H. L. BEELER.

SPEED CHANGING MECHANISM.

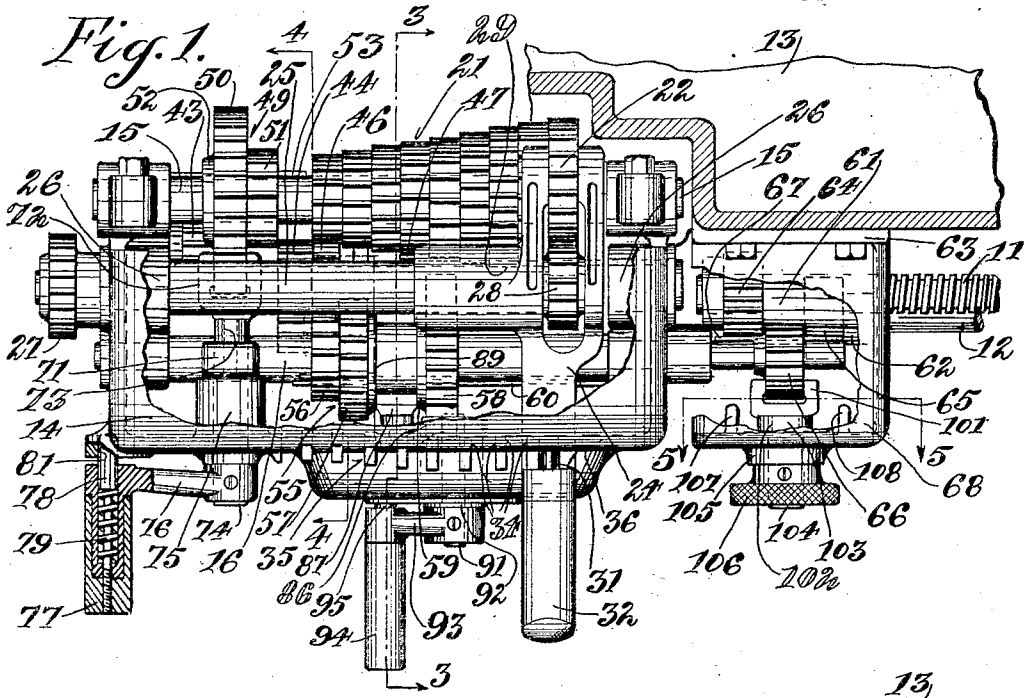
APPLICATION FILED SEPT. 25, 1911.

1,015,986.

Patented Jan. 30, 1912.

3 SHEETS—SHEET 1.

Fig. 1.



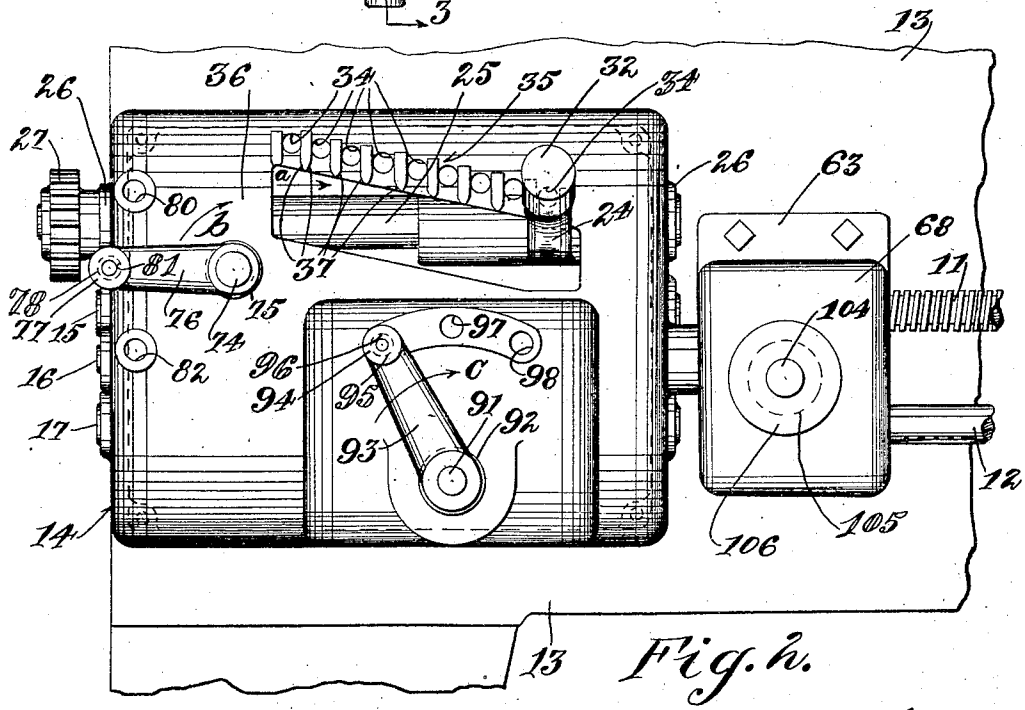


Fig. 2.

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3 SHEETS—SHEET 2.

Fig. 3.

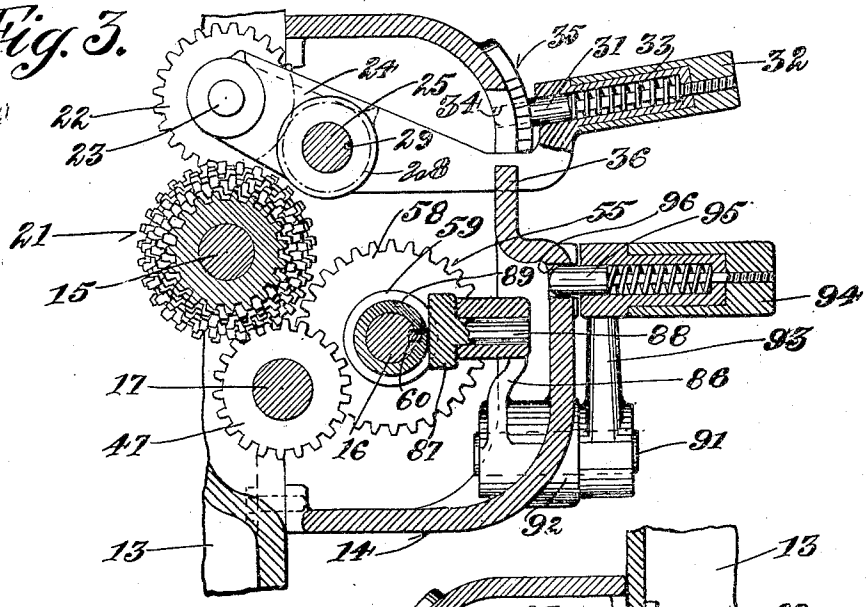


Fig. 4.

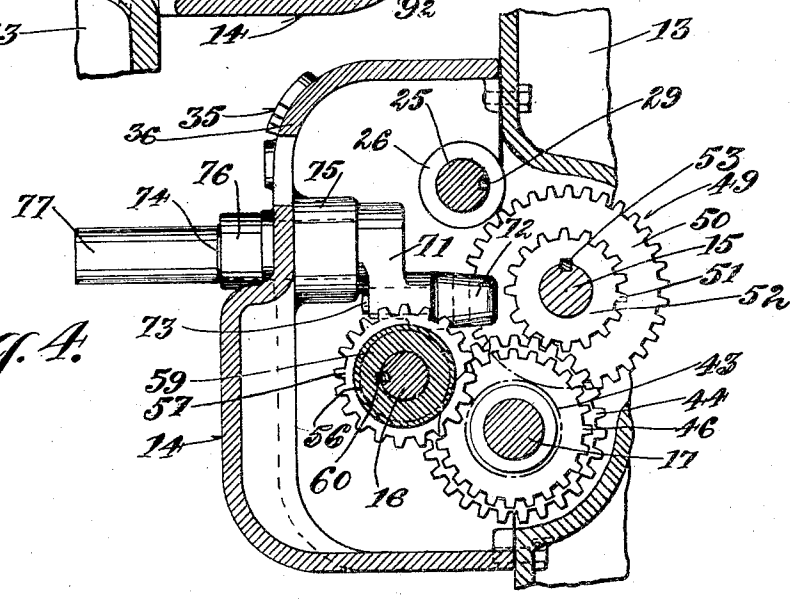
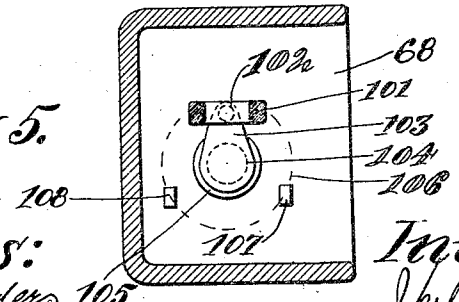


Fig. 5.



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3 SHEETS—SHEET 3.

Fig. 7.

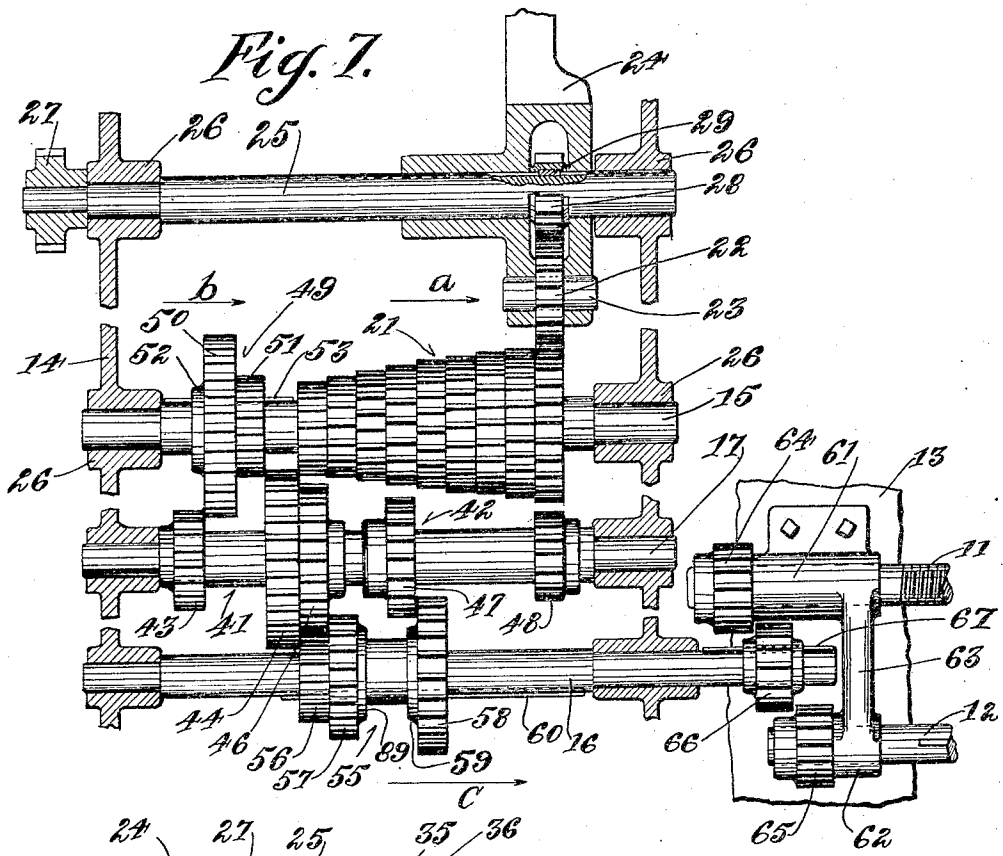
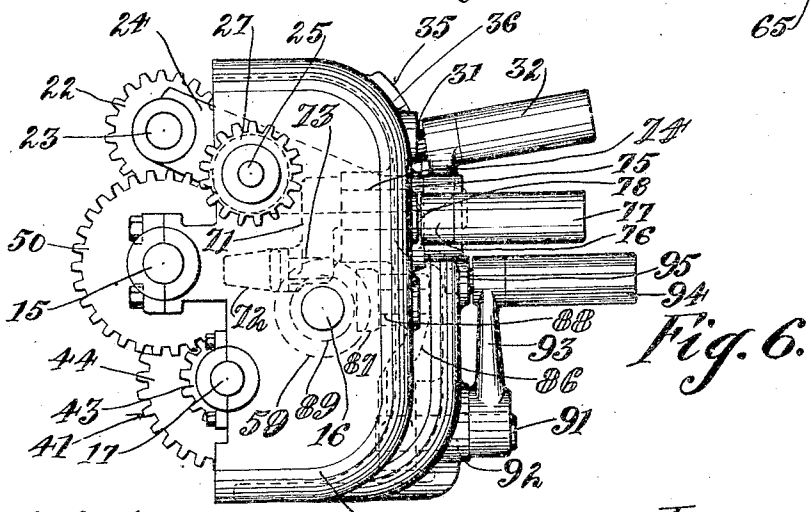


Fig. 6.



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UNITED STATES PATENT OFFICE.

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SPEED-CHANGING MECHANISM.

1,015,986. Specification of Letters Patent. Patented Jan. 30, 1912.

Application filed September 25, 1911. Serial No. 651,116.

To all whom it may concern:

Be it known that I, HERBERT L. BEELER, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Speed-Changing Mechanism, of which the following is a specification.

It is the object of my invention to provide novel speed changing mechanism capable of a great variety of changes by mechanism arranged in compact form; further to provide novel mechanism by which a plurality of multiples of speed ranges may be obtained, and the invention will be readily understood from the following description and claims, and from the drawings, in which latter:

Figure 1 is a plan view of my improved device, with the frame and the inclosing casings partly broken away and one of the operating handles shown in axial section for better illustration of parts. Fig. 2 is a front elevation of the same. Fig. 3 is a vertical section of the same on the line 3—3 of Fig. 1, the operating handle for sliding the tumbler-gear being also shown in axial section for better illustration of parts. Fig. 4 is a vertical section of my improved device taken on the line 4—4 of Fig. 1. Fig. 5 is a detail taken on the line 5—5 of Fig. 1. Fig. 6 is an end elevation of my improved device; and, Fig. 7 is a diagrammatic representation of the same with the gears laid out in plane.

My invention is illustrated as employed for the purpose of changing the speeds of rotation of the lead-screw and the feed-rod, for instance, in a metal turning lathe, the lead-screw being shown broken away at 11, the feed-rod being shown broken away at 12, and the main frame of the lathe being shown broken away at 13.

14 represents the casing or gear-box, which may be suitably secured to the main frame.

15 represents, in the present exemplification, the driving shaft, 16 the driven shaft, and 17 an intermediate shaft, also hereinafter referred to as the counter-shaft, which is operatively located between the driving and driven shafts. It is of course obvious that the direction of the transmission of motion may be reversed without departing from the spirit of my invention.

21 is a nest of diversely-sized gears, hereinafter referred to as the cone-of-gears, secured to the shaft 15.

22 is a tumbler-gear on a stud 23 on a tumbler-arm 24 pivoted about a tumbler-shaft 25, journaled in bearings 26 in the gear-box and having a pinion 27 thereon receiving motion from a suitable source of power, as from the spindle of the lathe.

28 is a gear which meshes with the tumbler-gear 22, and has spline-connection 29 with the tumbler-shaft. The tumbler-arm is arranged to be moved longitudinally of the tumbler-shaft for bringing the tumbler-gear thereon opposite any one of the gears of the cone-of-gears.

I have provided novel positioning and locking means for the tumbler-arm. The tumbler-arm has a locking-pin 31 thereon, shown as a pull-pin, having connection with the handle 32 of the tumbler-arm and normally urged outwardly by a spring 33. 34, 34, are a series of holes which coact with the locking-pin, so that when the locking-pin is located in any given hole the tumbler-gear will be in proper mesh with the corresponding given gear of the cone-of-gears.

35 is a comb on the front wall 36 of the casing, the sides of the teeth of the comb being presented toward said front wall, so that the pin may be moved across said front wall lengthwise of said teeth in the spaces between the same, and be guided between the adjacent side walls of said teeth, and snap into the hole therebetween when the pin reaches the hole. The ends of the teeth of the comb are beveled at both sides, as shown at 37, for leading the pin into the spaces between the adjacent side walls of the teeth, these beveled faces being distanced from the holes so as to locate the tumbler-gear in lateral position opposite the gear with which the hole corresponds prior to meshing position thereof, for insuring that meshing relation will be had only with said given gear of said cone-of-gears when bringing said tumbler-gear into meshing engagement, further insuring that said tumbler-gear will be brought out of meshing relation with any previously meshed gear of said cone-of-gears, and preventing that the corners only of the gears will be brought into meshing relation, in other words, insuring that the meshing gear-teeth will engage throughout their entire lengths.

The countershaft has thereon a plurality of groups 41, 42, of diversely-sized gears. The group 41 in the present instance comprises the gears 43, 44, secured to said intermediate shaft, the group 42 comprises the gears 46, 47 and 48, secured to said intermediate shaft.

49 is a group of diversely-sized gears represented as gears 50 and 51, which rotate together with the shaft 15 but are longitudinally slidable thereon as on a sleeve 52 having spline-connection 53 with said shaft. The group of gears 49 coacts with the group of gears 41. The group of gears 49 is arranged to be moved laterally for causing meshing relation between the gears 50 and 43 or between the gears 51 and 44 or said group of gears 49 may be placed in neutral position between the gears 43 and 44, which are spaced apart for the purpose.

55 is a group of gears which in the present instance comprises the gears 56, 57 and 58, which rotate with and are laterally slidable lengthwise of the shaft 16, as by being on a sleeve 59 having spline-connection 60 with said shaft. The group of gears 55 is arranged to be moved laterally for causing meshing relation between the gears 56 and 46, or between the gears 57 and 47, or between the gears 58 and 48, the gears 46, 47 and 48 being spaced apart for the purpose.

The lead-screw 11 is journaled in a bearing 61 and the feed-rod 12 is journaled in a bearing 62, the bearings 61 and 62 being on a bracket 63 secured to the main frame. A gear 64 is secured to the lead-screw and a gear 65 is secured to the feed-rod. These gears are located in spaced-apart relation longitudinally of the screw and rod. 66 is a gear rotating with but slidable longitudinally of the shaft 16, as by means of the spline-connection 67, for locating the gears 64, 65 and 66 in different cross-sectional planes when the gear 66 is out of meshing relation with both the gears 64 and 65, or for placing the gear 66 in coincident cross-sectional plane and meshing relation with either gear 64 or 65.

68 is a cover secured to the frame, in which said gears are located.

For accomplishing lateral shifting of the group of gears 51, I provide an arm 71 having a fork 72 pivoted thereon on a pin 73, the tines of the fork being received at the respective sides of the gear 50. The arm 71 is on a rock-shaft 74 journaled in a bearing 75 of the casing and provided with an arm 76 having a handle 77 which has a pin 78 secured thereto, the pin being pressed outwardly by a spring 79 into holes 80, 81, 82, at the front of the casing.

The group of gears 55 is shifted laterally by means of an arm 86 having a shoe 87 pivoted thereon on a pin 88 and received in an annular groove 89 of the sleeve 59. The arm 86 is secured to a rock-shaft 91 journaled in a bearing 92 of the gear-box and having an operating arm 93 provided with an operating handle 94 which connects with a pin 95 arranged to be received in any one of the holes 96, 97 and 98 in the casing.

For shifting the gear 66 laterally I provide a fork 101, the tines of which are received at its sides and which is pivoted on a pin 102 on an arm 103 secured to a rock-shaft 104 journaled in a bearing 105 in the cover and having a hand-wheel 106 thereon. 107, 108, are a pair of stops in the form of lugs on the inside wall of the cover 68.

The cone-of-gears with its tumbler-gear and the gears of the group of gears 49 and 41 and the gears of the group of gears 55 and 42 are so arranged with relation to their diameters, that movement of the arms 24, 76 and 93, for operating said tumbler-gear and group of gears 49 and 55 respectively will be in one direction for effecting increase of speed and in the other direction for effecting decrease of speed, so that confusion of the operator is avoided and compactness of arrangement of the gears is obtained. Thus for decrease of speed of the cone-of-gears, the arm 24 is moved in the direction of the arrow *a*, for decrease of speed between the group of gears 49 and 41, the arm 76 is moved in the direction of the arrow *b*, and for decrease of speed between the group of gears 42 and 55, the handle 93 is moved in the direction of the arrow *c*.

The cone-of-gears and the group of gears 49 have their smaller gears in adjacent relation, while the group of gears 41 and 42 have their larger gears in adjacent relation, and the cone-of-gears and the group of gears 42 have their smallest and largest gears in opposed relation.

My improved device further permits five series of stepped gears to be employed collectively having three axes of rotation, three of said series of gears being opposite each other in successive reversed stepped relation and two pairs of said series being respectively in axial line. The arrangement enables the centers of rotation of the gears to be brought close together.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In combination, a fixedly positioned countershaft, a plurality of groups of spaced-apart gears thereon, and laterally slidable gear-sleeves between which said fixedly positioned countershaft is operatively located, said laterally slidable gear-sleeves comprising gears arranged for operative connection with said respective plurality of groups of spaced-apart gears.

2. In combination, a fixedly positioned countershaft, a plurality of groups of spaced-apart gears thereon, and laterally

slidable gear-sleeves between which said fixedly positioned countershaft is operatively located, said laterally slidable gear-sleeves comprising gears arranged for operative connection with said respective plurality of groups of spaced-apart gears, a nest of diversely-sized gears whose rotary axes are coincident with the rotary axis of one of said gear-sleeves, and a tumbler-gear arranged to mesh the respective gears of said nest of diversely-sized gears.

3. In combination, a plurality of intermediate groups of spaced-apart gears having coincident rotary axes, a laterally slidable group of diversely-sized driving gears having selective operative connection with one of said first-named groups, a pair of operated shafts, a gear for each of said shafts, and a pair of slidable gear elements, one of which comprises a plurality of diversely-sized gears having selective operative connection with the other of said first-named groups, and the other of which has selective operative connection with said respective gears for said operated shafts.

4. In combination, a plurality of intermediate groups of spaced-apart gears having coincident rotary axes, a cone-of-gears and a laterally slidable group of diversely-sized driving gears driven by said cone-of-gears, said laterally slidable group of gears having selective operative relation with one of said first-named groups, a pair of operated shafts, a gear for each of said shafts, and a pair of slidable gear elements, one of which comprises a plurality of diversely-sized gears having selective operative relation with the other of said first-named groups, and the other of which has operative relation with said respective gears for said operated shafts.

5. In speed changing mechanism, the combination of a driving shaft, a driven shaft, and a pair of spaced-apart gear-groups, a slidable group of diversely-sized gears rotating with said driving shaft and having selective operative connection with one of said first-named gear-groups and a slidable group of diversely-sized gears rotating with said driven shaft and having selective operative connection with the other of said first-named gear-groups.

6. In speed changing mechanism, the combination of a pair of spaced-apart gear-groups respectively comprising gears of different diameters, a driving shaft, a slidable group of diversely-sized gears rotating with said driving shaft and having selective operative connection with one of said first-named gear-groups, a slidable group of diversely-sized gears rotating with said driven shaft and having selective operative connection with the other of said first-named gear-groups, a pair of operated shafts, a gear for each of the latter, and a laterally slidable gear rotating with said driven shaft and arranged to be selectively operatively connected with either of said gears for said operated shafts.

7. In combination, three shafts, and four groups of diversely-sized gears and a cone-of-gears mounted thereon, two of said groups of diversely-sized gears being longitudinally slidable for operative connection with two others of said groups of diversely-sized gears.

8. In combination, three shafts comprising a driving shaft and a driven shaft, and four groups of diversely-sized gears and a cone-of-gears mounted thereon, two of said groups of diversely-sized gears being longitudinally slidable for operative connection with two others of said groups of diversely-sized gears, a tumbler-gear coacting with the respective gears of said cone-of-gears, a pair of operated shafts, and means for selectively operatively connecting either of said operated shafts with said driven shaft.

9. In speed changing mechanism, the combination of a cone-of-gears, a tumbler-gear, a laterally movable pivoted tumbler-arm therefor, a wall past which said arm projects, said arm comprising a handle outside said wall, said wall having a comb thereon the teeth whereof have one of their sides presented to said wall, said wall provided with holes between said teeth, and a pin on said arm having connection with said handle arranged to be guided lengthwise of said teeth into said holes.

10. In speed changing mechanism, the combination of a driven shaft, a pair of operated shafts, a pair of gears for the latter located in spaced-apart cross-sectional planes, a gear rotating with and slidable on said driven shaft, the teeth of all said gears arranged to be placed in different cross-sectional planes, and means for sliding said last-named gear laterally comprising a shoe for sliding said gear, a pivoted arm on which said shoe is mounted, and stops at the respective sides of said arm for limiting the movement of said arm when said slidable gear is in meshing relation with the respective gears of said pair of gears.

11. In combination, a plurality of intermediate groups of spaced-apart gears having coincident rotary axes, and laterally slidable groups of diversely-sized gears between which said first-named groups are operatively located, the gears of said laterally slidable groups of diversely-sized gears arranged to coact with the gears of said respective intermediate groups of spaced-apart gears.

12. In speed changing mechanism, the combination of a cone of diversely-sized gears and a group of diversely-sized gears having coincident rotary axes and arranged in step-relation with their smaller

gears adjacent to each other, and a pair of groups of diversely-sized gears having coincident rotary axes arranged in step-relation with their larger gears adjacent to each other, one of said last-named groups being opposite said cone-of-gears and the other of said last-named groups being opposite said first-named group, and gearing having selective operative connection with the respective gears of said group of gears opposite said cone-of-gears.

13. In speed changing mechanism, the combination of a cone of diversely-sized gears forming a group of gears, and a pair of groups of diversely-sized gears, said pair of groups of diversely-sized gears comprising an intermediate group of diversely-sized gears, all said groups of gears being located opposite each other with the largest and smallest gears respectively of said intermediate group operatively positioned between respectively the smallest and largest gears of the others of said groups, and a pair of coacting groups of diversely-sized gears respectively in line with said cone-of-gears and said intermediate group.

14. In speed changing mechanism, the combination of a pair of groups of diversely-sized gears arranged in step-relation with their larger gears in adjacent relation, a pair of laterally slidable groups of diversely-sized gears arranged in step-relation between which said last-named groups are operatively located for being brought into meshing relation therewith and having their smaller gears in adjacent cross-sectional planes, an operating arm for each of said laterally slidable groups, a cone-of-gears, in axial line with one of said laterally slidable groups, the said cone-of-gears and last-named group having their smaller gears in adjacent relation, a tumbler-gear for said cone-of-gears, and an operating arm therefor, all said operating arms movable in similar directions for increase or for decrease of speed-relations between said gears.

15. In combination, five series of stepped gears, three of which series are oppositely arranged and two pairs of which series are axially arranged, the said series of stepped gears having three rotary axes and arranged for transmitting motion from one to the other of said series of stepped gears.

16. In combination, five series of stepped gears, three of which series are oppositely arranged and two pairs of which series are axially arranged, the said series of stepped gears having three rotary axes and arranged for transmitting motion from one to the other of said series of stepped gears, a tumbler-gear, and means for causing selective meshing between said tumbler-gear and the respective gears of one of said series of stepped gears.

17. In combination, five series of stepped gears, three of which are opposite each other in successive reversed stepped relation and two pairs of said series being respectively in axial line, the said five series of stepped gears collectively having three axes of rotation and arranged for transmitting rotary movement from one to the other thereof.

18. In combination, five series of stepped gears, three of which are opposite each other in successive reversed stepped relation and two pairs of said series being respectively in axial line, the said five series of stepped gears collectively having three axes of rotation and arranged for transmitting rotary movement from one to the other thereof, two of said series of stepped gears being movable lengthwise of their rotary axes with relation to two others of said series, and a tumbler-gear arranged for being selectively meshed with the gears of one of said series.

In testimony whereof, I have signed my name hereto in the presence of two subscribing witnesses.

HERBERT L. BEELER.

Witnesses:
CHAS. E. WEBER,
THERESA SILBER.