

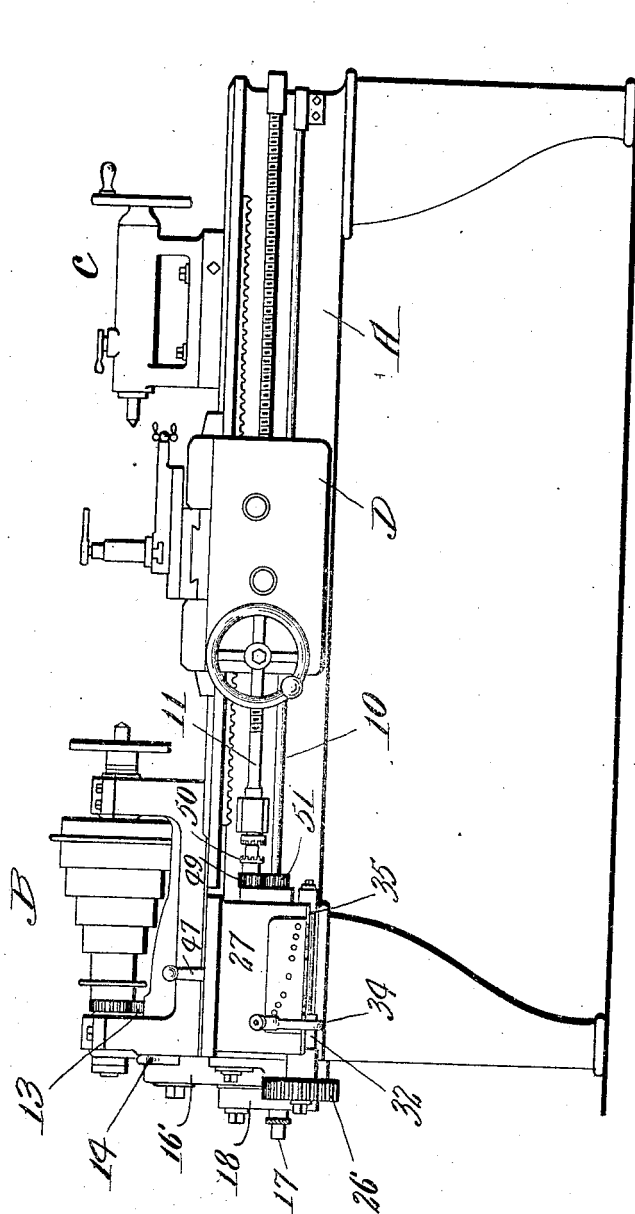
No. 810,634.

PATENTED JAN. 23, 1906.

H. L. FLATHER.  
CHANGE SPEED GEARING FOR ENGINE LATHES.

APPLICATION FILED MAY 19, 1905.

4 SHEETS—SHEET 1.



*Fig. 1.*

*witnesses:*  
*G. F. Mason.*  
*E. M. Allen.*

*Inventor:*  
*H. L. Flather.*  
*Attorneys*  
*Southgate & Southgate*

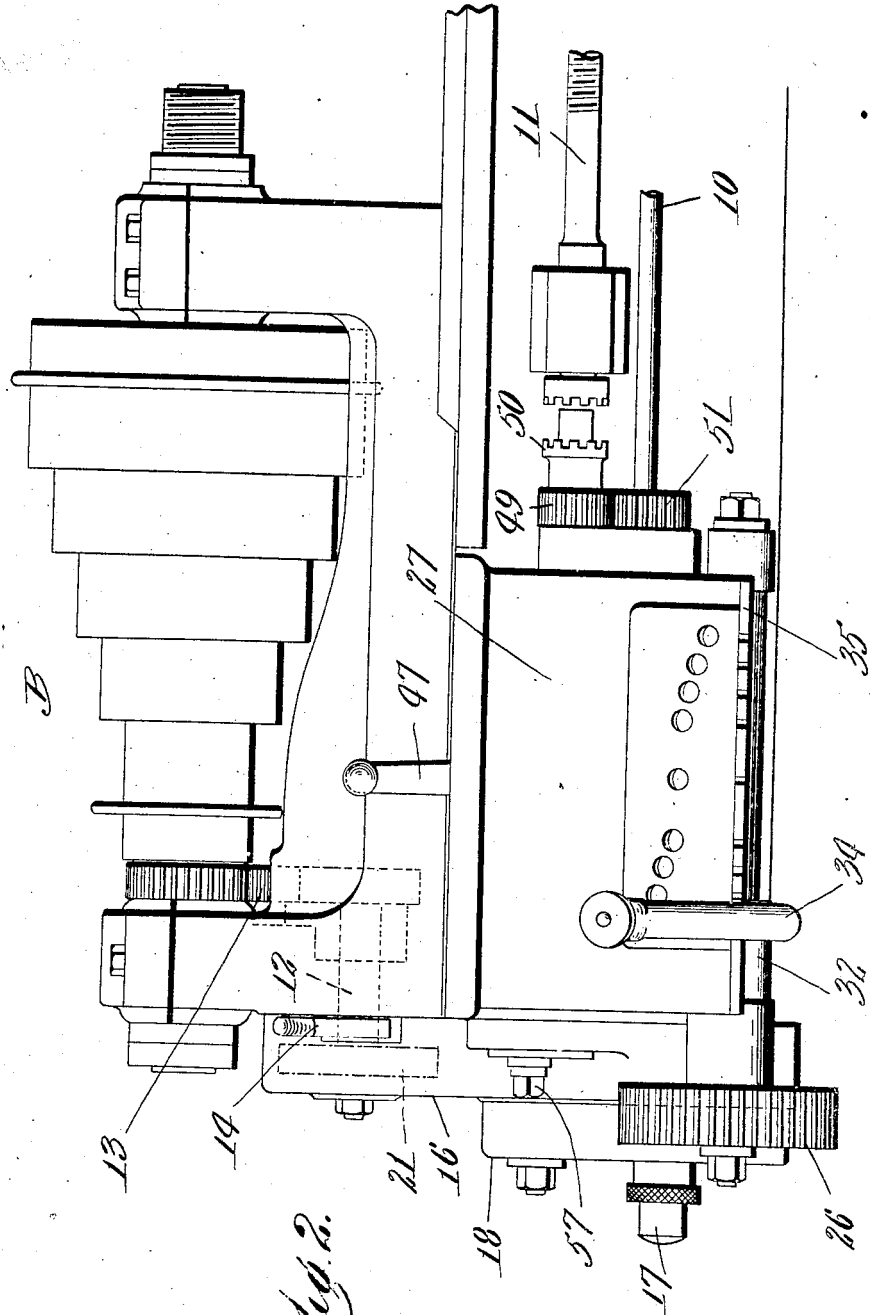
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4 SHEETS—SHEET 2.



*Fig. 2.*

*witnesses:*  
*G. F. Messer.*  
*E. M. Allen.*

*Inventor:*  
*H. L. Flather.*  
*By Attorneys*  
*Southgate & Southgate*

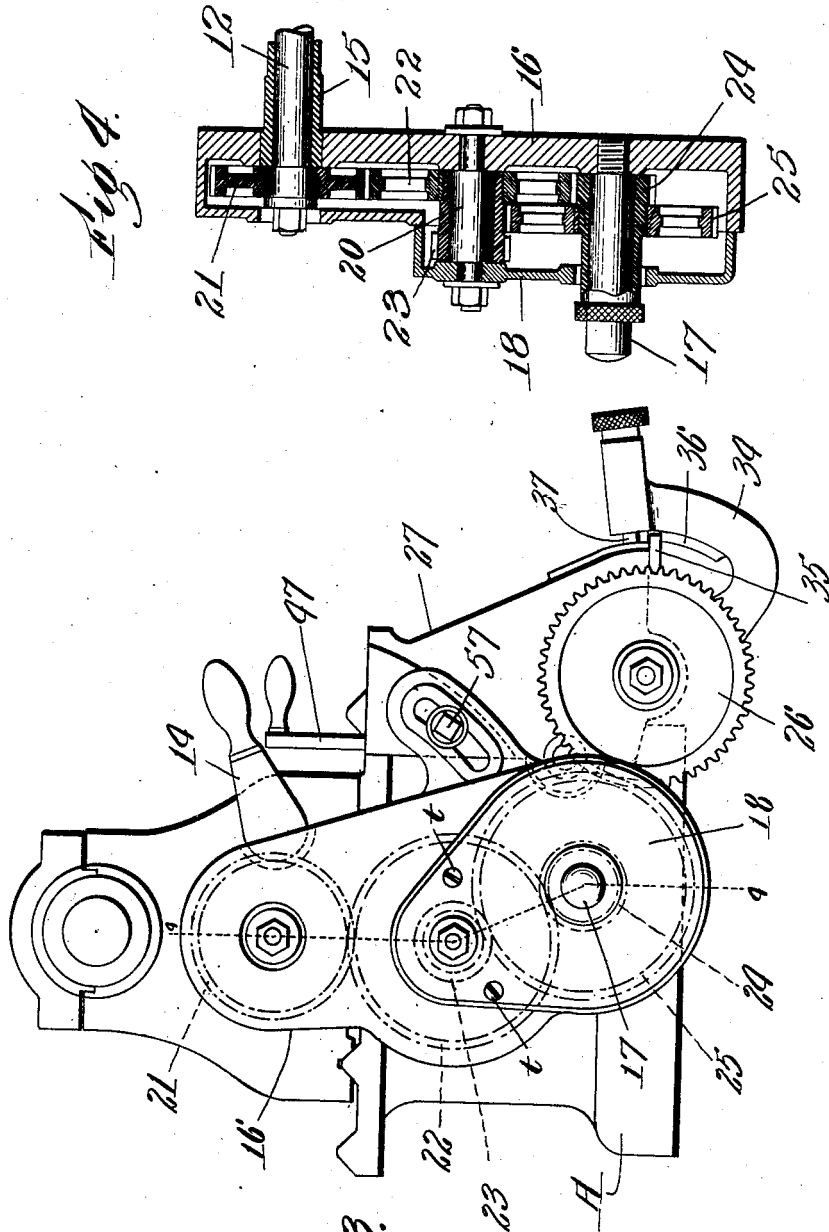
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4 SHEETS—SHEET 3.



Witnesses:  
G. F. Messon.  
E. M. Allen.

Fig. 3.

In Witness:  
H. L. Flather.  
By Attorneys  
Southgate & Southgate

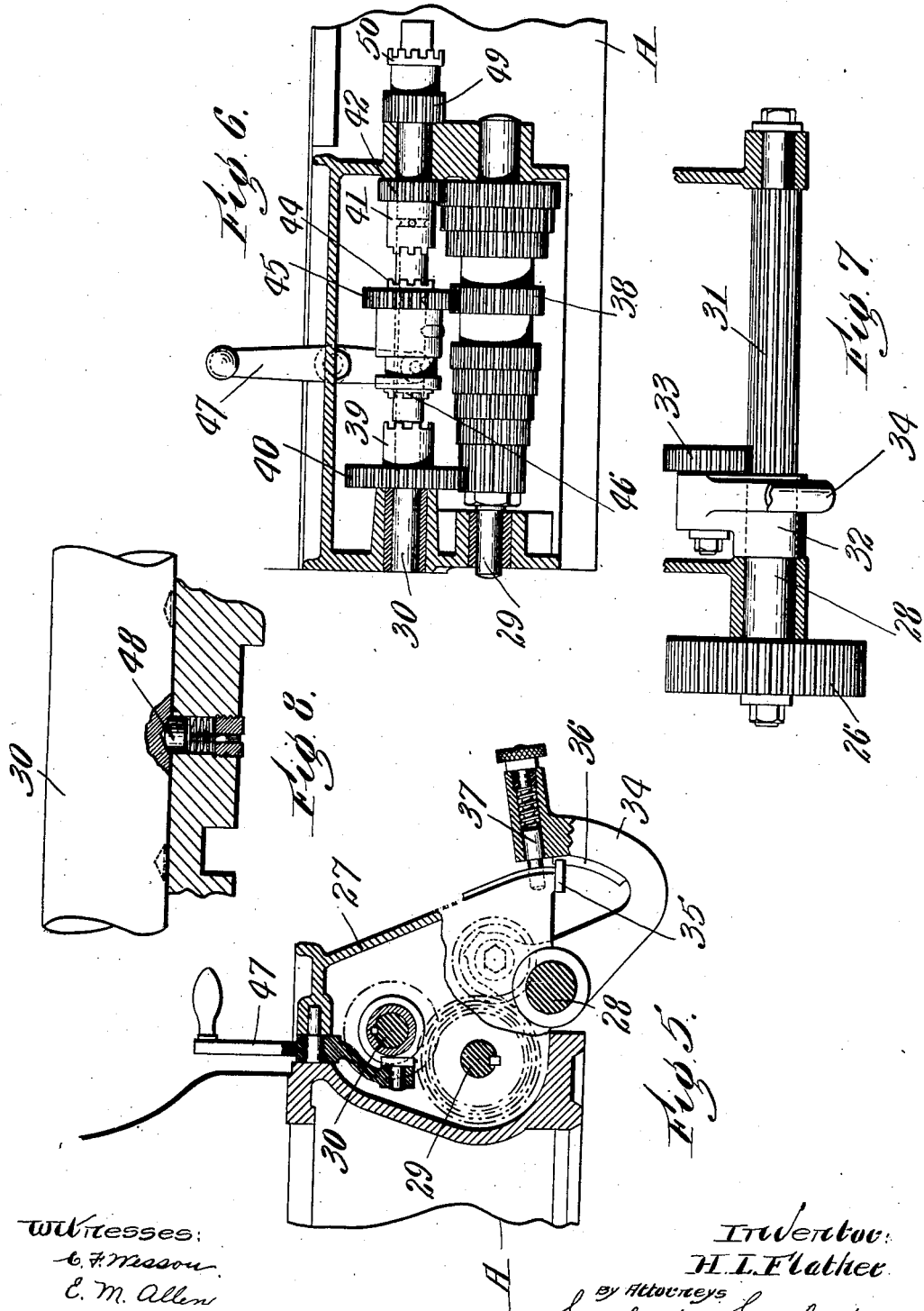
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4 SHEETS—SHEET 4.



Witnesses:  
C. F. Mason  
E. M. Allen

Inventor:  
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# UNITED STATES PATENT OFFICE.

HERBERT L. FLATHER, OF NASHUA, NEW HAMPSHIRE.

## CHANGE-SPEED GEARING FOR ENGINE-LATHES.

No. 810,634.

Specification of Letters Patent.

Patented Jan. 23, 1906.

Application filed May 19, 1905. Serial No. 261,190.

*To all whom it may concern:*

Be it known that I, HERBERT L. FLATHER, a citizen of the United States, residing at Nashua, in the county of Hillsboro and State of New Hampshire, have invented a new and useful Change-Speed Gearing for Engine-Lathes, of which the following is a specification.

This invention relates to a change-speed gearing designed to provide a variety of speed changes secured by simple and direct adjustments without the removal or replacement of parts.

This change-speed gearing has been especially designed for engine-lathes, although it may be otherwise employed, if desired.

The detail object of this invention is to provide a change-speed gearing, especially for engine-lathes, which can be economically manufactured and put in place and which can be manipulated to actuate either a lead-screw or feed-rod and which will have the capacity of producing a greater number of speed changes in a simpler and more direct manner than devices of this kind which have heretofore been employed.

To these ends this invention consists of the change-speed gearing and of the combination of parts therewith, as hereinafter described, and more particularly pointed out in the claims at the end of this specification.

In the accompanying four sheets of drawings, Figure 1 is a side view of an engine-lathe provided with a change-speed gearing constructed according to this invention.

Fig. 2 is an enlarged view of the head-stock portion of the lathe. Fig. 3 is an end view thereof. Fig. 4 is a sectional view on the line 4 4 of Fig. 3 of the gear-box, which incloses the primary speed-train and which can be clamped in different positions to act as a sweep. Fig. 5 is a transverse sectional view of the change-speed gear-box. Fig. 6 is a longitudinal sectional view thereof. Fig. 7 is a detail view of the primary shaft of the gear-box, and Fig. 8 is a detail view of the retaining-catch for holding the triple clutch in either one of its three positions.

In that class of change-speed gearing for engine-lathes to which this invention relates the older constructions employ two speed-changing trains. In these constructions the resulting number of speed changes equals the product of the number of changes secured by the feed-trains. In modern machine-shop practice it has been found desirable to pro-

vide even more speed-change trains, and in a number of instances it has already been proposed to provide change-speed gearing with three change-gear trains, so that the number of speed changes may be still further multiplied. In a change-speed gearing for engine-lathes constructed according to my invention I preferably provide a three-train change-speed gearing, which comprises a train from the lathe-spindle, having one compound gear, which may shift laterally, and a gear-box at the front of the lathe, having two speed-changing trains therein. In an engine-lathe constructed according to my invention the total possible number of speed changes is equal to the product of the number of the changes in the primary speed-changing train multiplied by the number of changes secured by first speed changing the mechanism of the gear-box and then multiplied by the number of changes of the second speed-changing mechanism of the gear-box. In practice I have designed a construction to secure a possible total of fifty-four speed changes, very few, if any, of which need be duplicates, and I have designed the parts to secure this result with a simple and direct mechanism comprising comparatively few gears or other parts.

Referring to the drawings and in detail, as shown in Fig. 1, the engine-lathe herein illustrated comprises a lathe-bed A, a head-stock B, a tail-stock C, and a traveling carriage D. The traveling carriage D may be actuated by the feed-rod 10 or the feed-screw 11. Journaled in the head-stock is a shaft 12, which is driven from the head-stock spindle by means of tumbler-gears 13, which are arranged to turn the shaft in either direction. These tumbler-gears consist of two intermediate gears arranged on a lever mounted on the shaft 12, one of which intermeshes or engages a pinion on the shaft 12, and by rocking said lever power can be taken through one or both of said intermediates to secure either direction of feed desired. This is a common construction in lathes and is not detailed herein, as it forms no part of the present invention. The tumbler-gears may be shifted by a handle 14.

As shown most clearly in Fig. 4, the shaft 12 is journaled in a bushing 15, which extends from the head-stock. Mounted to swing on the bushing 15 is a box or gear-casing which incloses the gearing forming the primary speed-change train of a lathe equipped according to my invention. As herein illustrated, this box or gear-casing consists of a

casting 16 and a cover-plate or casting 18. The parts 16 and 18 are fastened together by a stud 20 and by small tap-bolts *t*. (Shown in Fig. 3.) The stud 20, which fastens the body 16 and cover 18 of the gear-box, also forms the bearing of an intermediate gear of the speed-change train, and in order that this stud be set to proper position, so that the gear running thereon will mesh properly with other gears of the train, the holes which receive the projecting ends of the stud 20 are somewhat larger than the diameters of said projections, so that the stud can be moved to different positions and yet will hold the parts rigidly together when its nuts are tightened. The gears inclosed in this gear-casing comprise a driving-gear 21, secured on the shaft 12, a double intermediate consisting of a large gear 22, and a small gear 23, carried by a sleeve on the stud 20. The large gear 22 and the small gear 23 are separated from each other a sufficient distance to receive the gear 25. The gear 25 is mounted on a sleeve, which also carries a smaller gear 24. The sleeve carrying the gear 24 and smaller gear 25 is journaled on a stud 17 and may also be shifted endwise thereon. When this double gear is in the position illustrated in Fig. 4, the power is transmitted through the smaller gear 24. By moving the double gear transversely the larger section 25 may be drawn into mesh with the gear 23, and the sleeve is provided with a knurled handle for this purpose. As shown in Fig. 3, the swinging gear-box inclosing this primary speed-changing train may be shifted to different positions and may be fastened by a tap-bolt 57. By means of this construction the gear-box serves the purpose of a sweep, permitting the substitution of different gears 26, which are to be driven from the gear 25 of the primary speed-changing train. The second and third sets of speed-changing devices are housed within a gear-box at the front of the lathe-bed. As shown in Figs. 5 and 6, 27 designates the gear-box, which may be bolted or otherwise secured to the lathe-bed. Journaled in bearings in the gear-box 27 are three shafts 28, 29, and 30. The shaft 28, as shown in Fig. 7, carries the gear 26, which is driven from the primary speed-train. Carried by the shaft 28 and preferably formed by cutting gear-teeth therein is a long pinion 31, longitudinally movable upon which is a hub 32. Journaled in the hub 32 is a shaft carrying the sliding and swinging intermediate 33. The intermediate gear 33 can be shifted longitudinally and then turned up into engagement with any one of a number of gears secured upon the secondary shaft 29 of the gear-box. I have provided simple and convenient guiding and locking means for setting the intermediate 33 to secure different desired speed changes. As shown most clearly in Fig. 5, 34 designates the setting-lever for shifting

and rocking the hub 32. Cooperating with the lever 34 is a setting-strip 35, which may be formed with or bolted to the under side of the front edge of the gear-box 27. The setting-strip 35 is provided with notches for receiving a spline or key 36 of the lever 34. By the use of this setting-strip 35 and the cooperating key or spline 36 the lever can be raised to swing this intermediate 33 into operative position only when the parts occupy suitable relative positions, and in order to hold up the shifting-lever when its pinion has been thrown properly into mesh I have provided the lever 34 with a spring-pressed locking-pin 37, which may be engaged with any one of a series of holes in the front plate of the gear-box.

As shown most clearly in Fig. 6, a number of gears arranged step-like are fastened upon the intermediate shaft 29 of the gear-box. In practice I have employed a center gear 38, with a series of gears of smaller diameters at one side thereon and with a series of gears of larger diameters at the other side thereon. A gap is left between the center gear 38 and the step-like gears at each side thereof. A third speed-change instrumentality is employed between the shaft 29 of the gear-box and the top shaft 30 thereof.

As shown in Fig. 6, a clutch-section 39 is mounted loosely upon the shaft 30 and carries a gear 40, meshing with the smallest one of the gears arranged step-like upon the shaft 29. Also mounted upon the shaft 30 and running loosely thereon is a clutch-section 41, carrying a gear 42, which meshes with the largest one of the gears arranged step-like on the shaft 29. Between the two clutch-sections 39 and 41 is a shifting clutch mechanism which is keyed onto the shaft, but is movable longitudinally thereon.

The shifting-clutch device comprises a clutch-face 46, cooperating with the loose clutch-section 39, a clutch-face 44, cooperating with the loose clutch-face 41, and a gear 45, which meshes with the center gear 38 when the shifting-clutch device is in its central position, as shown in Fig. 6.

When the shifting clutch device is moved to the right from the position shown in Fig. 6, the clutch-faces 44 and 41 will be brought into engagement and the top shaft of the gear-box will be driven from the largest gear on the shaft 29. When the shifting clutch device is moved to the left from the position shown in Fig. 6, the clutch-faces 39 and 46 will be brought into engagement and the shaft 30 will be driven from the smallest one of the step-like series of gears on the shaft 29.

The body portion of the movable clutch section is provided with a groove, and fitting into this groove is a shifting piece carried by the lever 47. In order to hold the movable clutch device in any one of its three positions, I usually provide a small spring-pressed plunger 48, (shown in Fig. 8,) which may engage

any one of the three sockets in the shaft 30. The shaft 30 of the gearing-box may be connected to drive either the feed-rod 10 or the lead-screw 11. For example, as shown in Fig. 2, the shaft 30 may be provided with a clutch-piece 50, which when moved to the right will couple the shaft 30 to the lead-screw 11, while carried by the clutch-piece 50 is a gear 49, which will mesh with the driving-gear 51 on the feed-rod when ordinary turning operations are desired.

In a complete engine-lathe as thus equipped it will be seen that I have provided a form of construction in which the primary speed-change train at the head of the lathe is inclosed in a box or casing, that this box or casing will not interfere with the use of special gears inasmuch as the gear-box itself forms the adjustable sweep, which may be clamped in different positions, according to the size of the gear which it is found necessary to employ. It will also be seen that the gear-box secured to the front of the lathe-bed provides two additional sets of speed-change mechanisms and that three of the sets of gears arranged step-like upon the intermediate shaft of the gear-box are utilized for securing three different driving-speeds of the top shaft of the gear-box. It will also be observed that by the proportions of the parts which I have adopted I have secured an exceedingly strong and efficient arrangement enabling me to get fifty-four different speed changes by the use of a comparatively small number of gears, which gears are all of comparatively small diameters and which vary comparatively little in size. It is still further to be observed that my speed-change gearing for engine-lathes constitute, in effect, an attachment which may be put onto ordinary engine-lathes without changing or interfering with the usual arrangement of parts, that part of my speed-change gearing may be finished at the bench, and extremely little machine work is required upon the lathe-bed or lathe itself.

I am aware that numerous changes may be made in practicing my invention by those who are skilled in the art and that changes may be made in proportions and arrangements of parts. For example, while I have shown the gear-box at the front of the lathe as consisting of a single casting I may prefer to use a construction that may be made up of several parts, and in lathes which are intended for cutting screw-threads measured under the metric system instead of driving into the series of gears arranged step-like this arrangement may be reversed. I do not wish, therefore, to be limited to the particular lathe which I have herein shown and described; but

What I do claim, and desire to secure by Letters Patent of the United States, is—

1. In a change-speed gearing, the combi-

nation of a driven shaft, a swinging gear-box having an opening in the periphery thereof, a train of gearing inclosed in the gear-box and turned by the driven shaft, and means for clamping the gear-box in a plurality of different operative positions to act as a sweep with the last gear of the train in engagement with gears of different sizes. 70

2. In a change-speed gearing, the combination of a driven shaft, a sweep pivoted concentrically with respect to the driven shaft, a train of gears carried by the sweep, means for fastening the sweep in a plurality of different operative positions to set the last gear of the train into engagement with gears of different sizes, said train including a compound gear and a transversely-shiftable compound gear. 75

3. In a change-speed gearing, the combination of a driven shaft, a gear-box hung to swing upon a center concentric with said shaft, said gear-box comprising a casting and cover-plate therefor, a stud holding the cover-plate in place, said stud being mounted so that it may be adjusted to different positions, a gear fastened on the driven shaft, and a train of gears mounted in the gear-box and turned from said gear on the driven shaft, one of said gears of said train being journaled on the stud which fastens the parts of the gear-box together. 80 85 90 95

4. In a change-speed gearing, the combination of a driven shaft, a gear on the driven shaft, a sweep pivoted to swing on a center concentric with the driven shaft, a train of gears mounted on the sweep, and means for fastening the sweep in a plurality of different operative positions to set the last gear of the train into engagement with gears of different sizes, said train including a double gear having sections of two different diameters, and a transversely-shiftable gear also having sections of two different diameters. 100 105

5. In a change-speed gearing, the combination of a driven shaft, a gear on the driven shaft, a sweep mounted to swing on a center concentric with the driven shaft, a train of gears mounted on the sweep including a compound gear having parts of different diameters, either part of which may be driven from the previous double gear of the train, a wide-faced gear meshing with and driven from the transversely-shiftable gear on the sweep, and means for adjusting the sweep in different positions, whereby use will be permitted of wide-faced gears of different diameters. 110 115 120

6. In a change-speed gearing, the combination of a driven shaft, a swinging gear-box having an opening in the periphery thereof; a train of gearing inclosed in said gear-box and turned by the driven shaft, means for clamping the gear-box in different positions to act as a sweep by swinging the last gear of the train into engagement with gears of different sizes, and a second speed-changing train 125 130

driven from the gears in the sweep and comprising a set of gears arranged step-like, and a swinging gear which can be set into mesh with the desired one of the gears arranged step-like.

7. In a change-speed gearing, the combination of a driven shaft, a shaft to be driven therefrom, three gears fastened on the driven shaft, two gears loosely mounted on the shaft to be driven, and meshing with the end gears on the driven shaft, and a clutch-piece turning with and longitudinally movable on the shaft to be driven, said clutch-piece having provision for making connection with the end gears when thrown to the limits of its movement, and having a gear for meshing with the middle gear on the driven shaft when the clutch-piece occupies an intermediate position.

8. In a change-speed gearing, the combination of a gear-box, three shafts mounted therein, a transversely-movable shiftable lever pivoted concentrically with the driving-shaft, a series of gears arranged step-like on the intermediate shaft, a gear carried by the lever and adapted to engage any one of the series of gears arranged step-like on the intermediate shaft and a change-speed connection with the shaft to be driven comprising loose clutch-sections driven from two of the gears arranged step-like on the intermediate shaft and a shifting-clutch engaging the loose-running clutch-pieces and having a gear for engaging a third one of the gears arranged step-like.

9. In a change-speed gearing, the combination of two shafts, one a driven shaft and the other a shaft to be driven therefrom, three gears fastened on one shaft, two gears loosely mounted on the other shaft meshing with the end gears on the first shaft, and a clutch-piece turning with and longitudinally movable on the second shaft, said clutch-

piece having clutch-teeth for making connection with the end gears when thrown to the limits of its movement, and having a gear meshing with the middle gear on the first shaft when the clutch-piece occupies an intermediate position.

10. In a change-speed gearing, the combination of a driven shaft, a gear on the driven shaft, a gear-box pivoted to swing on a center concentric with the driven shaft, a train of gears inclosed in the gear-box and including a transversely-shiftable compound gear, either section of which may be driven, means for clamping the gear-box in different adjusted positions to act as a sweep, a gear-box secured to the front of the lathe-bed, three shafts mounted in the gear-box, a wide-faced gear on one of said shafts meshing with the final gear of the train carried by the swinging gear-box, a set of gears arranged step-like on the intermediate shaft, a shifting-lever, a transversely-movable intermediate thereon which can be set into engagement with any one of the gears arranged step-like, and change-speed gearing between the intermediate shaft and final gear, comprising end gears loosely mounted on the third shaft and driven from the intermediate shaft, and a movable clutch-piece mounted on the third shaft and having provision for making connection with the loose gears when at the limits of motion in opposite directions, and having a gear meshing with one of the gears on the intermediate shaft when the clutch-piece occupies an intermediate position.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

HERBERT L. FLATHER.

Witnesses:

PHILIP W. SOUTHGATE,  
K. E. HOY.