W. SCHELLENBACH.

CHANGE GEAR MECHANISM.

APPLICATION FILED OCT. 28, 1912.

1,067,142.

Patented July 8, 1913.

2 SHEETS—SHEET 1.

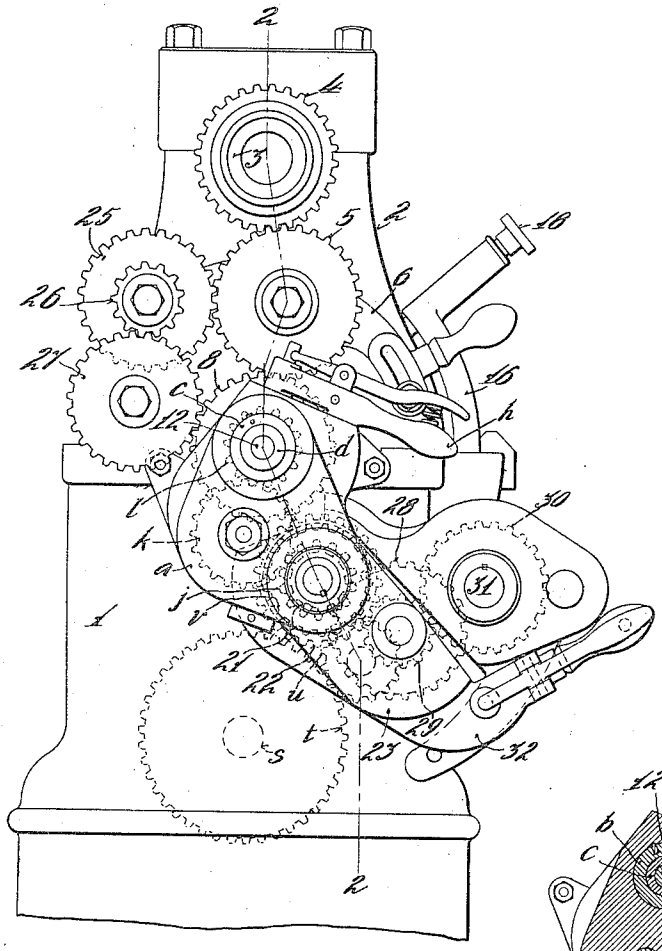


Fig. 1.

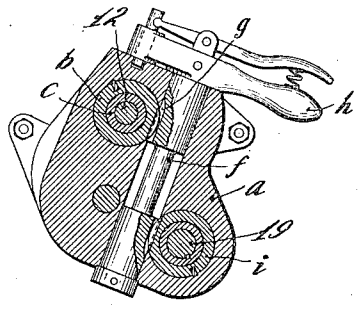


Fig. 3.

Witnesses

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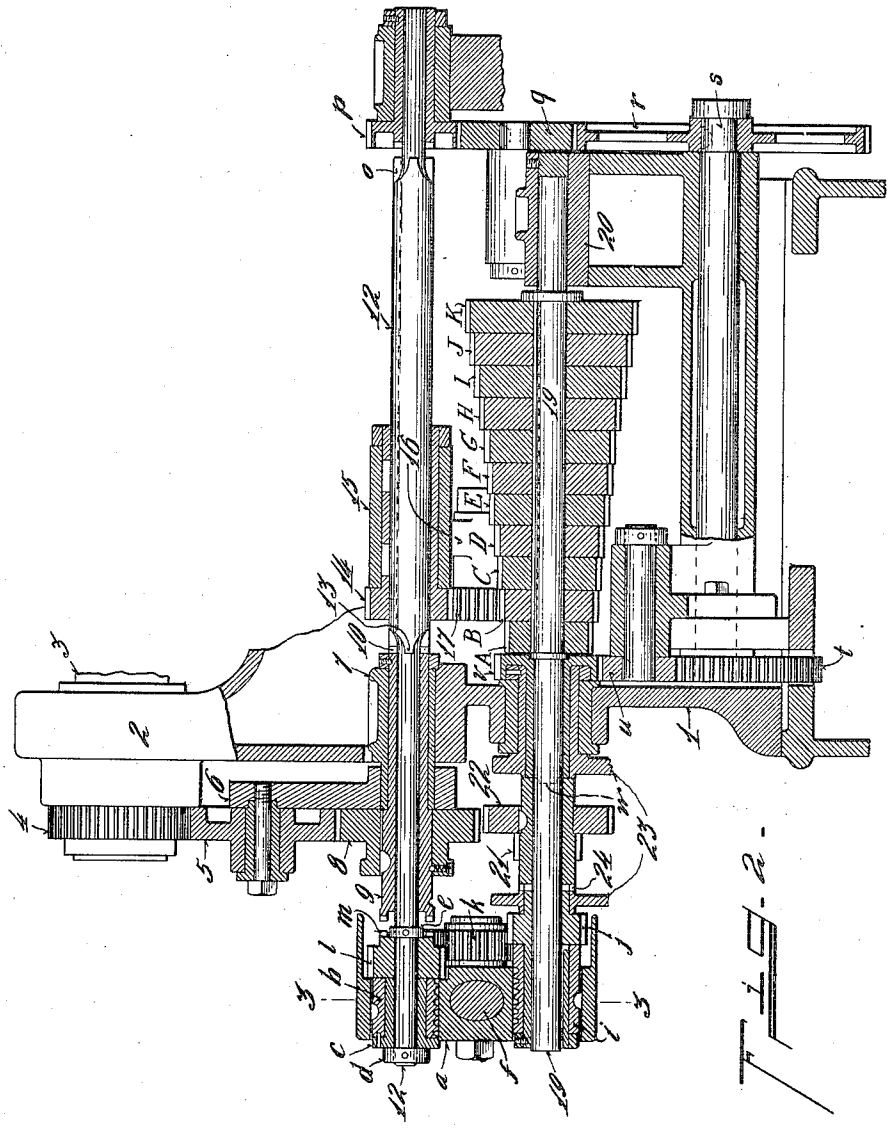


Fig. 2.

Witnesses

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UNITED STATES PATENT OFFICE.

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CHANGE-GEAR MECHANISM.

1,067,142. Specification of Letters Patent. Patented July 8, 1913.

Application filed October 28, 1912. Serial No. 728,327.

To all whom it may concern:

Be it known that I, WILLIAM SCHELLENBACH, a citizen of the United States, residing at Hartwell, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Change-Gear Mechanism, of which the following is a specification.

This invention relates to means for enabling a member to be fed at a rate corresponding either to any one of a plurality of so-called English pitches, or to any one of a plurality of so-called metric pitches, and to enable the change to be effected quickly and in a simple manner; but in a more concrete sense, it proposes an instrumentality forming a part of a screw cutting apparatus, as in a lathe, in which by the simple movement of a system-change lever, either English or metric threads will be cut and in which another lever may be moved to enable any thread of either the English or metric systems to be cut.

Another object is to provide an arrangement such that the manufacturer may use a standard construction adapted for satisfying the demands of customers wishing to cut English threads only, and to correlate with this standard construction certain simple elements adapted to be readily applied to the same, to extend its capacity, whereby the apparatus may also cut metric threads with equal facility.

Another object is to devise a mechanism whereby either English or metric threads may be cut, without any operation other than the simple movement of a system-change lever, and whereby threads of various ranges can be readily cut in either of the pitches by positioning a tumbler or "pitch" lever in its standard notches.

Another object is to devise a mechanism for cutting either English or metric pitches and in which the conversion will be effected in a very simple and direct manner and in a way avoiding confusion on the part of the operator due to the reverse movements of designating pitches adopted in the respective standards.

Other objects will be in part obvious from the annexed drawings, and in part indicated in connection with the following description.

In order that this invention may be made more readily comprehensible to those skilled in this art, drawings illustrating one of the many possible embodiments thereof have been appended as a part of this disclosure, and in such drawings like characters of reference denote corresponding parts throughout all the figures, of which:—

Figure 1 illustrates an end elevation of a lathe to which this invention has been applied. Fig. 2 is a section taken through line 2—2 of Fig. 1, showing the details of one manner of arranging this invention. Fig. 3 is a section taken through line 3—3 of Fig. 2, showing further details of a shifting mechanism such as may be used in connection with this invention.

As rendering better understood the general character of this invention, it may be here noted that in the English or Whitworth system, the index is based on the number of threads in a unit of length (the inch); while in the metric system, the index is based on the size of each thread, *i. e.*, the number of length units (millimeters) in each thread. Consequently, as the index of the English system increases, say along the series 32, 36, 38, 40, etc., the threads become progressively finer. Conversely, however, as the index of the metric system, increases, say along the series 1mm., $1\frac{1}{8}$ mm., $1\frac{3}{16}$ mm., $1\frac{1}{4}$ mm., the threads become progressively coarser. In devising an attachment to cut in either system it is therefore highly desirable to preserve the order of the index series customary in each case, to prevent confusion, and in shifting the mechanism from one system to the other it must therefore also operate to cut progressively finer threads in the English shift, and progressively coarser threads in the metric shift, with an ascending series of index numerals in both cases. Now, in older forms of single-system thread cutting devices, it was usual to effect the necessary changes of relative speeds by removing one or more of the gears between the work turning spindle and the tool carrier and substituting others to change the gear ratio. This was done by hand and was troublesome and easily permitted of errors. By subsequent improvements, the gears in single-system devices were all mounted in a casing and an arrangement was made so that by merely shifting a tumbler lever from one notch or hole to another, the proper ratio automatically would be obtained. This was a great convenience, but as the holes or notches indicated an ascending series applicable say to

the English system, they would not apply for the converse series of the metric system if the customary index order is to be preserved unless a permanent rearrangement be made in the construction of the gear box. By this invention, however, it becomes possible in a double-system thread cutting device, to overcome these difficulties so that, by the simple shifting of a system-change lever, when the other tumbler lever is moved and set at holes A, B, C, D, etc., the device will cut English threads 32, 36, 38, 40, respectively, or it will cut metric threads 1 mm., $1\frac{1}{8}$ mm., $1\frac{3}{16}$ mm., or $1\frac{1}{4}$ mm., respectively, notwithstanding the converse status of the customary index of these two systems. Continuing now by way of a more complete disclosure of the underlying principles and features of this invention, it may be stated that the description, while dealing largely with specific features is to be taken in an illustrative or explanatory sense, rather than in a limiting sense, inasmuch as the features of the invention may assume different forms from that shown, as will be readily comprehended by those skilled in the art in the light of this disclosure. It will suffice to show this mechanism in connection with certain parts of an engine lathe without entering into a detailed description of conventional lathe elements.

In Fig. 1, 1 indicates the head-stock end of the bed of a lathe embodying this invention and 2 denotes the head stock casting, in which is journaled the spindle 3 that revolves the piece to be threaded. It will be understood, of course, that the thread cutting tool is in such cases mounted on a tool carriage adapted to slide on slide-ways provided by the bed of the lathe, and that a so-called lead screw operates to propel such carriage. These parts being purely conventional, will be adequately comprehended by those skilled in the art, and hence require no illustration other than as indicated by Fig. 1. Intervening between such spindle and lead screw is arranged gearing so designed as to insure the proper ratio of movements between the work and the tool required for the cutting of the predetermined thread or threads. In the example shown, a gear 4 is keyed to the left hand end of the spindle. This gear communicates motion to an intermediate gear 5 carried by an arm 6 journaled on a bearing 7 so that this gear may be readily interchanged in position by others to reverse movements, or change the speed ratios. Thus, by swinging the arm 6, gear 25 may be brought into mesh with gear 4 (see Fig. 1), to act through gear 5 to reverse the motion. Or by sliding gear 8 to the left, it will mesh with gear 27 and receive motion through pinion 26 and gear 25 to reduce the speed ratios. The gear 5 in turn meshes with a gear 8 splined to a tumbler sleeve 9, also mounted in the bearing 7 and having a clutch 10 at its right hand end. The clutch 10 becomes effective when English or Whitworth threads are to be cut. It will be convenient in continuing this description first to describe the parts as arranged for cutting English threads, and then explain how the metric threads are cut.

In cutting English threads the parts are positioned as shown by Fig. 2. Passing freely through the bore of the sleeve 9 is a tumbler shaft 12, which is in this case rotated directly by the sleeve 9, and to this end it carries a clutch 13 that is brought into locking relation with the sleeve-clutch 10, by translating the shaft 12 to the left. The means for shifting this shaft will be described presently. Splined to this tumbler shaft is a gear 14 that is intended to be brought into mesh with any one of a series of gears, so to vary the gear ratio that a corresponding one of a range of threads may be cut. To enable this gear 14 to be shifted longitudinally on the tumbler shaft, there is provided a part 15 in which such gear is journaled, and an arm 16 extends from such part and forms a hand-actuated member, which may be provided with a plunger stop 18 coöperating with a plurality of holes or notches having the purpose of fixing the position of the gear 14 through the aforesaid parts. An intermediate or tumbler gear 17 is shown, also carried on the swinging and shifting arm 16 to serve as a means instrumental in enabling the gear 14 to be geared to gears of the different diameters necessary for obtaining the different ratios. These change-ratio gears are indicated by A to K, included, and are all keyed on the cone-gear shaft 19 that is journaled at its right hand end in a fixed bearing 20. Thus, in cutting English threads, the motion is transmitted through the gears and parts aforesaid to either of the gears A, B, C, etc., which in this case are driven directly by the intermediate gear 17 (in the metric these gears are drivers for gear 17) and these turn shaft 19 at a rate corresponding to the thread to be cut. Of the parts shown, the gears 21 and 22 are those ultimately driven in either the English or the metric shift. These gears are contained within a casing indicated by 23, and indirectly connect with the lead screw 31 (see Fig. 1), through any suitable compound gearing as will be readily understood by those skilled in this art. Thus, the large gear 28 meshes with the small gear 21, and the gear 29 meshes with the large gear 22, and both these gears 28 and 29 are mounted on swinging arm 32 so that either may be brought into mesh with the slide gear 30 on the lead screw 31. In the English shift they are driven by the cone-gear shaft 19 by being in effect clutched directly thereto,

while in the metric shift, they are driven at a different speed from the shaft 19 by other means. Such gears 21 and 22 are therefore normally freely mounted on the shaft 19, and have a clutch 24 adapted to be engaged with a companion clutch member on a gear splined to the shaft 19, so as to be enabled to be shifted out of engagement to free the gears 21 and 22 from the shaft 19 when metric threads are to be cut.

The metric thread cutting may now be described, and in explaining the means instrumental in so doing, it will be convenient to use lower case alphabetical letters in designating parts other than those already described.

Arranged at the left hand ends of the shafts 12 and 19 is the shifting mechanism shown in detail by Fig. 3. This consists of a supporting casting *a* having upper and lower holes. In the upper hole is contained a rack-sleeve *b* that is splined therein and is loosely mounted on the tumbler shaft 12, as by means of a bushing *c*. Collars *d* and *e* restrain this rack-sleeve from longitudinal movement with respect to the tumbler shaft 12 so that the latter may be shifted axially by moving the rack sleeve *b*. To enable this to be done, a shaft *f* is journaled in the casting *a* and is provided with a gear *g* meshing with the teeth of the rack sleeve *b*. The shaft *f* terminates in an operating lever *h* having some conventional means for holding it in its predetermined positions; as for example, a spring plunger operating in suitable holes or notches in the casting *a*. In the other hole and on the other side of the shaft *f* is a second rack sleeve *i* also splined therein and meshing with a gear on the shaft *f*, as in the case of the sleeve *b*. The sleeve *i* is revolubly journaled on the hub of a gear *j* that is in turn splined to the shaft 19 and also has a bearing in the wall 23 of the compound gear casing. A gear *k* is also mounted on the casing *a* and meshes on the one hand with gear *j* and on the other hand with a gear *l* that is loosely mounted on the tumbler shaft 12 and has a clutch *m*. Now, when the system change lever *h* is turned clockwise, the tumbler shaft 12 is moved longitudinally to the right until the clutch *m* engages its companion member on the sleeve 9 and the clutch at 10 simultaneously becomes disengaged. The effect of this is that the tumbler shaft 12 is freed from direct driving engagement with the sleeve 9, and, as will presently appear, it is driven from the cone of gears instead of being the driver for such cone. The gear *l*, now being clutched to the sleeve 9, is driven thereby (independently of shaft 12) and it turns the gear *k*, and, through the latter, the gear *j* is rotated. The shaft 19 is then driven in turn, but it is to be noted that the clutch 24 is now disengaged (by the movement to the left of the rack-sleeve *i* by the shaft *f*) and the gears 21 and 22 now may be moved independently of the cone-gear shaft 19 which is driven by gear *j*. Either of the cone of gears A, B, C, etc., will now drive the tumbler gear 17 and the gear 14 will be driven and, as it is keyed directly to the tumbler shaft 12, the latter is now driven at a rate corresponding to which of the gears A, B, C, etc., are in mesh. When the tumbler shaft 12 was moved to the right, a clutch *o* thereon was engaged with a companion clutch on a gear *p* that is journaled in a stationary bearing and loosely receives the end of the tumbler shaft 12 and supports the same. This gear now drives the intermediate *q* and the latter turns a gear *r* keyed to a shaft *s*. These gears are so ratioed as to provide the constant necessary to effect a conversion of the relative movements of the parts so as to satisfy the requirements of the metric system. The shaft *s* at its other end drives the gear *t* that in turn meshes with an intermediate *u* which meshes with and drives the gear *v* that is journaled in a bearing formed by a hub from the casing 23. The gear *v* is loose on the shaft 19, but it is clutched to the gears 21 and 22 by means of the tenent clutch *w* so that the latter are now rotated by gear *v* independently of the shaft 19, and at the rate or rates required for cutting the metric threads. When, for cutting English threads, the clutches 10 and 24 are engaged, and the clutches *m* and *o* are disengaged, the gears *j*, *k*, and *l* as well as the gears *v*, *u*, *t*, *r*, *q* and *p* turn ineffectively. This train from *p* to *v* constitutes an evaluating gearing that introduces the constant or factor in the system necessary to enable the gears C to K to be used in an order inverse to that employed for the English system, whereby the metric system is available in the way that foreigners are accustomed to. Thus, when this evaluating gearing is thrown in, the gear ratios are such that change-gears C, D, E, etc., will exactly correspond to a given well-known standard pitch in the metric system, thus avoiding irregular pitches. The same condition prevails also for the English system. By making this evaluating gearing an automatically available element of this arrangement, a great convenience is afforded the user, and by bringing it compactly and simply into the mechanism, the cost of production is reduced and its desirability enhanced.

I therefore claim and desire to secure by Letters Patent:—

1. An apparatus of the nature disclosed combining a driving member, a driven member, a series of gears intervening between said driving and driven members, an intermediate gear, and shifting mechanism for connecting said series of gears with said driving member independently of said in-

termediate gear to enable motion to be transmitted in a given sequence through said series of gears or through said intermediate gear in a reverse sequence through said series of gears to said driven member.

2. An apparatus of the nature disclosed combining two shafts, a driving gear journaled on one shaft, a gear keyed to said other shaft, a driven member, a series of gears intervening between said shafts, ratio evaluating gearing, and shifting mechanism adapted in one position to clutch the driving gear with said shaft to connect said gear series in one order including said evaluating gearing with said driving gear, and adapted in another position to gear said driving gear with said other shaft to connect said gear series in a reverse order with said driving gear and simultaneously to eliminate said evaluating gearing.

3. An apparatus of the nature disclosed combining a first shaft, a gear having a fixed movement ratio therewith, a second shaft, speed change gearing between said gear and said second shaft, a driving gear journaled on said first shaft, a driven gear journaled on said second shaft, a gear journaled on said first shaft having a driving connection with said driven gear, clutches on said first shaft, and means for longitudinally translating said first shaft in one direction to clutch it with said driving gear or in an opposite direction to clutch it with said gear.

4. An apparatus of the nature disclosed combining a first shaft, a gear having a fixed movement ratio therewith, a second shaft, speed change gearing between said gear and said second shaft, a driving gear journaled on said first shaft, a driven gear journaled on said second shaft, a gear journaled on said first shaft and having a driving connection with said second shaft, another gear journaled on said first shaft and having a driving connection with said driven gear, clutches between said driving gear and first shaft, and between said first shaft and said other journaled gear, and between said driving gear and said first mentioned journaled gear, and means for simultaneously unclutching said first mentioned clutch and simultaneously engaging said other clutches.

5. An apparatus of the nature disclosed combining a first shaft, a gear having a fixed movement ratio therewith, a second shaft, speed change gearing between said gear and said second shaft, a driving gear journaled on said first shaft, a driven gear journaled on said second shaft, gearing extending from said second shaft to said driving gear, a clutch between said driving gear and said gearing, a clutch between said driven gear and said second shaft, gearing extending from said driven gear to said first shaft, a clutch between said first shaft and said gearing, a clutch between said driving gear and said first shaft, and means for simultaneously clutching the last two mentioned clutches and unclutching the remaining clutches, or for clutching the remaining clutches and unclutching said last two clutches.

6. An apparatus of the nature disclosed combining a driving member, a driven member, a series of gears intervening therebetween, ratio evaluating gearing, and means adapted in one position to connect said gear series in one order together with said gearing with said driving member, and adapted in another position to connect said gear series in a reverse order with said driving member and to eliminate said evaluating gearing.

In testimony whereof, I have hereunto set my hand.

WILLIAM SCHELLENBACH.

Witnesses:

OLIVER B. KAISER,

CLARENCE B. FOSTER.