E. J. KEARNEY & T. TRECKER.

SPEED CHANGING GEARING.

APPLICATION FILED JULY 25, 1908.

1,019,798.

Patented Mar. 12, 1912.

3 SHEETS—SHEET 1.

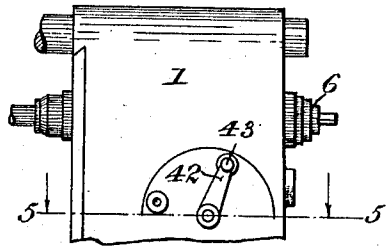

Fig. 2.

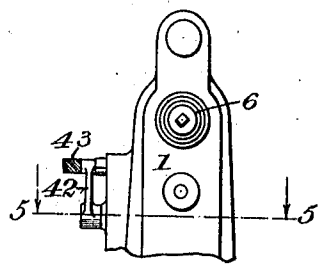

Fig. 3.

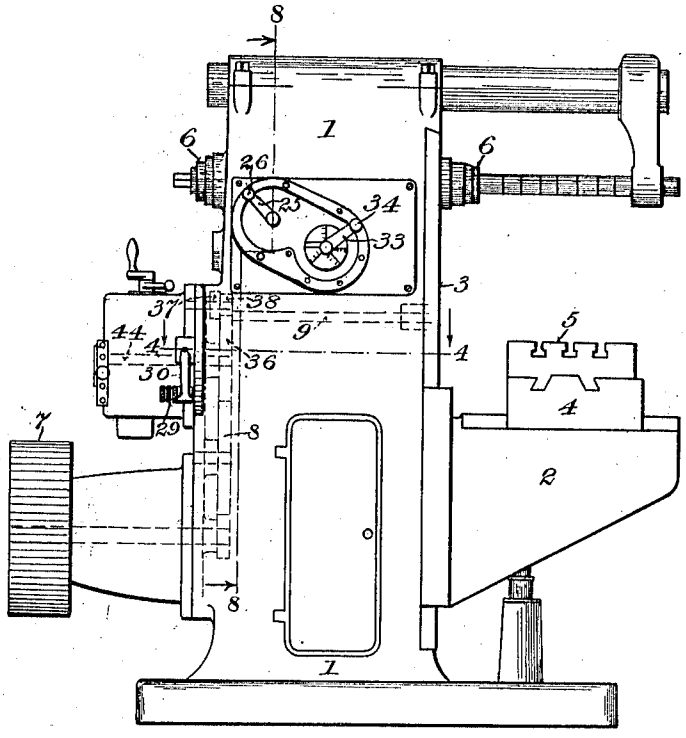

Fig. 1.

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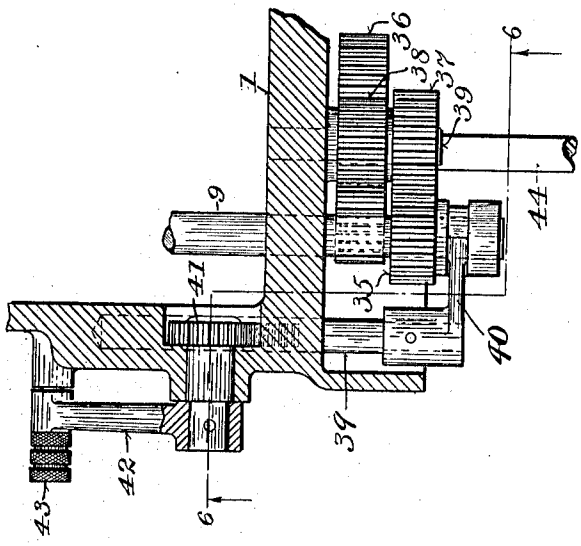

Fig. 5.

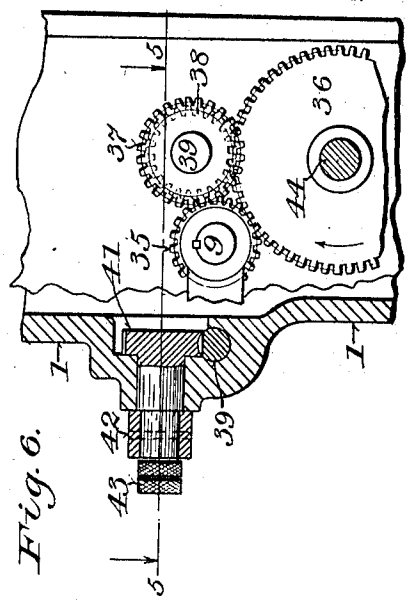

Fig. 6.

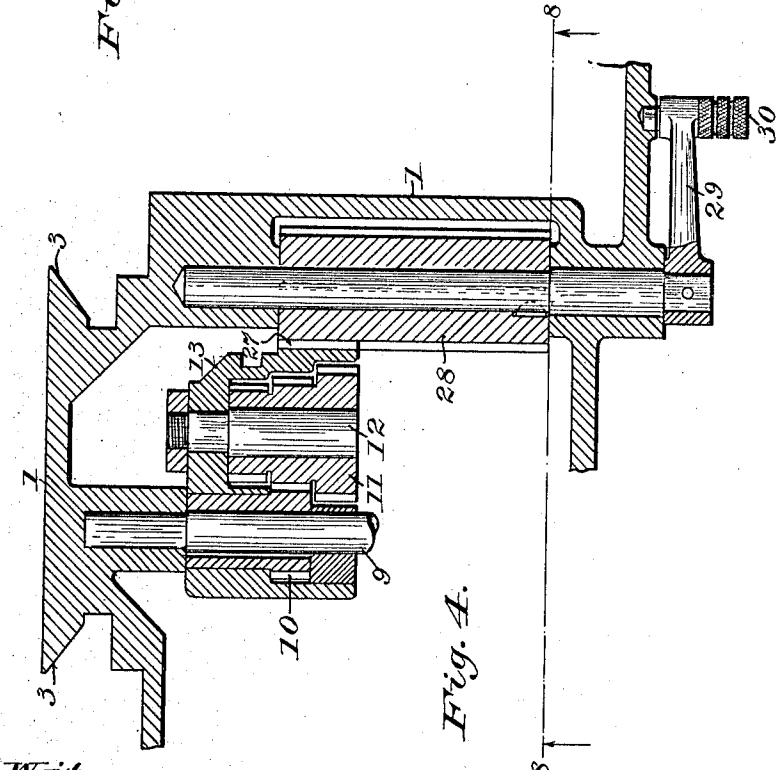

Fig. 4.

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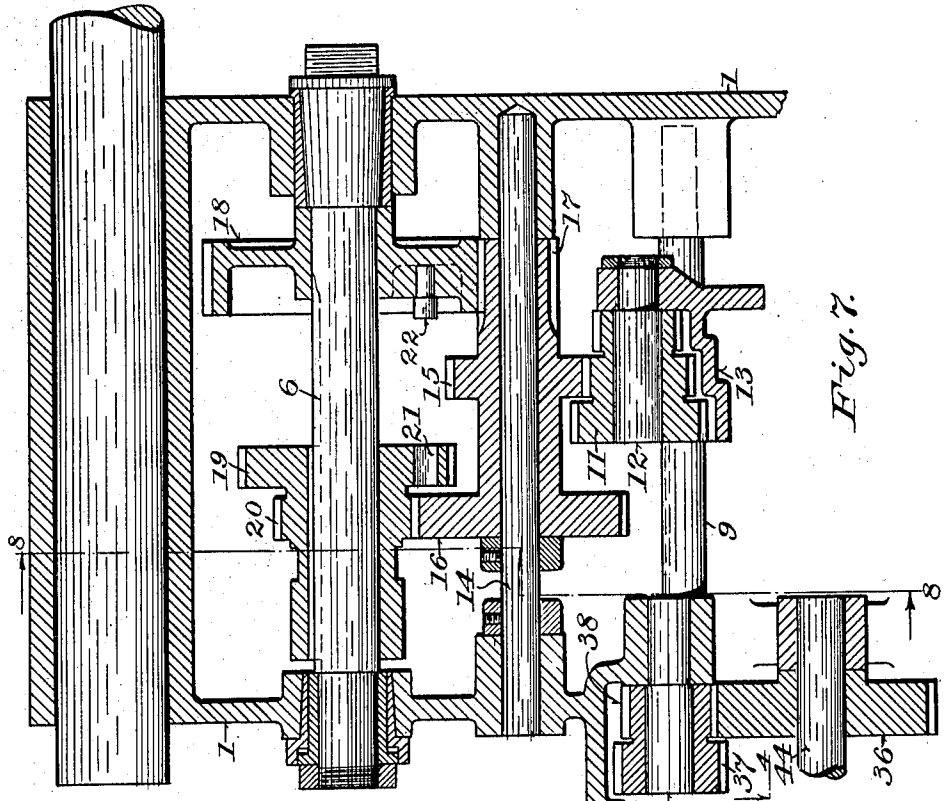

Fig. 7.

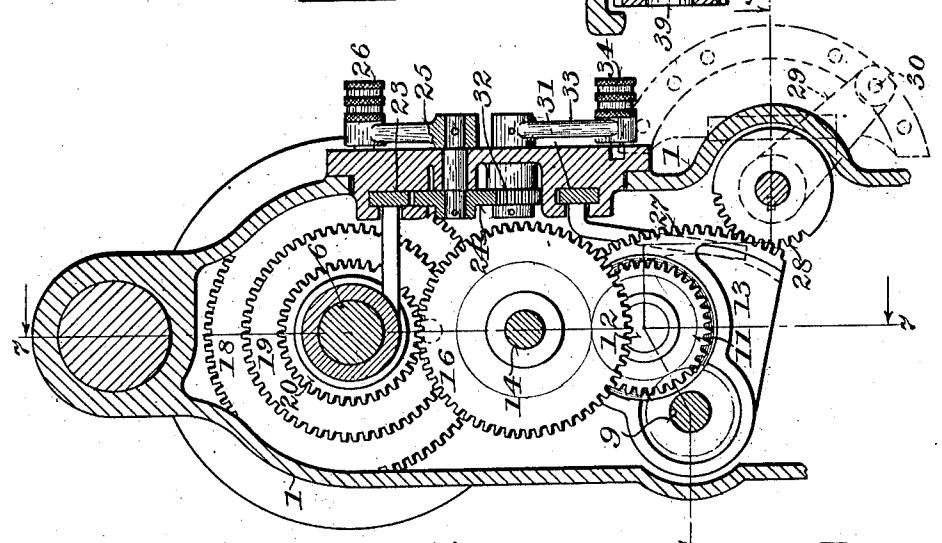

Fig. 8.

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UNITED STATES PATENT OFFICE.

EDWARD J. KEARNEY, OF WAUWATOSA, AND THEODORE TRECKER, OF WEST ALLIS, WISCONSIN.

SPEED-CHANGING GEARING.

1,019,798. Specification of Letters Patent. Patented Mar. 12, 1912.

Application filed July 25, 1908. Serial No. 445,433.

To all whom it may concern:

Be it known that we, EDWARD J. KEARNEY and THEODORE TRECKER, citizens of the United States, residing at Wauwatosa and West Allis, respectively, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Speed-Changing Gearing, of which the following is a specification, reference being had to the accompanying drawing, forming a part thereof.

The main objects of this invention are to provide machine tools with self-contained mechanism for driving the tool spindle at different speeds, which may be substantially in geometrical progression, from a constant speed source; and generally to simplify and improve the construction and operation of mechanism of this class.

It consists in certain novel features of construction and in the peculiar arrangement and combination of parts as hereinafter particularly described and pointed out in the claims.

In the accompanying drawing like characters designate the same parts in the several figures.

Figure 1 is a side elevation of a milling machine embodying the invention; Fig. 2 is a reverse side elevation of the upper part of the machine; Fig. 3 is a back end elevation of the upper part of the machine as viewed from the left with reference to Fig. 1; Fig. 4 is an enlarged horizontal section on the line 4 4, Figs. 1 and 8; Fig. 5 is a horizontal section on the line 5 5, Fig. 6, showing the reversing gear; Fig. 6 is a partial elevation and partial vertical section on the line 6 6, Fig. 5, also showing the reversing gear; Fig. 7 is a vertical section on the line 7 7, Fig. 8, showing in detail the speed changing gearing; and Fig. 8 is a vertical section on the line 8 8, Figs. 1 and 7.

For the purpose of illustration and explanation the invention is shown as embodied in the speed changing and reversing mechanism of a horizontal milling machine, but it is applicable with little or no change to other machines, in which it is necessary or desirable to provide for a number of changes in the speed of the tool spindles or other parts.

Referring to Fig. 1, 1 designates the frame of the machine, which in the present case is of the usual box type. It is provided with a vertically adjustable knee 2, movable up and down on the ways 3. A saddle 4 is movable on horizontal ways on the knee toward and from the frame, and a work carrying table 5 is movable by hand or power on the saddle 4 at right angles to the ways on the knee. A tool spindle or driven shaft 6 is journaled in the usual way horizontally in the upper part of the frame 1, and a driving pulley 7, the shaft of which is journaled in the lower part of the frame, is connected, as indicated by dotted lines, by a train of spur gearing 8 with a horizontal shaft 9 below and parallel with the spindle 6.

Referring to Figs. 4, 7 and 8, a pinion 10 which is feathered and movable endwise on the shaft 9, meshes with a step, in the present case the middle step, of a cone gear 11. The cone gear 11 turns on a stud 12 in a swinging support 13, which is pivotally mounted on the shaft 9 concentric with the pinion 10, which it embraces and carries with it in its endwise adjustment. On a shaft 14 between and parallel with the shaft 9 and the spindle 6, are fixed gears 15 and 16 of different sizes, with each of which the several steps of the cone gear 11 are adapted to be brought into mesh by the proper adjustments of the support 13, as hereinafter explained. A pinion 17, also fixed on the shaft 14, constantly meshes with a loose gear 18 on the spindle 6. Connected gears 19 and 20 of such size or diameters as to properly engage with the gears 15 and 16, are feathered and movable endwise on the spindle 6. The gear 19 is formed with a hole 21 arranged to engage with a pin 22 on the gear 18 when the gears 19 and 20 are shifted to the extreme right, as shown in Fig. 7, and are thus carried out of engagement with the gears 15 and 16. A rack 23, guided in the frame parallel with the spindle 6, has an arm engaging a groove in the hub of the connected gears 19 and 20, as shown in Fig. 8. The shaft of a pinion 24, meshing with the rack 23, is provided with a crank arm 25, which has a handle and locking pin 26, working with properly spaced holes in the frame to determine the several positions of the gears 19 and 20 on the spindle 6, and to hold them in such positions, with the gear 19 in mesh with the gear 15 or locked to the gear 18, or the gear 20 in mesh with the gear 16.

The gear support 13 is formed or pro-

vided with a segment gear or gear teeth 27, meshing with a wide faced or long pinion 28, as shown in Figs. 4 and 8. The shaft of the pinion 28 is provided with a crank arm 29, which has a handle and locking pin 30, working with properly spaced holes in the frame for determining the several angular adjustments of the support 13 relative to the shaft 9 to bring the several steps of the cone gear 11 into mesh with each of the gears 15 and 16.

It will be observed that while the shaft 9 revolves at a constant speed, the shaft 14 will be driven at a different speed for each of the six positions of the handle 26 and of the handle 30. It will also be seen that the spindle 6 will be driven from the shaft 14 at three different speeds, by the gears 19 and 20 in their three different positions, thereby providing in connection with the six different positions of the cone gear 11, for eighteen changes of speed in the spindle. The gears are or may be so proportioned that these changes in speed will vary substantially in geometrical progression.

For reversing the movement of the spindle and of the speed changing gearing through which it is driven, the shaft 9 is provided as shown in Figs. 5 and 6, with a pinion 35, which is feathered and movable endwise thereon into engagement with either a gear 36 of the train 8, or with a pinion 37 formed with or attached to a smaller pinion 38, which turns on a stud 39 in mesh with the gear 36. These gears are so constructed and arranged that the teeth of the pinion 35 when in mesh with the gear 36, will clear the teeth of the pinion 38. The pinion 35 is shifted from either of its two positions to the other by means of a rack 40, guided in the frame parallel with the shaft 9 and having an arm 40 engaging with a groove in the hub of said pinion, a pinion 41 meshing with said rack, and a crank arm 42 attached to the shaft of the pinion 41 and having a handle and locking pin 43 working with properly located holes in the frame.

It will thus be seen that the machine is provided within itself with mechanism comprising few and simple parts for driving the spindle at any of a considerable number of different speeds and for reversing the rotation of the spindle and of the speed changing gears, which may be accomplished by few and simple manipulations.

The gear 36, which is mounted on and drives the shaft 44, as shown in Figs. 1, 5 and 7, may be utilized by means of connections which are not shown, for imparting the desired feed movements to the work table 5.

Various modifications in the details of construction and arrangement of parts may be made without departing from the principle and scope of the invention.

The reversing gearing shown and described in connection with the speed changing gearing is not claimed herein, but is made the subject matter of another application.

We claim:

1. The combination of parallel shafts, a gear fixed on one shaft, a gear shiftable endwise upon and rotatable with the other shaft, a gear support pivotally mounted upon and movable with said shiftable gear endwise of the second shaft and provided with gear teeth, a stepped cone gear carried by said support with one of its steps in mesh with said shiftable gear and movable to carry any of its steps into mesh with the fixed gear on the first shaft, and a wide faced pinion meshing with the gear teeth on said support and provided with a crank arm for changing the angular adjustment of said support, substantially as described.

2. The combination of parallel shafts, a gear fixed on one shaft, a gear shiftable endwise upon and rotatable with the other shaft, a gear support pivotally mounted upon and movable with said shiftable gear endwise of the second shaft, a stepped cone gear carried by said support with one of its steps in mesh with said shiftable gear and movable to carry any of its steps into mesh with the fixed gear on the first shaft, a rack movable parallel with said shafts and connected with said support, and a pinion meshing with said rack and provided with a crank arm for adjusting said support and stepped cone gear endwise, substantially as described.

3. The combination of parallel shafts, gears of different sizes fixed on one shaft, a gear shiftable endwise upon and rotatable with the other shaft, a gear support pivotally mounted and movable endwise with said shiftable gear on the second shaft and provided with gear teeth, a stepped cone gear carrier by said support with one of its steps in mesh with said shiftable gear and movable to carry any of its steps into mesh with any of the fixed gears on the first shaft, and a wide faced pinion meshing with the gear teeth on said support and provided with a crank arm for changing the angular adjustment of said support, substantially as described.

4. The combination of parallel shafts, gears of different sizes fixed on one shaft, a gear shiftable endwise upon and rotatable with the other shaft, a gear support pivotally mounted and movable endwise with said shiftable gear on the second shaft, a stepped cone gear carried by said support with one of its steps in mesh with said shiftable gear and movable to carry any of its steps into mesh with any of the fixed gears on the first shaft, a rack movable parallel with said shafts and connected with said support, and a pinion meshing with said rack and pro-

vided with a crank arm for adjusting said support and stepped cone gear endwise, substantially as described.

5. The combination of parallel shafts, a gear fixed on one shaft, a gear shiftable endwise upon and rotatable with the other shaft, a gear support pivotally mounted and movable endwise with said shiftable gear on the second shaft and provided with gear teeth, a stepped cone gear carried by said support with one of its steps in mesh with said shiftable gear and movable to carry any of its steps into mesh with the fixed gear on the first shaft, a wide faced pinion meshing with the gear teeth on said support and provided with a crank arm for changing the angular adjustment of said support, a rack movable parallel with said shafts and connected with said support, and a pinion meshing with said rack and provided with a crank arm for adjusting said support and stepped cone gear endwise, substantially as described.

6. The combination of parallel shafts, gears of different sizes fixed on one shaft, a gear shiftable endwise upon and rotatable with the other shaft, a gear support pivotally mounted and movable endwise with said shiftable gear on the second shaft and provided with gear teeth, a stepped cone gear carried by said support with one of its steps in mesh with said shiftable gear and movable to carry any of its steps into mesh with the fixed gears on the first shaft, a wide faced pinion meshing with the gear teeth on said support and provided with a crank arm for changing the angular adjustment of said support, a rack movable parallel with said shafts and connected with said support, and a pinion meshing with said rack and provided with a crank arm for adjusting said support endwise, substantially as described.

7. The combination of parallel shafts, a gear mounted on one shaft, gears of different sizes mounted on the other shaft, a support angularly adjustable concentrically with the gear on the first shaft, a stepped cone gear carried by said support with one of its steps in mesh with the gear about whose center it is adjusted and movable endwise to bring any of its steps into mesh with any gear on the second shaft, a driven shaft parallel with said shafts and gears of different sizes rotatable with said driven shaft and movable endwise thereon into mesh one at a time with corresponding gears on said second shaft, substantially as described.

8. The combination of parallel shafts, gears of different sizes fixed on one shaft, a gear shiftable endwise upon and rotatable with the other shaft, a gear support pivotally mounted upon and movable endwise with said shiftable gear on the second shaft, a stepped cone gear carried by said support with one of its steps in mesh with said shiftable gear and movable to carry any of its steps into mesh with any of the fixed gears on the first shaft, a driven shaft parallel with the other shafts, and gears of different sizes rotatable with and movable endwise on said driven shaft into mesh one at a time with corresponding fixed gears on said first shaft, substantially as described.

9. The combination of parallel shafts, a gear mounted on one shaft, fixed gears of different sizes mounted on the other shaft, a support angularly adjustable concentrically with the gear on the first shaft, a stepped cone gear carried by said support with one of its steps in mesh with the gear about whose center it is adjusted and movable endwise to bring any of its steps into mesh with any gear on the second shaft, a driven shaft parallel with said shafts, a loose gear mounted on said driven shaft in mesh with one of said fixed gears, and connected gears of different sizes rotatable with said driven shaft and movable endwise thereon, each into mesh one at a time with a corresponding fixed gear on said second shaft and one into locking engagement with the loose gear on said driven shaft, substantially as described.

10. The combination of parallel shafts, gears of different sizes fixed on one shaft, a gear shiftable endwise upon and rotatable with the other shaft, a gear support pivotally mounted and movable endwise with the movable gear on the second shaft, a stepped cone-gear carried by said support with one of its steps in mesh with said shiftable gear and movable to carry any of its steps into mesh with any of certain fixed gears on the first shaft, a driven shaft parallel with said shafts, a loose gear mounted on said driven shaft in mesh with one of said fixed gears, and connected gears of different sizes rotatable with said driven shaft and movable endwise thereon each into engagement with a corresponding fixed gear on said first shaft and one into locking engagement with the loose gear on said driven shaft, substantially as described.

11. The combination of parallel shafts, gears of different sizes fixed on one shaft, a gear shiftable endwise upon and rotatable with the other shaft, a gear support pivotally mounted and movable endwise with said shiftable gear on the second shaft, a stepped cone gear carried by said support with one of its steps in mesh with said shiftable gear and movable to carry any of its steps into mesh with any of certain fixed gears on the first shaft, a driven shaft parallel with said shafts, connected gears of different sizes rotatable with said driven shaft and movable endwise thereon each into mesh with a corresponding fixed gear on said first shaft, racks movable parallel with said shafts, one connected with said pivoted gear support

and the other with the gears on said driven shaft, and pinions meshing with said racks and provided with crank arms for adjusting said gear support and the connected gears on the driven shaft endwise, substantially as described.

12. The combination of a shaft, gears of different sizes fixed thereon, a driven shaft parallel with the other shaft, a loose gear mounted on said driven shaft in mesh with one of said fixed gears, and connected gears of different sizes rotatable with said driven shaft and movable endwise thereon each into mesh with a corresponding fixed gear on said first shaft and one into locking engagement with the loose gear on said driven shaft, substantially as described.

In witness whereof we hereto affix our signatures in presence of two witnesses.

EDWARD J. KEARNEY.
THEODORE TRECKER.

Witnesses:
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Jos. C. MILLMANN.