No. 842,883. PATENTED FEB. 5, 1907.

G. E. GREENLEAF.

LATHE.

APPLICATION FILED APR. 20, 1906.

2 SHEETS—SHEET 1.

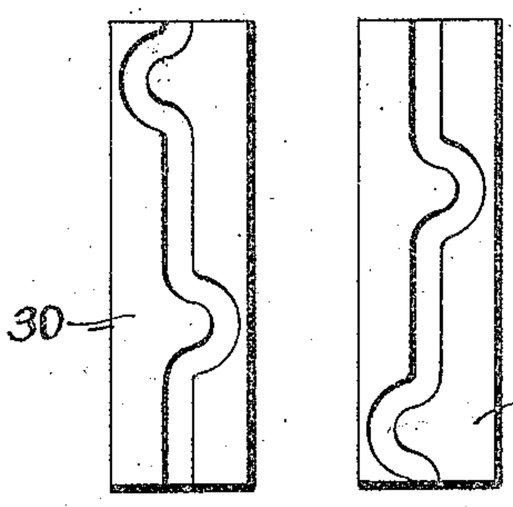


FIG. 6




FIG. 1

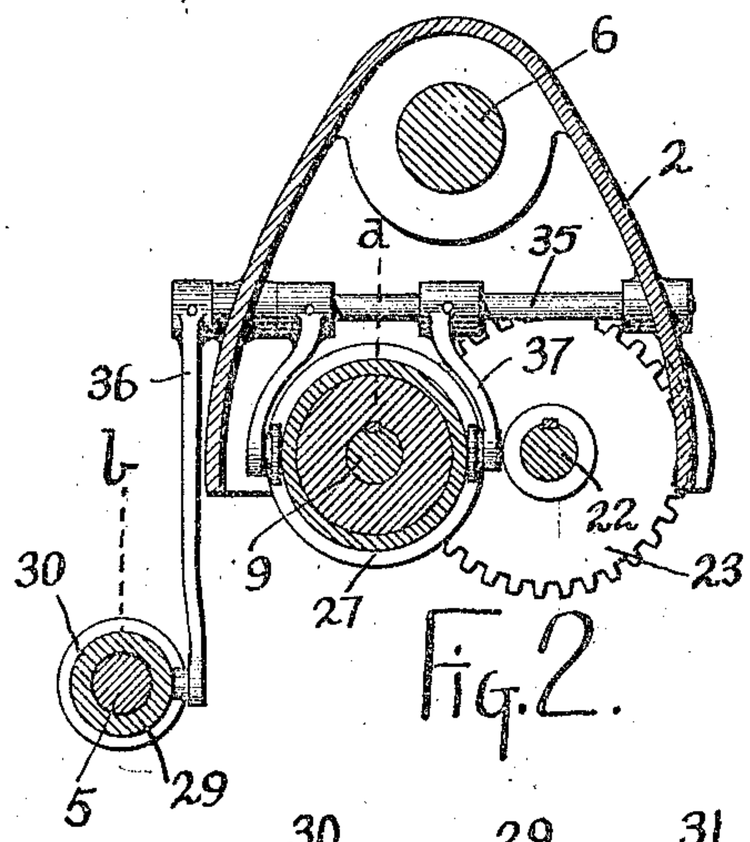


FIG. 2.

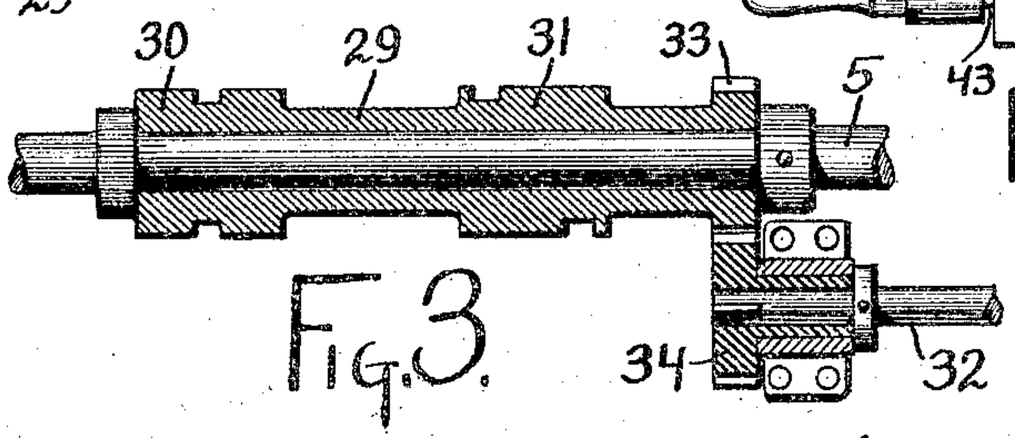


FIG. 3.

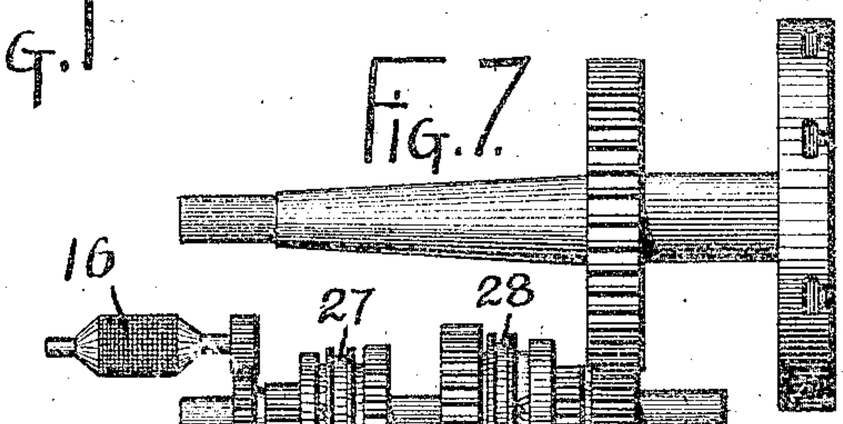


FIG. 7.

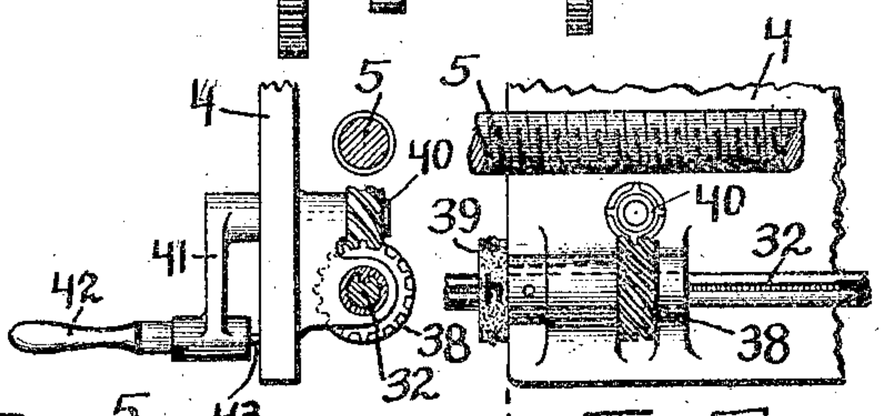


FIG. 4



FIG. 5.

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2 SHEETS—SHEET 2.

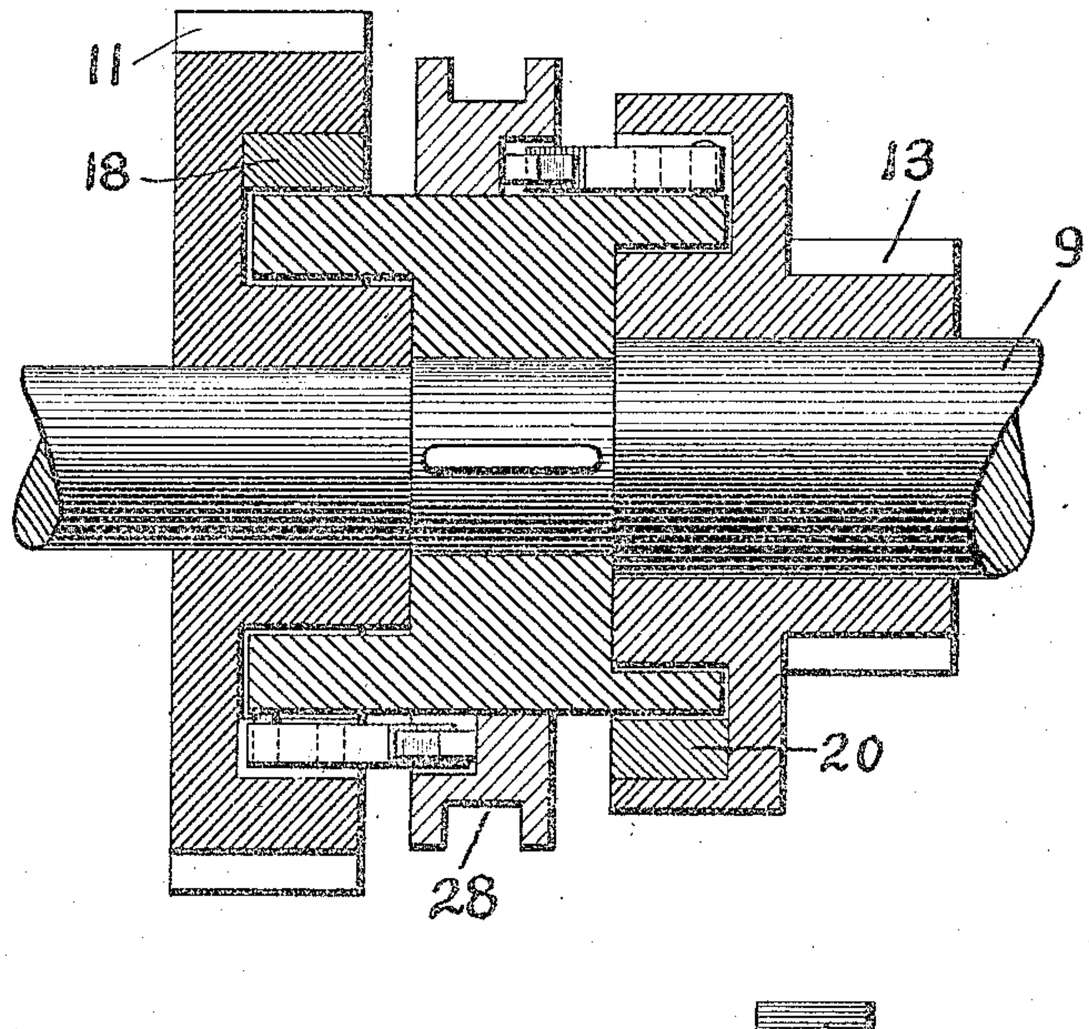


FIG. 8.

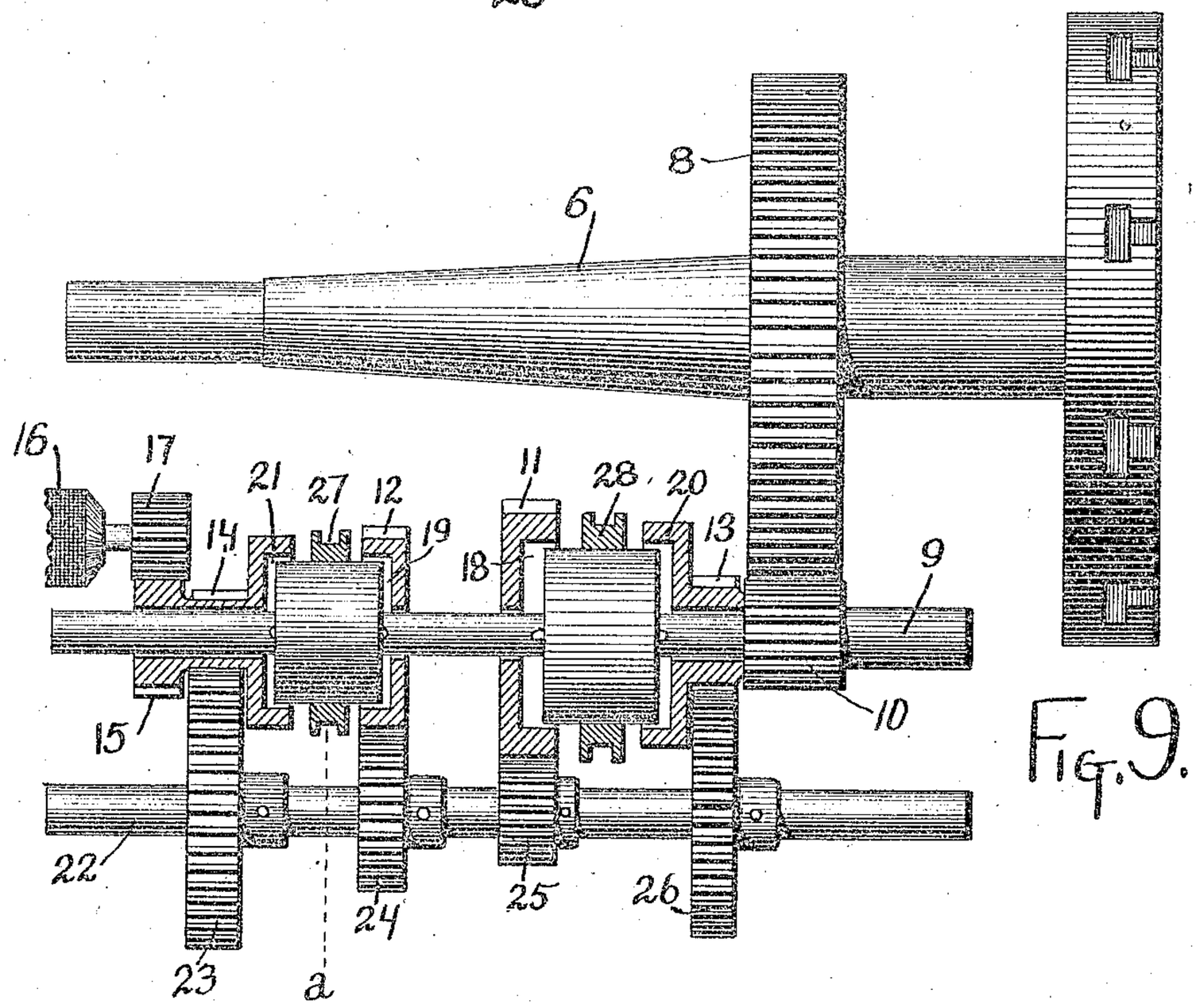


FIG. 9.

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# UNITED STATES PATENT OFFICE.

GEORGE E. GREENLEAF, OF PLAINFIELD, NEW JERSEY, ASSIGNOR TO NILES-BEMENT-POND COMPANY, OF JERSEY CITY, NEW JERSEY.

## LATHE.

No. 842,883. Specification of Letters Patent. Patented Feb. 5, 1907.

Application filed April 20, 1906. Serial No. 312,780.

*To all whom it may concern:*

Be it known that I, GEORGE E. GREENLEAF, a citizen of the United States, residing at Plainfield, Union county, New Jersey, (post-office address care The Pond Machine Tool Co., Plainfield, New Jersey,) have invented certain new and useful Improvements in Lathes, of which the following is a specification.

This invention relating to improvements in lathes will be readily understood from the following description, taken in connection with the accompanying drawings, in which—

Figure 1 is a front elevation of a lathe with sundry parts omitted, embodying an exemplification of my invention; Fig. 2, a vertical transverse section of the same in the plane of line *a;* Fig. 3, a vertical longitudinal section through the speed-changing cam in the plane of line *b;* Fig. 4, an end view of a portion of the carriage-apron, the speed-changing rod and the index appearing in vertical transverse section in the plane of line *c;* Fig. 5, a rear elevation of a portion of the apron; Fig. 6, a plane view of the speed-changing cams; Fig. 7, a diagrammatic or single plane view of the gearing, &c., in the head-stock; Fig. 8, a diametrical section of a typical friction-clutch suited for employment in connection with the head-stock gearing, and Fig. 9 a diagram forming virtually in enlarged duplication of Fig. 7 with the clutch-gears appearing in diametrical section.

In the drawings, 1 indicates the lathe-bed; 2, the head-stock; 3, the carriage; 4, the carriage-apron; 5, the lead-screw; 6, the lathe-arbor; 7, usual gear by which the lead-screw receives its motion from the head-stock gearing, the details of transmission being immaterial to the present invention; 8, a gear fast on the lathe-arbor; 9, a first counter-shaft journaled in the head-stock; 10, a pinion fast on this counter-shaft and engaging gear 8; 11, 12, 13, and 14, gears loose on this counter-shaft and each carrying an element of a clutch; 15, a gear fast with gear 14; 16, the first-motion element of the arbor-driving mechanism, the same being illustrated in the present case as an electric motor; 17, a pinion driven by the motor and engaging gear 15; 18, 19, 20, and 21, the clutch elements before referred to as being carried by the four gears loose on the counter-shaft; 22, a second counter-shaft journaled in the head-stock; 23, 24, 25, and 26, gears fast on the second counter-shaft and engaging, respectively, the clutch-gears on the first counter-shaft, the several pairs of gears being diversely proportioned with a view to a properly-graduated range of speeds; 27, a clutch member carried by the first counter-shaft and adapted for adjustment longitudinally of the shaft, so as to serve in locking either gears 12 or 14 alternatively to the shaft, and 28 a similar clutch member on the first counter-shaft to coöperate with the gears 11 and 13.

The clutches may be of any ordinary suitable type, Fig. 8 illustrating a friction-clutch of a form common in the market, in which the shifting of a circumferentially-grooved ring one way or the other from the neutral position serves in bringing about the expansion, alternatively, of two split rings serving in frictionally locking either of the two gears to the shaft on which the gears are loosely mounted.

At this point it will be apprehended, from a consideration of Fig. 9, that if motor 16 runs at constant speed and the two clutches 27 and 28 be in released position the four gears 11, 12, 13, and 14 will turn idly on first counter-shaft 9. If now clutch 28 be thrown to the left, gear 11 will become locked to the first counter-shaft and that counter-shaft will turn and through the medium of gears 10 and 8 transmit motion to the lathe-arbor at given rate. This condition represents the lowest speed-step in the system. If, however, clutch 28 be released from gear 11 and clutch 27 be thrown to gear 12, then the motion will be transmitted to the lathe-arbor at a higher rate than before. If now clutch 27 be released from gear 12 and clutch 28 be thrown to gear 13, then the lathe-arbor will be driven at a still higher rate. Thus far in the three selections of speed for the lathe-arbor the second counter-shaft 22, with its gearing, has served as a transmitting agent, and, in virtue of its diversity of gearing, as a determining agent for the rate of speed. If, however, clutch 28 be released and clutch 27 be thrown to the left, then gear 15 will be locked to the first counter-shaft and motion will be transmitted to the lathe-arbor at still higher rate than in any of the previous cases, and under this condition the second counter-shaft 22, with its gears, is without office. It is thus seen that four selective speeds are

available for the lathe-arbor, while a constant speed is imparted to pinion 17, the speed for the lathe-arbor being dependent on which of the two clutches is thrown and in which direction it is thrown. It may be here stated that the particular transmission system illustrated is exemplifying only and is manifestly susceptible of great extension and variation.

Proceeding with the drawings, 29 indicates a sleeve mounted for free rotation, being in the present case mounted loosely on the lead-screw near its head end; 30, a circumferentially-grooved cam on this sleeve; 31, a second circumferentially-grooved cam on this sleeve; 32, a splined rod journaled on the front of the lathe-bed and extending the length of the carriage travel thereon; 33 and 34, gears connecting this splined rod with the sleeve 29; 35, a pair of shafts journaled in the head-stock at right angles to the counter-shafts; 36, arms fast on these shafts and having rollers at their free ends engaging the grooves of the cams on sleeve 29, and 37 arms carried by shafts 35 and engaging the shifting clutches on the first counter-shaft.

The cams 30 and 31, as will be apprehended from a study of Fig. 6, have their throwing points so disposed in relation to each other that a continued angular advance of sleeve 29 will first throw one of the clutches in one direction, then release it and throw the second clutch in one direction, and then release the second clutch and throw the first clutch in the direction opposite its first throwing, and then release the first clutch and throw the second clutch in the direction opposite its first throwing, the turning of the sleeve through a proper angle thus putting the speed-selecting mechanism through all of its paces. The sleeve is turned to proper angular position by the turning of splined rod 32, and the speed for the lathe-arbor depends on which of the several cam-lobes is brought into action.

Continuing with the drawings, 38 indicates a gear journaled on the carriage-apron and splined on rod 32; 39, an index-disk mounted on the hub of this gear and bearing a circumferential series of designations indicative, respectively, of the several cam-lobe activities; 40, a gear journaled in the carriage-apron and engaging gear 38 of the splined rod, the gears in the present case being illustrated as of angle type with such proportioning that gear 40 makes four turns for one turn of gear 38; 41, a crank on the spindle of gear 40 at the front of the apron; 42, the handle of this crank; 43, a detent-pin carried by the handle, and 44 two detent-recesses to be selectively engaged by the detent-pin.

The turning of crank 41 obviously results in the turning of the cam-sleeve and in the successive rockings, one way and the other, of the clutch-throwing arms 36. In the illustrated example the lobes of the cams, taken collectively, are equally distributed circumferentially, and as there are four throwing-points provided by the two cams it follows that each quarter-turn of the cam-sleeve will effect a change from one clutch-throwing point to the next one, and consequently from one lathe speed to the next one. If gears 33 and 34 be equal, as is illustrated, then gears 38 and 40, being in the proportion of four to one, it follows that a full turn for crank 41 brings about a quarter-turn for the cams. One of the detent-holes for crank 41 is employed for each of the four different speed adjustments, the other detent-holes serving for the disengaged condition of both clutches. The exposed symbol on the index-disk designates such active speed condition as may have been adjusted for by means of the crank. The gearing connecting handle 41 with the splined rod is of angle or spiral type and when properly proportioned and constructed has the merit of transmitting the crank motion smoothly and powerfully and of bringing the axis of the crank at right angles to that of the rod and the proportioning of the spiral gear or worm, whichever it may be called, on the axis of the crank may be such as to cause the device to be self-holding—that is to say, the reaction on the cams will not result in their angular displacement.

It is to be observed that the construction provides for the complete and continued rotation of the cams by motion of the adjusting-handle in one direction, the handle having two positions, one representing gearing in activity and the other representing all gearing idle. Giving to the handle a continued motion of angular advance thus puts the selection of speeds through a range of gradual increase from minimum to maximum, and the range having been completed a stopping-point is found for the handle preliminary to again beginning the range at the minimum.

The rod-turning device specifically illustrated will be found adequate and commendable; but it is manifest that as their purpose is merely to provide at the lathe-carriage convenient means for turning the rod the contrivance of numerous substitutes for them is well within the capacity of those skilled in the art of lathe construction without departing from the principle of my invention.

All of the specific details illustrated are to be considered as exemplifying only and as showing simply the best mode in which I at present contemplate applying the principle of my invention

I claim—

1. In a lathe, the combination, substantially as set forth, of a bed, a carriage, a head-stock, a lathe-arbor, a first-motion part for imparting motion to the lathe-arbor, select-

ive transmission-gears between said first-motion part and lathe-arbor, a lead-screw, clutches for bringing said gears selectively into action, arms for throwing said clutches, rotary cams mounted loosely on the lead-screw for controlling said arms, a splined rod journaled on the lathe-bed, connections between said rod and cams, a handle carried by the lathe-carriage, and connections between said handle and rod whereby the turning of the handle brings about the turning of the cams and the bringing of the clutches selectively into action.

2. In a lathe, the combination, substantially as set forth, of a bed, a carriage, a head-stock, a lathe-arbor, a first-motion part for imparting motion to the lathe-arbor, selective transmission-gears between said first-motion part and lathe-arbor, clutches for bringing said gears selectively into action, arms for engaging and disengaging said clutches, a completely rotary cam for each arm, each of said cams having a plurality of lobes each of which will actuate its arm, means rigidly uniting the cams so that their lobes together form a complete circular series of lobes in which the lobes on one cam alternate with those on the other cam, a splined rod journaled on the lathe-bed, connections between said rod and cams, a completely rotary handle carried by the lathe-carriage, connections between said handle and rod whereby the continuous turning of the handle brings about the continuous turning of the cams, and means for locking the handle in positions corresponding with the idle and active positions of the cam-lobes.

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