C. L. GROHMANN.

MILLING MACHINE.

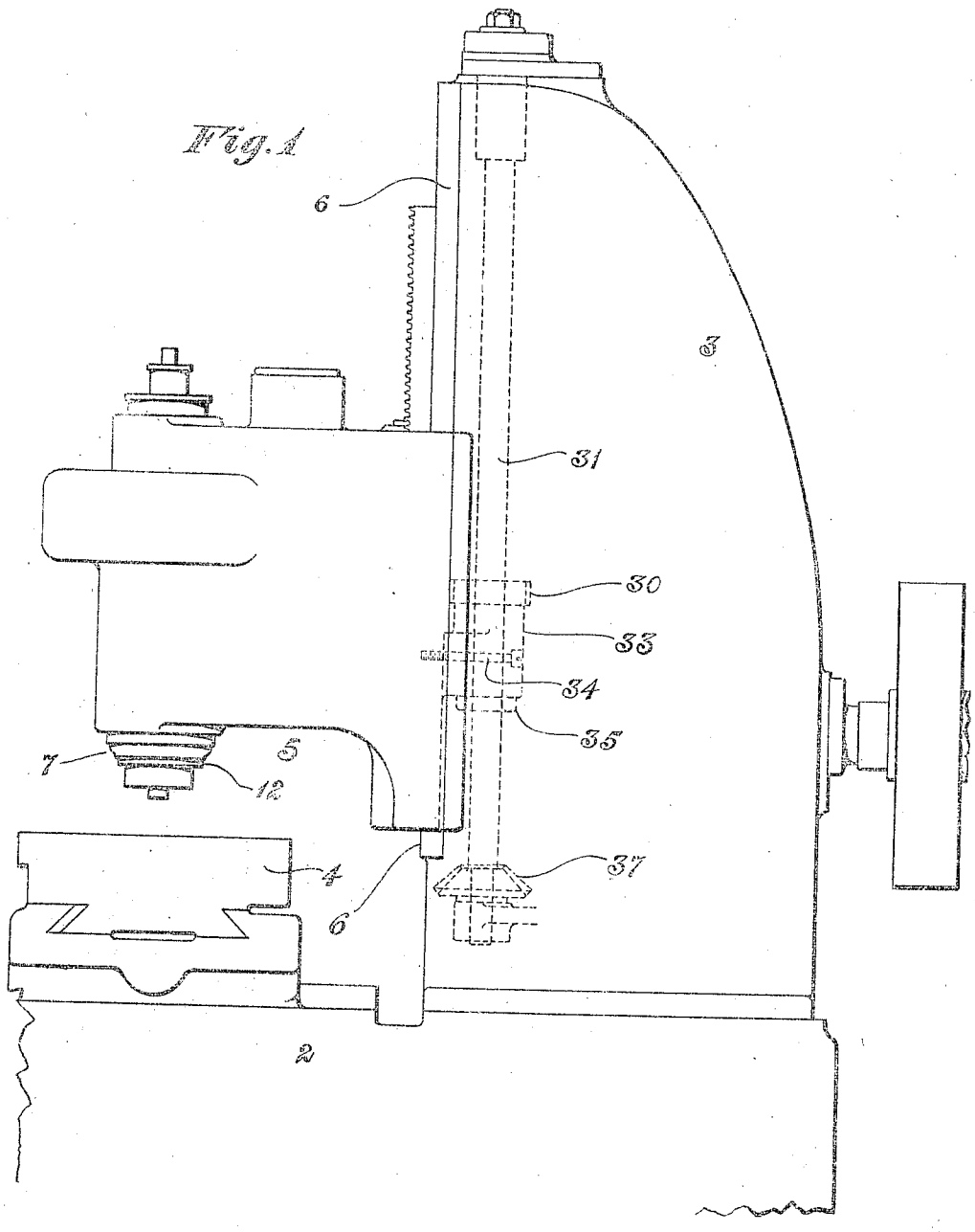
APPLICATION FILED JAN. 21, 1909.

971,885.

Patented Oct. 4, 1910.

3 SHEETS—SHEET 1.

Fig. 1



Witnesses:

Inventor:
C. L. Grohmann
By his Attorneys,
Sutherland & Anderson

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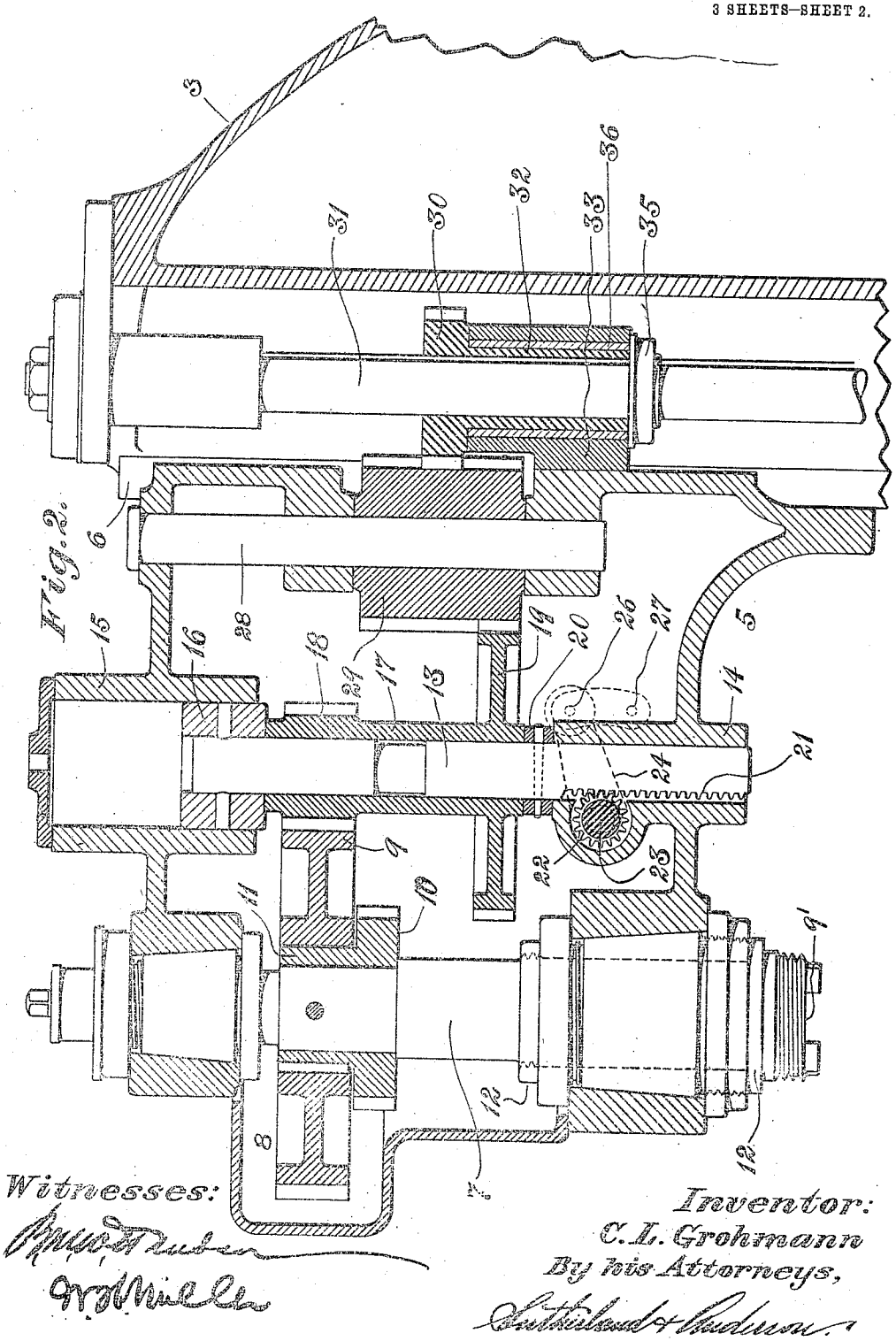

Fig. 2.

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3 SHEETS—SHEET 3.

Fig. 3.

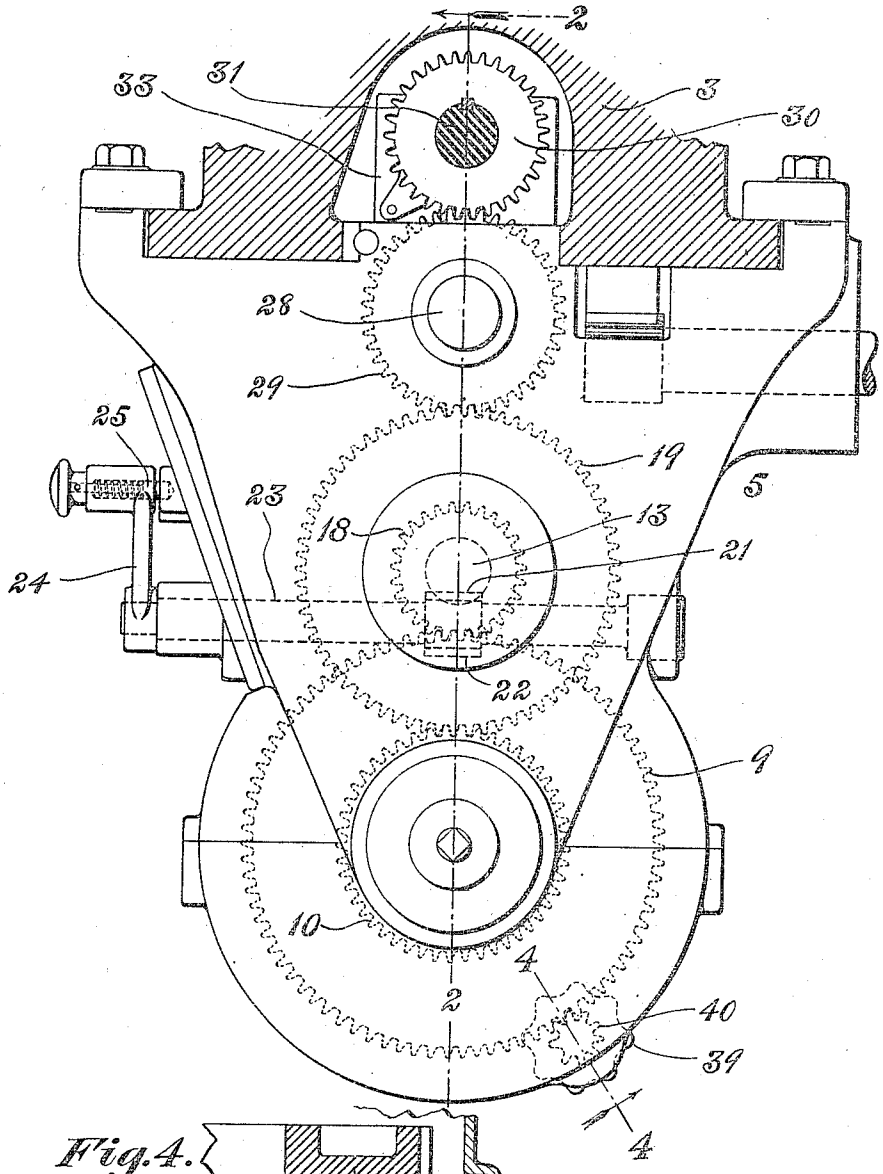
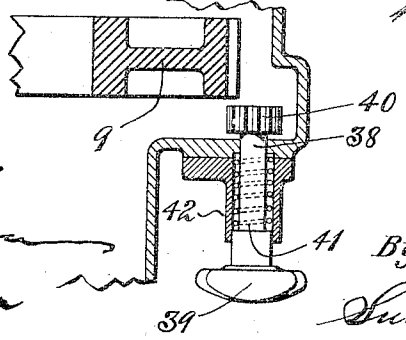


Fig. 4.



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UNITED STATES PATENT OFFICE.

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MILLING-MACHINE.

971,885 Specification of Letters Patent. **Patented Oct. 4, 1910.**

Application filed January 21, 1909. Serial No. 473,518.

To all whom it may concern:

Be it known that I, CARL L. GROHMANN, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Milling-Machines, of which the following is a specification.

This invention relates to milling machines one of the primary objects of the invention being to provide a machine of this type wherein the tendency to bend is greatly reduced as compared with certain existing forms of such machines with which I am familiar.

The machine possesses other advantageous features which with the foregoing will be set forth at length in the following description wherein is outlined in detail that form of embodiment of the invention whichI have selected for illustration in the drawings accompanying and forming part of this specication..

Referring to said drawings, Figure 1 is a side elevation of a milling machine involving my invention. Fig. 2 is a vertical section on the line 2—2 of Fig. 3. Fig. 3 is a horizontal sectional plan view of the head and column, and, Fig. 4 is a sectional detail on the line 4—4 of Fig. 3.

The figures are on different scales and throughout the same similar characters refer to like parts.

My improvements although susceptible of general application are of prime utility when embodied in a vertical spindle milling machine as represented in full in Fig. 1. Such a machine comprises a bed as 2 and a column as 3 rising from said bed the former being equipped with a work-support or table as 4. The head which directly sustains the cutter spindle may take various forms the one illustrated being denoted in a general way by 5, the column 3 being provided with ways as 6 to support and guide said head 5 during the several vertical adjustments thereof. Said ways 6 it will be observed practically extend to the bed 2 by virtue of which when the head 3 is in its lowest adjustment it will be substantially supported; in other words at such time there is no overhang of said head.

The cutter spindle may be of various forms; that represented is denoted by 7 and as the same in itself forms no specific part of the present invention it is unnecessary to describe the same in detail, any more than to state that it is rotatively supported by and is bodily movable with the head 5 so that when the head is adjusted the cutter spindle is similarly adjusted. Associated with said cutter spindle 7 is a driving element therefor; that illustrated being denoted in a general way by 8 and being preferably although not essentially of compound form in that it comprises two sub elements whereby variations in speed of said spindle can be secured. In the present case there is no relative movement between the cutter spindle 7 and the driving element 8 by reason of which I can reduce the flexing tendency of said cutter spindle to its least possible extent. Milling machines usually have a cutter spindle and a driver therefor the spindle having a driving slidable connection with the driver for purposes of adjustment, the consequence being the greater the adjustment of said old spindle the greater the flexing tendency therein. The spindle 7 is provided with the usual tool-holder 9′ with which the customary tool or cutter is connected and in the present case it will be clear that the relation between my cutter, spindle and spindle driver never varies so that I am enabled to secure the advantage stated. Therefore to adjust the tool toward or from the work it is necessary that the head 5 be adjusted the spindle partaking always of the adjustments of said head.

While I have termed the part 8 a driving element it is in turn driven by other mechanism as will hereinafter appear, and it is shown as consisting of a gear 9 and pinion 10, the latter having a hub as 11 pinned or otherwise suitably connected to said spindle for rotation therewith. To said hub 11 is fitted the gear 9, said gear and pinion constituting part of a suitable speed varying mechanism. The cutter spindle 7 may be held longitudinally immovable in any desirable manner; for example by several collars all denoted by 12 bearing against the head interiorly and exteriorly thereof.

I have shown as within the head 5 and in proximity to the spindle 7 a shaft 13 endwise movable in bearings as 14 and 15 of tubular form and illustrated as forming parts of the bottom and top respectively of said head. The said shaft 13 is shown as having pinned to its upper end a collar 16

which has a sliding movement in the upper bearing 15 from which it will be evident that said shaft has an endwise or longitudinal movement and this action I utilize in the present case for alternately putting into mesh gears on said shaft 13 with the gear 9 and pinion 10. There is shown as fitted to said shaft 13 an elongated sleeve 17 which may be and is shown as loose on said shaft although it is slidable thereon for a purpose that will hereinafter appear. Said sleeve 17 is shown as equipped with a rigid pinion 18 and a gear 19. The upper end of said sleeve 17 is shown as bearing against the collar 16 while the lower end thereof rests upon a collar as 20 suitably fastened to said shaft 13. It therefore follows that when said shaft 13 is adjusted the pinion 18 and gear 19 will be correspondingly adjusted. In Fig. 2 the pinion 18 is shown as being in mesh with the gear 9. To increase the speed of the spindle 7 the gear 19 will be put into mesh with the pinion 10 it being of course evident that the gear 19 is greater in diameter than the pinion 18. The adjustment of said pinion 18 and gear 19 is accomplished through the endwise movement of the shaft 13 and I will now describe the means shown for thus operating said shaft. Said shaft 13 is shown as having rack teeth or a rack portion 21 with which meshes a pinion as 22 rigid on a rock-shaft as 23 supported for oscillation by the head 5. I have shown as rigidly connected with one end of said rock-shaft 23 a handle or crank arm 24 provided near its free end with the familiar spring plunger 25 to alternately enter the perforations or seats 26 and 27 in said head 5 to maintain the respective adjustments of said shaft 13. The spring plunger 25 is shown in Fig. 2 as being in the upper seat 26 the consequence being that the pinion 18 is held positively in mesh with the gear 9. To increase the speed of the spindle 7 the plunger will be removed from said upper opening and the handle 24 swung to the limit of its adjustment or until said plunger can enter the lower seat 27 at which time said plunger is sprung into said lower seat to positively hold the gear 19 in mesh with the pinion 10 which relation was secured by the upward movement of the sleeve 17 by manipulation of said handle 24 acting through the intermediate described parts.

It will be perceived that the collar 16 is somewhat closely fitted and slidable within the upper tubular bearing 15 and owing to the fact that this collar is in proximity to the pinion 18 the latter when in action is effectually supported against lateral motion this bearing 15 being aided in steadying the shaft 17 by the suitably supported member 13 which it will be remembered has a substantial bearing in the tube 14. When the shaft 17 is elevated to put the spur gear 19 into mesh with the pinion 9 the pinion 18 is received within the said tubular bearing 15.

The vertically movable head 5 is represented as supporting a second shaft as 28 being provided with suitable bearings for the purpose. Loose on said shaft 28 is a barrel or elongated pinion as 29 and with which the gear 19 is always in mesh, this result being secured by making said barrel pinion of a length equaling the range of adjustment of said gear 19 which is advantageous owing to the fact that there is at all times a driving relation between the said pinion 29 and the gear 19. This barrel pinion although freely rotative is longitudinally immovable such a condition being maintained in the present case by positioning it between two of the relatively fixed bearings for said shaft 28. The barrel pinion 29 is shown as being in mesh with a pinion as 30 which preferably has a splined connection with a shaft as 31 illustrated as vertically disposed and as approximately coextensive with the column 3. The pinion 30 is represented as furnished with an elongated hub 32 supported for rotation in a bracket or bearing as 33 rigidly connected as by screws or bolts 34 with the head 5 said hub being preferably provided with a collar as 35 bearing against the underside of said bracket 33, a bushing 36 being usually interposed between said hub 32 and bracket 33. The pinion 30 has a sliding movement on the shaft 31 from near one end thereof to near the other end thereof by reason of which a great range of adjustment of said head 5 is secured thereby adapting the machine to widely different sizes of work. The shaft 31 is continuously rotative; that is it is in motion while the machine is in action but I do not deem it necessary to describe the means for operating said shaft although one of the elements, namely, the bevel gear 37 is illustrated. During the adjustment of the head 5 there is always a driving connection between the shaft 31 and the cutter spindle 7 assuming of course that either the pinion 18 be in mesh with the spur gear 9 or the spur gear 19 be in mesh with the pinion 10.

While I provide for a considerable amount of adjustment of the head 5 I reduce to the least possible extent the flexing tendency of said shaft 31 during the major part of the operation of the machine. It will be understood that practically all the work of a milling machine is done while the head thereof is in the neighborhood of the work support of whatever nature these members may be. In Fig. 1 I have shown the head 5 as being practically at its lowest limit of adjustment and it will be evident that when the head is in such position the

flexing tendency of said shaft 31 is inconsiderable and the same will apply or possibly the flexing tendency may be slightly increased by a reasonable upward adjustment of the head. In any event during ordinary work or the usual action of the machine while the stock may vary in depth the head is at no time so close to the work-support as to make the flexing tendency of said shaft an undesirable factor. Of course there is more flexing tendency in said shaft when the head is moved upward the same increasing to its maximum when said head is at the limit of its upward adjustment. While therefore I reduce the flexing tendency of said shaft 31 to a negligible amount during the major period of operation of the machine I provide for a great range of adjustment of the head 5.

I provide means as will now appear for turning the gear members 9 and 10 with respect to the coöperating gear members 18 and 19 whereby I can insure when necessary a proper mesh between the respective coöperative gear members. The head 5 is shown as supporting for endwise rotary movements a manually-operable spindle 38 provided at its lower end with a knob or equivalent operating device as 39. I have shown as fastened to the upper end of this spindle a pinion 40 which is represented as located within the hollow head 5 and as cooperative with the spur gear 9. Said pinion 40 is normally out of mesh with said spur gear 9, this relation being preferably secured by a spring as 41 of coiled type surrounding said spindle 38. The lower end of the spring bears against the hub or body of the knob 39 while the upper end thereof bears against the head 5 said spring being normally under tension to positively hold the gear or pinion 40 in its normally inoperative position or that shown in Fig. 4. The spring 41 is shown as being inclosed by the sleeve 42 flanged at its upper end and rigidly connected at said end with said head; the spindle as will be obvious extends through said sleeve 42. Should it be necessary to have recourse to the pinion 40 it is elevated to put it into mesh with the spur gear 9; should there be any difficulty in getting said pinion into mesh with said spur gear the difficulty can be easily remedied by turning said pinion, it being understood that the shaft or spindle 38 to which the pinion is connected is capable of rotation. After the pinion 40 is in mesh with said spur gear 9 the latter and hence the pinion 10 can be turned by the operator to put the said two last mentioned parts accurately into mesh with the coöperative power driven gear members 18 and 19.

I have described in detail that form of embodiment of the invention shown in the accompanying drawings so that as stated those skilled in the art can successfully practice my invention. I do not restrict myself to the disclosure thus made for many variations may be adopted within the spirit of my invention as expressed by my claims.

It will be perceived that the spindle 7 is non-endwise movable with respect both to the head 5 and the driving element 8. It is customary in milling machines to have a double adjustment, one a rough or primary adjustment to carry the tool nearly to the work or vice versa necessary and the other the fine or finished adjustment. By the peculiar mounting of the spindle I can obtain both of these adjustments from the head. The several back gears are also inclosed in the head by reason of which they will be effectually protected while the shaft 31 and its coöperating parts are inclosed in the column 3. The latter it will be observed is vertical and the head 5 travels vertically or up and down said column and in a path parallel to the spindle 7 and shaft 31 or otherwise stated in a direction parallel to the axes of motion of said spindle 7 and shaft 31. In securing an adjustment or adjustments there is therefore no movement whatsoever of the spindle 7 longitudinally with respect either to the head 5 or the driving element for said spindle.

What I claim is:

1. In a milling machine, a head, a cutter spindle rotatively supported by said head, a pair of rigidly connected gears rotative with said spindle, an endwise movable shaft provided with a collar, the head having a tubular bearing to slidably receive said collar, and two rigidly connected gears fastened to said shaft and of different diameters the endwise movement of the shaft being adapted to vary the meshed relations of the two sets of gears and to also carry one of the gears thereon into said tubular bearing.

2. In a milling machine, a head, a cutter spindle rotatively supported by said head, two rigidly connected gears of different diameters fastened to said spindle, an endwise movable shaft, a pair of rigidly connected gears fastened to said shaft for shifting movement therewith the movement of the shaft serving to vary the meshed relation between the two sets of gears, and a collar at one end of the shaft, the head having a tubular bearing to receive said collar and also having a bearing for the other end of said shaft the latter on the endwise movement thereof in one direction being adapted to move one of the gears thereon into said tubular bearing.

3. A milling machine comprising a head, a cutter spindle rotatively supported by said head, a pair of rigidly connected gears of different diameters connected with said spindle for rotation therewith, an endwise

movable shaft, a pair of rigidly connected gears also of different diameters said shaft on its movement serving to vary the meshed relation between the two sets of gears, a collar fastened to said shaft, and adjacent to the smaller gear thereon said collar being located near one end of the shaft, a tubular bearing for slidingly receiving said collar and for also receiving the smaller gear on said shaft when the latter is moved in one direction, and a bearing on the head for supporting the other end of said shaft.

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

CARL L. GROHMANN.

Witnesses:
W. W. MILLER,
B. M. W. ANDERSON.