No. 734,691. PATENTED JULY 28, 1903.

H. L. FLATHER.

CHANGE SPEED GEARING FOR LATHES, &c.

APPLICATION FILED MAR. 16, 1903.

NO MODEL. 3 SHEETS—SHEET 1.

FIG. 1.

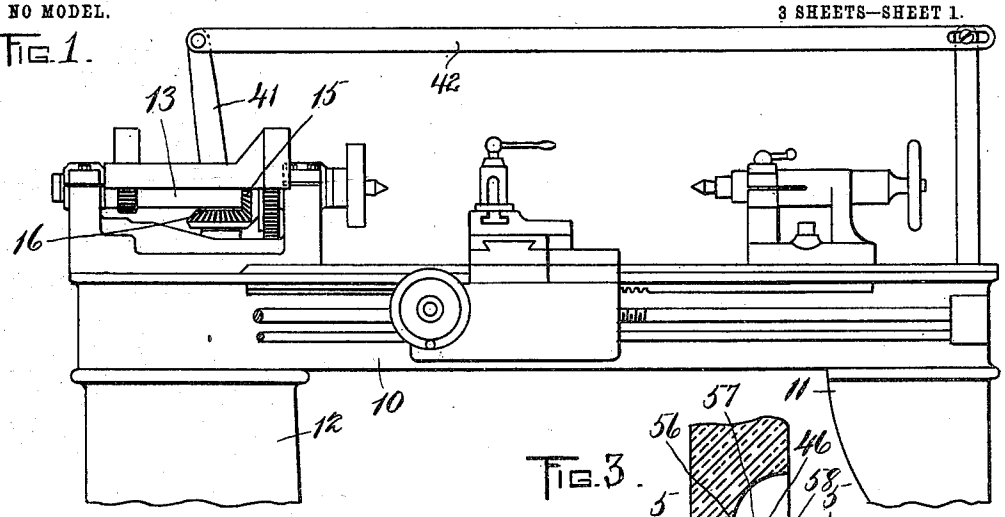


FIG. 3.

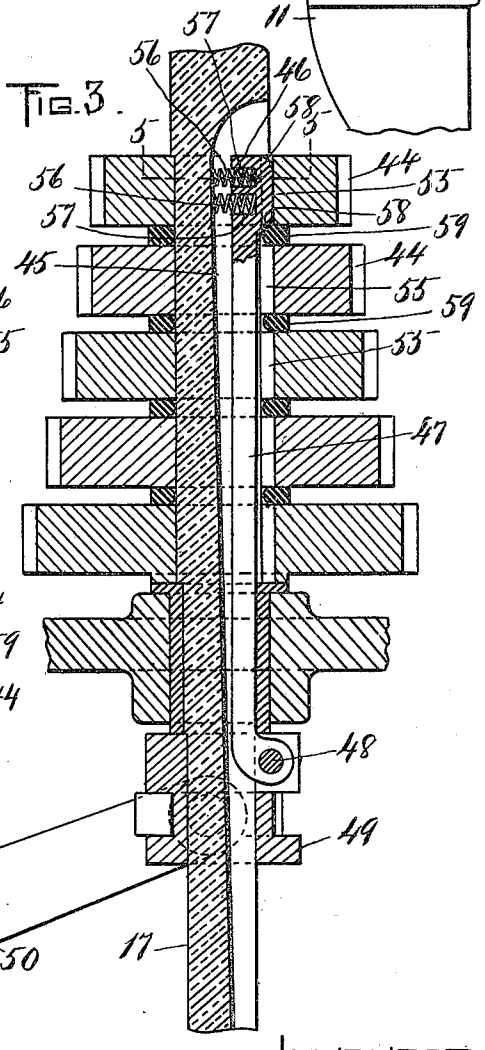


FIG. 5.

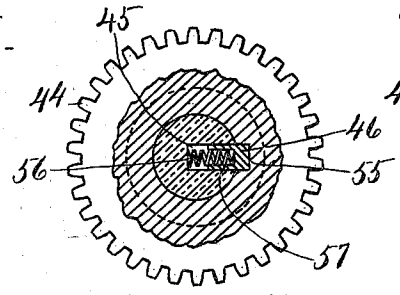
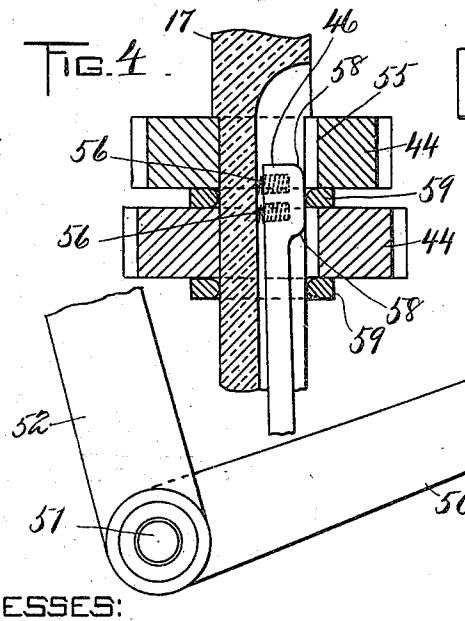


FIG. 4.



WITNESSES:
C. C. Reagan
P. W. Pezzetti

INVENTOR:
H. L. Flather
by Wright, Brown & Quinby
Attys

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 734,691. PATENTED JULY 28, 1903.

H. L. FLATHER.

CHANGE SPEED GEARING FOR LATHES, &c.

APPLICATION FILED MAR. 16, 1903.

NO MODEL. 3 SHEETS—SHEET 2.

FIG. 2.

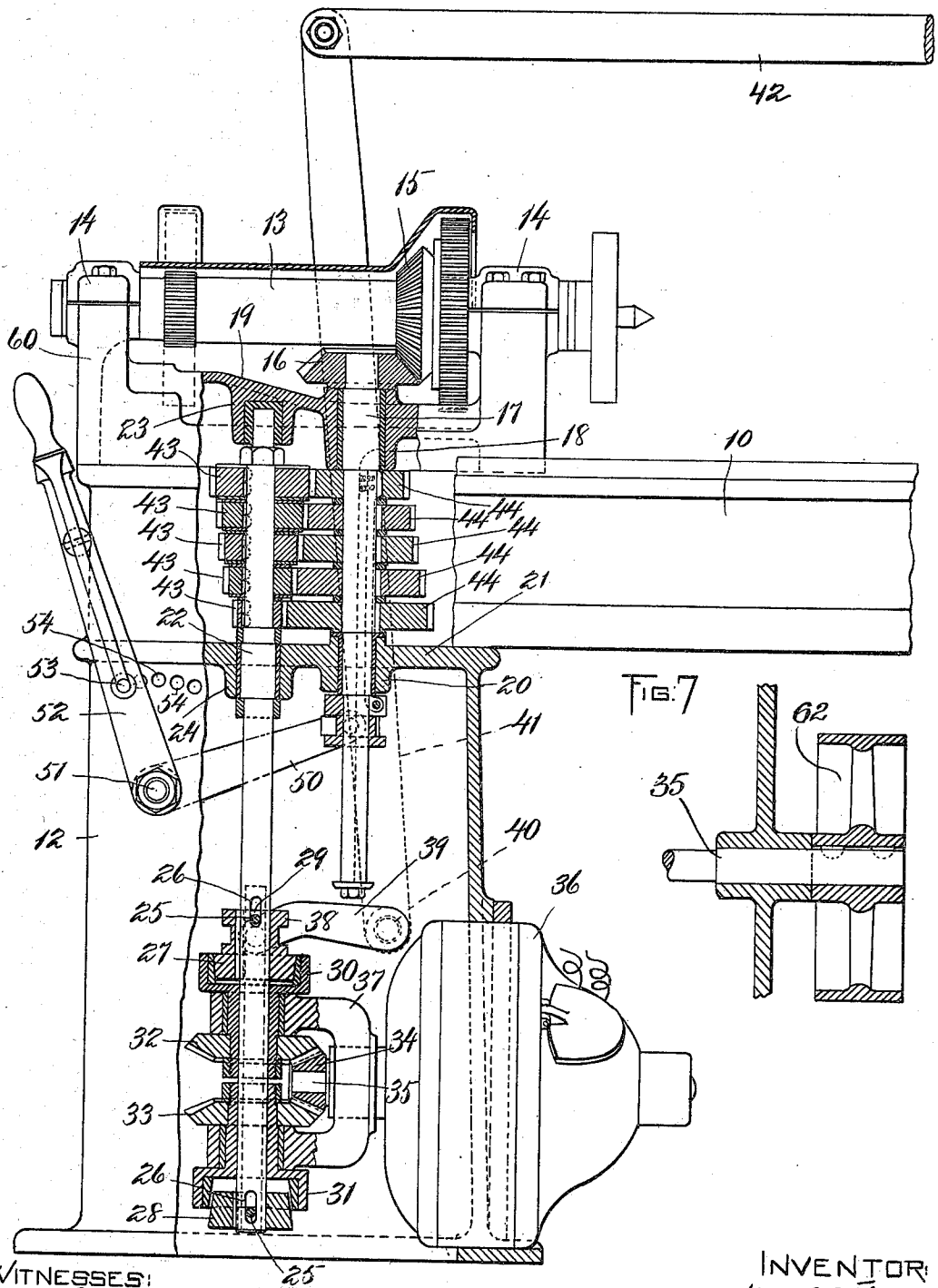


FIG. 7.

WITNESSES:
A. C. Rodigan
O. W. Pezzetti

INVENTOR:
H. L. Flather
by Wright, Brown & Quinby
Attys.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 734,691. PATENTED JULY 28, 1903.

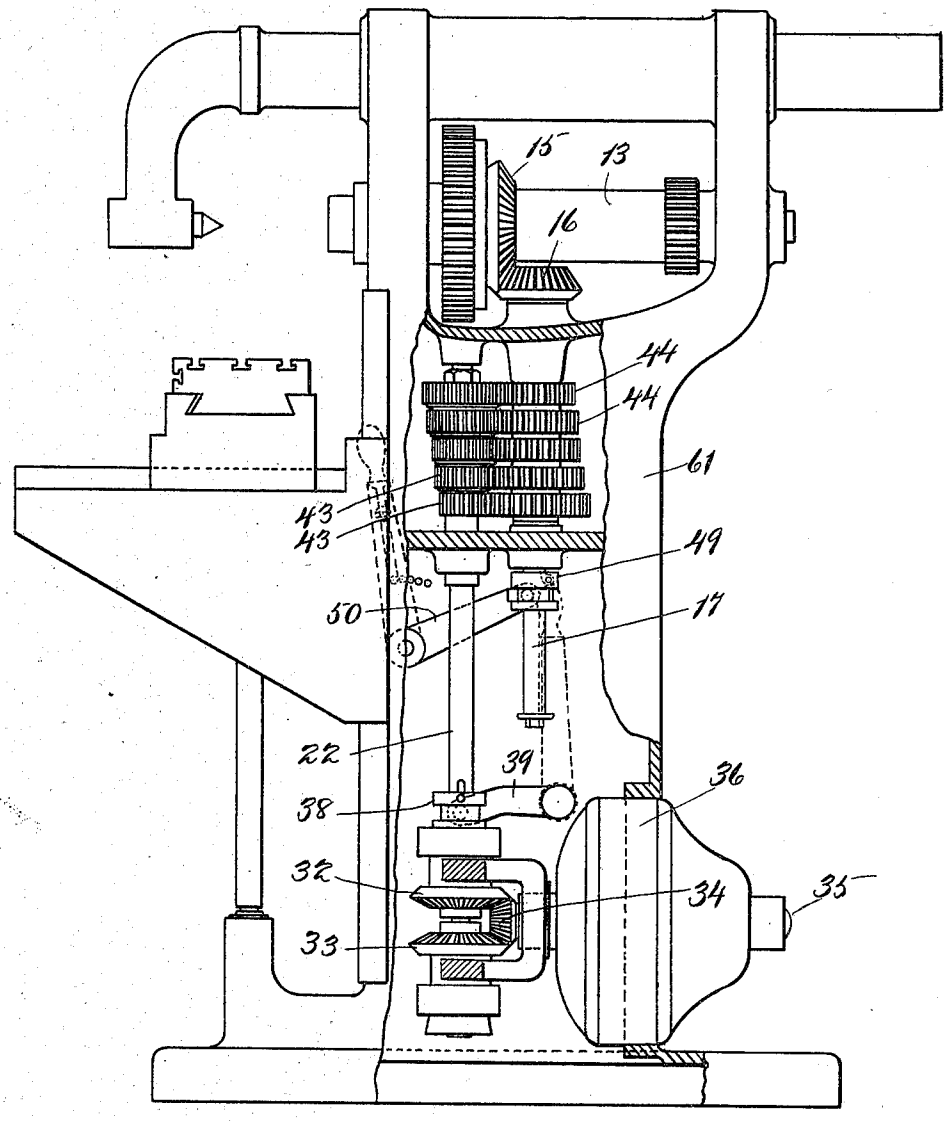
H. L. FLATHER.

CHANGE SPEED GEARING FOR LATHES, &c.

APPLICATION FILED MAR. 16, 1903.

NO MODEL. 3 SHEETS—SHEET 3.

Fig 6.



WITNESSES:
C. C. Ratigan
P. W. Pezzetti

INVENTOR:
H. L. Flather
by Wright, Brown & Quinby
Attys.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 734,691. Patented July 28, 1903.

UNITED STATES PATENT OFFICE.

HERBERT L. FLATHER, OF NASHUA, NEW HAMPSHIRE.

CHANGE-SPEED GEARING FOR LATHES, &c.

SPECIFICATION forming part of Letters Patent No. 734,691, dated July 28, 1903.

Application filed March 16, 1903. Serial No. 147,894. (No model.)

To all whom it may concern:

Be it known that I, HERBERT L. FLATHER, of Nashua, in the county of Hillsboro and State of New Hampshire, have invented certain new and useful Improvements in Change-Speed Gearing for Lathes, &c., of which the following is a specification.

This invention relates to lathes, milling-machines, and other machines employing a live-spindle or shaft which supports the work or a tool and which it is desired to drive at a plurality of different speeds.

The object of the invention is to provide a form and arrangement of speed-changing mechanism in which vibration is reduced and space economized. To the end of accomplishing these results the driving-shaft by which power is applied to the machine is located on the lower part of a frame which supports at its upper end the live-spindle or shaft, and between said power-shaft and spindle the change-speed gearing is extended in the form of an upright connection. By this means the vibrations, which are progagated principally from the driving-shaft in a mechanism of this kind, are resisted by the proximity of said shaft to the floor instead of being transmitted and multiplied through the large mass of the change-gearing and exerting a detrimental vibratory effect on the live-spindle, which would be experienced were the devices which I employ concentrated in the vicinity of the spindle.

Of the accompanying drawings, Figure 1 represents a side elevation of a lathe embodying my improvements. Fig. 2 represents a vertical section of one end of the lathe, showing the change-speed gearing. Fig. 3 represents an enlarged section of the vertical driven shaft with the gears thereon. Fig. 4 represents a fragment of Fig. 3, showing the sliding key in a different position. Fig. 5 represents a section on the line 5 5 of Fig. 3. Fig. 6 represents a side elevation, partly broken away, showing the application of my invention to a milling-machine. Fig. 7 represents a detail sectional view showing a shaft and pulley drive.

The same reference characters indicate the same parts in all the figures.

In the drawings, 10 represents the bed of a lathe having legs or standards 11 12, whereby the lathe is supported on the floor or base, the standard 12 at the live-spindle end, or left end as viewed in Figs. 1 and 2, being hollow in form and containing the change-speed gearing. 13 is the rotary power-driven spindle, mounted in bearings 14 14 horizontally at one end of the lathe-bed and having fixed to it a bevel-gear 15, meshing with the teeth of a bevel-gear 16, fixed to the upper end of a shaft 17, which I may term the "vertical" driven shaft. Said shaft has a bearing 18 in the floor 19 of the head-casting and another bearing 20 in the roof 21 of the leg 12. Back of the shaft 17 is a vertical driving-shaft 22, parallel to the shaft 17 and likewise having bearings 23 24 in the webs 19 21. The lower end of the shaft 17 is extended downwardly not quite half the height of the leg 12, and the shaft 22 is extended downwardly substantially to the bottom of said leg. Said shaft 22 has connected to it by spline connections consisting of pins 25 and slots 26 in the shaft two clutch-cones 27 28, connected to move together by means of the pins 25 and a rod 29, sliding in a bore of the shaft 22. The cones 27 28 alternately engage with complemental conical clutch members 30 31, fixed to two bevel-gears 32 33, meshing with a bevel-pinion 34 on a horizontal power-shaft 35. This shaft, as shown in Fig. 2, is that of an electric motor 36, set into an aperture in one wall of the leg 12. The lower end of the shaft 22 and the shaft 35 have bearings in a fixed bracket 37, secured to the walls of the leg 12. The upper splined clutch member 27 has a circumferentially-grooved hub 38, engaged by an arm 39 on a rock-shaft 40, suitably supported in bearings on the walls of the leg 12. Also secured to said rock-shaft is a long upwardly-projecting arm 41, having a horizontal hand rail or rod 42 pivoted to its upper end, whereby the machinist may work the reversing mechanism from any position along the lathe.

To the upper end of the vertical driving-shaft 22 are keyed a number (five in this instance) of spur-gears 43 43 of different diameters, forming a cone of gears and each one in constant mesh with an opposite gear 44, loosely mounted on the vertical driven shaft 17, said gears 44 forming a complemental cone of gears. Where the gears 44 surround the

shaft 17, the latter is grooved, as at 45, and said groove contains a sliding key 46, having a long stem 47, whereby it is pivotally secured at 48 to a circumferentially-grooved sleeve 49, mounted to slide on shaft 17. Sleeve 49 is engaged by an arm 50 on a rock-shaft 51, mounted in bearings in the walls of the leg 12, and oscillated by an arm 52, fixed to said shaft outside of the leg, said arm having a handle at its upper end and adapted to be fixed in five different positions corresponding to the five changes of speed by means of a latch 53 engaging a segment of holes 54 in the wall of the leg 12. Each of the gears 44 is formed with a longitudinal keyway or groove 55, adapted to be entered by the key 46, which latter is yieldingly pressed into position to engage the keyways by springs 56 56, housed in sockets 57 57 in the key and adapted to slide along the bottom of the groove 45 when the key is moved from one position to another. As indicated, the corners 58 58 of the key 46 are rounded or beveled, and the gears 44 are separated by washers 59 59, the edges of whose apertures are complementally rounded or beveled, thereby allowing the key to be withdrawn from engagement with gear 44 by a longitudinal movement imparted to the key. From an inspection of Fig. 4 it will be evident that the key 46 cannot become engaged with any gear until it has become fully disconnected from the gear with which it was previously engaged. It is apparent that by swinging the controlling-arm 52 the key 46 may be engaged with any one of the gears 44, thereby causing that gear to rotate the shaft 17, and thus five changes of speed can be given to the live-spindle 13. The changes can be made with great rapidity without any detrimental shock to the machine, the results being much superior to and more satisfactory than those afforded by the use of a shifting belt and cone-pulleys. The bevel-gears 32 33 revolve in opposite directions, and the direction of rotation of the spindle 13 is determined by the clutch 30 or 31 which is in operation.

Among the advantages of my invention are that it secures changes of speed for the live-spindle 13 by positive gearing without the employment of a counter-shaft or other mechanism outside of the lathe. A natural support, such as the hollow box-leg 12 of the lathe, is utilized to inclose a part of the driving mechanism, and the latter does not interfere with other operating parts of the lathe or require a redesigning and arrangement of these parts to accommodate the change-speed mechanism. The lathe is driven from the base of the leg 12. This alone is a great advantage, as it removes obstructing belting and shafting from above the lathe and allows the lathe to be driven by an independent motor, such as an electric motor 36, without producing the objectionable vibration which is noticed when a driving-motor is mounted upon the bed 10. It will be noted that two cones of gears 43 44 are located within the vertical limits of the lathe-bed 10, thus giving the shafts 17 22 a natural bearing on both sides of the gear-cones in the webs 19 21 of the head 60 and leg 12, respectively.

In Fig. 6 my invention is shown as applied to a milling-machine, which is virtually a short type of lathe. The supporting-standard or hollow frame 61 of this machine is utilized as an inclosure and support for the vertical shafts and change-speed gearing in a manner similar to the employment of the lathe-bed and box-leg of the lathe previously described. The moving parts in this machine are constructed substantially as before described and are designated by similar reference characters.

I do not claim the speed-changing mechanism herein described as new by itself, nor do I wholly restrict myself to the form of change-speed mechanism disclosed, as other types or modifications of this type may be employed.

In either form of my invention disclosed the shaft 35 may be provided with a belt-pulley 62 for driving it instead of the motor 36. The shaft 35 may also project in a different direction from that shown, if desired.

I claim—

1. In a machine of the character specified, the combination of a frame, a work or tool supporting spindle journaled at the upper portion of said frame, a shaft whereby power is communicated to the machine journaled at the base of said frame, and upright power-transmitting devices connecting said shaft and spindle and including speed-changing mechanism.

2. In a machine of the character specified, the combination of a frame, a work or tool supporting spindle journaled at the upper portion of said frame, a prime motor supported at the base of the frame, and upright power-transmitting devices connecting said motor and spindle and including speed-changing mechanism.

3. In a machine of the character specified, the combination of a hollow frame or support, a work or tool supporting spindle journaled at the upper portion of said frame, a shaft whereby power is communicated to the machine journaled at the base of said frame, and upright power-transmitting devices inclosed in said frame and connecting said shaft and spindle, said devices including speed-changing mechanism.

4. In a machine of the character specified, the combination of a frame, a work or tool supporting spindle journaled at the upper portion of said frame, a shaft whereby power is communicated to the machine journaled at the base of said frame, upright power-transmitting devices connecting said shaft and spindle and including speed-changing mechanism, and a reversing mechanism located at the junction of the shaft with the power-transmitting devices.

5. In a machine of the character specified,

the combination of a frame, a work or tool supporting spindle journaled at the upper portion of said frame, a shaft whereby power is communicated to the machine journaled at the base of said frame, parallel upright shafts geared to said shaft and spindle respectively, inversely-related conical speed-changing members on said upright shafts, and means movable upwardly and downwardly to effect connection of said upright shafts through said conical members in different planes.

In testimony whereof I have affixed my signature in presence of two witnesses.

HERBERT L. FLATHER.

Witnesses:

GEO. W. BOUTELLE,

CLARENCE P. BODWELL.