This invention pertains to feed boxes for engine lathes and is particularly related to such change speed and feed boxes which are totally enclosed and in which the operating parts function in a bath of lubricant at all times without external oiling being required on the part of the operator of the machine.

In addition to providing a totally enclosed feed box for lathe, it is another object of this invention to avoid the use of the conventional tumbler gear and pinion to be manipulated by a rocking shifting handle as in the more conventional and open type of feed box.

Still another object of this invention is to provide in a feed box transmission mechanism for a lathe, an arrangement in which all of the feed and thread changes are accomplished by sliding gears mounted on splined shafts, rather than through the less satisfactory method of shifting a tumbler pinion.

And a still further feature of this invention is to provide a single direct reading indicating dial operable by the movement of the fine feed and thread selection lever for indicating all of the various feeds and threads which may be obtained from the box by manipulating the coarse change lever on the box and the change speed gear drive to the box from the work spindle of the lathe headstock.

Further features and advantages of this invention will appear from the detailed description of the drawings in which:

Figure I is a front elevation of the exterior of the feed box incorporating the features of this invention.

Figure II is a diagrammatic section on the line II—II of Figures III and IV showing the arrangement of the gearing in the transmission of the feed box.

Figure III is a cross section through the feed box shown on the line III—III of Figures I and II.

Figure IV is another cross section of the feed box indicated by the line IV—IV in Figures I and II.

Figure V is a fragmentary section through the feed and lead screw drive gearing shown on the line V—V of Figure IV.

Figure VI is a diagrammatic showing of the geared transmission with two changes of speed connecting the power from the work spindle to the feed box input drive shaft.

In this particular arrangement, noting Figure VI, the feed box transmission is driven from the work spindle 1 in the headstock 2 of a lathe upon which it is mounted through the gear 3 fixed on this work spindle 1 and which work spindle is appropriately driven by suitable power transmission mechanism as conventionally used in lathe headstocks. The gear 3 in turn drives a gear 4 fixed on an intermediate shaft 5, upon which is fixed the two gears 6 and 7. On the feed output shaft 8 of the lathe headstock, is slidably mounted the compound gear 9 comprising the gears 10 and 11 which may be slid axially in driving relationship on the shaft 8 by means of a lever 12 on the headstock shown having positions D and E as diagrammatically shown in this Figure VI. By shifting the compound gear 9, the gear 11 may be engaged with the gear 7 to give a slow feed drive to the output shaft 8 or the gear 10 may be shifted into the gear 6, in which case a more rapid rotation of the shaft 8 may be accomplished.

On the outer end of the output shaft 8 is provided suitable change gears 13 and 14, the gear 14 in turn driving a change gear 15 mounted on the input shaft 16 of the feed box transmission.

Noting particularly Figure II, this input shaft 16 is journaled on suitable bearings 17 and 18 mounted in the housing 19 of the quick change box. Slidably mounted on the splined portion of this shaft is the change gear 21 which is arranged to engage a series of different size gears 22 to 30, inclusive, which are journaled on eccentric portions 31 to 39, inclusive, of the eccentric cone of gears shaft 40 in such a manner that at the line of engagement of the pinion 21 with each of these gears 22 to 30, inclusive, the pitch line or position of all of the teeth of each of these gears will lie in the same straight line so that proper engagement will be effected in moving the gear 21 on the splined portion 20 of the shaft 16 into engagement with any of these gears 22 to 30, inclusive. It will be noted that this shaft 40 is fixed in appropriate bushings 41 and 42 in the frame 16 of the feed box, so as to properly hold the various eccentric portions 31 to 39, inclusive on the shaft in proper oriented position with respect to the shaft 16 and its pinion 21.

Journaled parallel to the axis of rotation of the various gears on the eccentric cone gear shaft 40 is the fixed cone of gears shaft 43 journaled on appropriate bearings 44 and 45 carried in the housing 19 of the feed box and upon which shaft is securely fixed the various gears 41 to 55, inclusive, which are each respectively arranged to at all times be in driving engagement with the respective gears 22 to 30, inclusive on the fixed cone of gears shaft 40. It can thus be seen that by
appropriately shifting pinion 21 on the shaft 16 to engage the various gears on the eccentric cone of gears shaft, the shaft 43 may be rotated at appropriate different rates of speed.

Also fixed in driving relationship on the fixed cone of gears shaft 43 is the pinion 58 which at all times drives the gear 57 fixed on the shaft 58 journaled in appropriate bearings 59 and 60 in the frame 19 of the feed box. On the shaft 58 in addition to the gear 57 are two smaller gears 61 and 62, so arranged.

The feed output shaft 63 for the feed box which is journalled in suitable bearings 64 and 65 is provided with a splined portion 66 on which is mounted the shaft 67 comprising the gears 68, 69, and 70, which may be respectively engaged with the gears 57, 61, and 62 fixed on the shaft 58, so that a series of three course feed changes may be effected between the shaft 58 and the shaft 63 in addition to the nine feed changes effected between the input shaft 48 and the shaft 43 by shifting pinion 21, as described. To the output shaft 63 of the feed box is connected the usual feed rod 71 for the lathe apron mechanism.

On this shaft 63 is also provided a driving gear 72 which may be shifted axially on the shaft to engage or disengage it with respect to a gear 73 fixed on the feed screw 14 of the lathe by appropriately sliding the shifter rod 75 by means of the knurled pull knob 76 whereby the yoke 77 fixed on this rod effects the shifting of the gear 72 so that the lead screw may be put in or taken out of operation at will by manipulating this knob 76.

The triple gear 67 is shifted axially on the shaft 63 by means of the shifter mechanism best shown in Figure IV which comprises a shifter handle 78 carried on a rock shaft 79 to which is connected the lever arm 80 which in turn has a pin 81 operating in the slotted portion 82 of the shifter rod 83 carried in appropriate bearings for sliding motion in the feed box housing 19. Noting Figure I, it can be seen that on this shaft 83 is mounted the usual forked shifter yoke 84 which operates in the annular slots 85 formed in the triple gear 67. The lever has indicated three positions, A, B, and C as seen in Figure I representing the respective engagements of the gears 68, 69, 61, and 70—62. The pinion 21 is shifted by means of the apparatus particularly shown in Figures I and III, this apparatus comprising a shifter lever 86 pivotally mounted on a pin 87 fixed in the feed box 19 and having a depending arm on the lower end of which is carried a yoke 88 which engages each side of the gear 21, so that as this shifter arm 86 is swung back and forth the gear 21 will be accurately slid along the splined portion 20 of the shaft 16. In order to effect the accurate careful positioning of this lever arm 86 and to indicate the selected speed obtained by positioning the gear 21 with respect to each of the gears on the eccentric cone of gear shaft 40, a dial shaft 89 is appropriately journalled in the housing 19 and has fixed on its outer end a dial indicating disk 90 having the indexing plunger handle 91 fixed thereon so that the disk 90 may be rotated there- in and locked into position by means of the locking pin handle 92 which has an indexing plunger 93 which enters the various indexing holes 94 formed in the surface 95 provided in the feed box housing 19.

On the inner end of this dial shaft 89 is formed a gear 96 which is arranged to mesh with a segmental gear 97 fixed on the lever arm 65 in such a way that rotation of the dial 90 by means of the handle 91 causes appropriate swinging of the lever arm 65 to shift the gear 21 to its various positions of engagement with the gears on the eccentric cone of gear shaft. One indicating dial disk 90 is provided a dial 97 having appropriate graduations as best shown in Figure I showing the various positions to which the gear 21 has been moved by rotation of the shaft 89 and rocking of the lever 66 to the mechanism as described. A suitable indicating pointer 98 provided on the front of the feed box indicates the selected position and the nature of the gear selection effected by appropriately rotating the disk to the various positions and allowing the indexing plunger 92 to enter the respective indexing plunger holes 93. It is also to be noted that this dial is arranged with a series of letters A, B, C, D, and E indicated in a series of concentric circles, the purpose of which is to show the selection effected in addition to the actual changes effected by the relationship of the shaft 16 to the shaft 43 but also to effect manipulating the lever 70 having positions A, B, and C and the effects of manipulating the lever 12 to positions D, or E, so that by observing the dial and the pointer 98, the operating position produced by the positions of the various control levers on the feed box and headstock, can be instantly and easily determined.

Having thus fully set forth and described our invention what we claim as new and desire to secure by United States Letters Patent.

1. In a change speed transmission, an input shaft, an output shaft located in a predetermined fixed position relative to said input shaft, an intermediate shaft associated with said input and output shafts and having a plurality of eccentric portions formed thereon, a series of gears journalled on said eccentric portions of said intermediate shaft, a gear on said input shaft adapted to be selectively engaged with each gear on said eccentric shaft, and a series of gears, fixed on said output shaft, each in engagement with a gear journalled on said eccentric shaft.

2. In a change speed transmission, an input shaft, an output shaft located in a predetermined fixed position relative to said input shaft, an intermediate shaft having a plurality of eccentric portions thereof, so that said portions all lie tangent to a plane parallel to the axis of rotation on said input shaft, a series of gears journalled on said eccentric portions of said intermediate shaft, a gear on said input shaft adapted to be selectively engaged with each of the gears on said eccentric shaft, and a series of gears fixed on said output shaft, each in engagement with one of the gears on said intermediate shaft.

3. In a change speed transmission, an input shaft, an output shaft located in a predetermined fixed position relative to said input shaft, an intermediate shaft positioned parallel with said input and output shafts, a series of eccentric portions formed on said intermediate shaft, a series of gears journalled one on each of said eccentric portions, a driving pinion slidably mounted on said input shaft for selective engagement with each gear on said intermediate shaft, and a series of gears fixed on said output shaft each adapted to engage one of the gears on said intermediate shaft.

4. In a change speed transmission, a frame, an input shaft journalled in said frame, an output shaft journalled in said frame with its axis in a
fixed predetermined spaced position parallel to said input shaft, an intermediate shaft having a series of eccentric portions formed thereon, the axes of said eccentric portions being each parallel with said input and output shaft axes, a gear journaled on each one of said eccentric portions of said intermediate shaft, a driving pinion axially movable on said input shaft for selective engagement with each gear on said eccentric shaft, and a series of gears fixed on said output shaft each meshing with a gear on said eccentric shaft.

5. In a change speed transmission, a frame, an input shaft journaled in said frame, an output shaft journaled in said frame with its axis in a fixed predetermined spaced position parallel with the axis of said input shaft, a multiple eccentric shaft fixed in said frame and having a plurality of eccentric portions formed thereon, the axis of each of said portions being parallel with said input and output shafts, a series of gears journaled on the eccentric portions of said intermediate shaft, a driving pinion axially slidable on said input shaft arranged for selective engagement with each gear on said eccentric shaft, and a plurality of gears fixed on said output shaft each engaging a gear on said eccentric shaft whereby power may be selectively applied from said input shaft to said output shaft for effecting different rates of speed of rotation between said shafts.

6. In a change speed transmission, a frame, an input shaft journaled in said frame, an output shaft journaled in said frame in a fixed predetermined spaced position parallel with said input shaft, an intermediate multiple eccentric shaft fixed in said frame having a series of eccentric portions formed thereon so that all of said eccentric portions lie tangent to a plane which is perpendicular to a plane passing through the axes of rotation of said input and output shafts, a plurality of gears journaled on said eccentric portions of said intermediate shaft, a driving pinion movably mounted on said input shaft for selective engagement with each of said gears on said eccentric shaft, and a series of gears fixed on said output shaft each in engagement with a gear on said eccentric shaft.

7. In a change speed transmission, a frame, an input shaft journaled in said frame, an output shaft journaled in said frame with its axis in a fixed predetermined spaced position parallel to the axis of said input shaft, a multiple eccentric shaft fixed in said frame between said input and output shafts and having a series of eccentric portions whose axes are parallel to the axes of said input and output shafts and which axes lie in a plane defined by the axes of said input and output shafts, a series of gears journaled on each of said eccentric portions of said intermediate shaft, a gear movable axially on said input shaft for selective engagement with each gear on said eccentric shaft, and a series of gears, fixed on said output shaft, each arranged in engagement with a gear on said eccentric shaft.

8. In a change speed transmission, a frame, an input shaft journaled in said frame, an output shaft journaled in said frame with its axis in a fixed predetermined spaced position parallel to the axis of said input shaft, an intermediate shaft located between said input and output shaft and having a series of eccentric portions whose axes are parallel to and lie in a plane defined by the axes of said input and output shaft and which eccentric portions are tangent to a plane perpendicular to the plane defined by said axes of said input and output shafts, a series of gears journaled on the eccentric portions of said intermediate shaft, a driving pinion slidable on said input shaft so as to selectively engage each of said gears on said eccentric shaft, and a series of gears fixed on said output shaft adapted to engage each of the gears on said eccentric shaft.

9. In a change speed transmission, an input shaft, an output shaft located in a predetermined fixed position relative to said input shaft, a cone of gears fixed on said output shaft, a series of gears journaled on an intermediate shaft, a gear on said input shaft selectively engageable with said series of gears, said series of gears having all of their pitch diameters lying in a common plane perpendicular to a plane defined by the axis of said input and output shafts and which series of gears are intermeshed with each gear of said cone of gears fixed on said output shaft.

WILLIAM F. GROENE.
GEORGE W. LUNING.