quadrant, said gear being the width of the separate members of said compound gears, whereby said transmitting-gear may be shifted to various positions to simultaneously engage different members of said compound spur-gears, substantially as specified.

6. In a lathe, in combination with a clutch-reversing mechanism, a rod 20 extended in the path of the movable member whose direction is to be reversed, a spiral 19 arranged on said rod, a clutch-shifting lever engaging respectively with said spiral and with the clutch-shifting device, and tripping mechanism mounted on said rod and traveling member adapted to be brought into engagement by the movement of said traveling member to partially rotate said rod in either direction, whereby said clutch is automatically shifted in either direction at predetermined points in the path of said movable member, substantially as described.

7. In a lathe, in combination with a clutch-reversing mechanism, a double reversing-rod 20 extended longitudinally in the path of travel of the tool-carriage, adjustable collars mounted upon said rod, tripping-blocks mounted on said carriage adapted to engage with said collars to rotate said shaft partially in either direction, a spiral cam 19 in the face of said rod, and a lever engaging respectively therewith and with the clutch-shifting device, whereby the direction of travel of said carriage may be reversed at

predetermined points in either direction, substantially as described.

8. In a lathe employing a tool-carriage driven by a train of gears mounted on said carriage, and receiving motion from a variably-speeded rod Q, the transverse tool-feeding mechanism driven by said train of gears, said feeding mechanism consisting of a cross-screw feed-shaft, a clutch splined thereto, and means for throwing said clutch into and out of gear, substantially as specified.

9. In a lathe employing a tool-carriage driven by a train of gears, the transverse tool-feeding mechanism driven from said train of gears, said feeding mechanism consisting of a cross-screw feed-shaft, a clutch member splined thereto, and means for automatically shifting said friction member out of gear at any predetermined point of the transverse travel of the tool-holder, substantially as specified.

10. In a lathe in combination with the train of gears for driving the tool-carriage, a gear 32 journaled upon a sleeve sliding upon a shifting pin 36, a shifting arm 37 connected to said pin and to a clutch member 38 splined upon the cross-feed screw-shaft 34, a gear 33 journaled upon said shaft and adapted to be engaged by said clutch member, whereby the tool-holder may be fed across the carriage, substantially as specified.

11. In a lathe the combination of the transverse tool-holder-feeding mechanism, consisting of, a cross-feed screw-shaft 34, a clutch member splined thereto and adapted to engage and disengage a gear 33 journaled upon said shaft, a shifting pin 36 the inner end of which carries an arm 37, the lower end of said arm being connected to a sliding clutch member 38 splined upon said shaft 34, a gear 32 journaled upon a sleeve sliding upon said shifting pin 36 and adapted to be slid into engagement with said gear 33 and one of the train of gears for driving the tool-carriage, substantially as specified.

12. In a lathe in combination with the transverse tool-feeding mechanism consisting of a cross-feed screw-shaft, a sliding clutch member splined thereon, a gear journaled thereon and adapted to be engaged by said clutch, a shifting pin carrying an arm attached to said sliding clutch, a shifting rod 39 extended along the path of travel of said cross-feed, adjustable stop-blocks mounted on said rod and adapted to be engaged by the tool-holder, an arm connected to said shifting rod and pivoted to a rock-shaft 43, a pair of yoke-arms 46 secured to said rock-shaft and adapted to engage with lugs on the shifting pin 36 when said shaft is rocked, whereby the clutch member is automatically thrown out of gear at any desired predetermined point, substantially as specified.

13. In a lathe in combination with the gear-wheel q splined upon the feed-rod Q, a bell-crank lever 53 the lower end of which engages with the hub of said gear, the upper end of said lever being provided with a cam-face, a tripping-lever 52 mounted upon a rock-shaft 50 provided with a hand-lever 51, whereby the gear q may be shifted on rod Q out of engagement with the apron-gear mechanisms, substantially as specified.

In testimony whereof I have hereunto set my hand.

WILLIAM DONALDSON.

Witnesses:
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N. A. NEWTON.