No. 612,412. Patented Oct. 18, 1898.

C. L. GROHMANN.

INDEX HEAD FOR MILLING MACHINES.

(Application filed Nov. 5, 1897.)

(No Model.) 4 Sheets—Sheet 1.

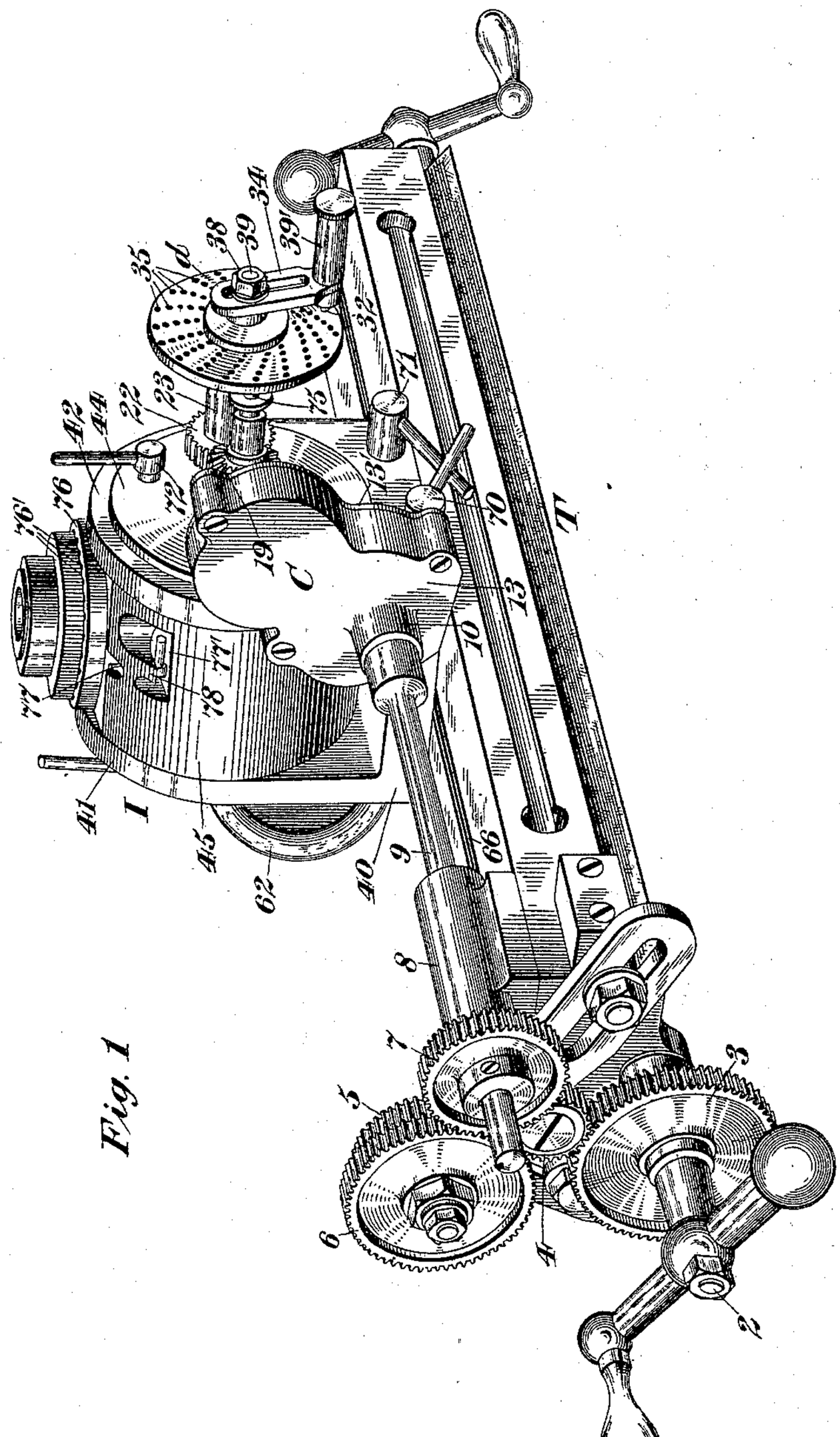

Fig. 1

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(No Model.) 4 Sheets—Sheet 2.

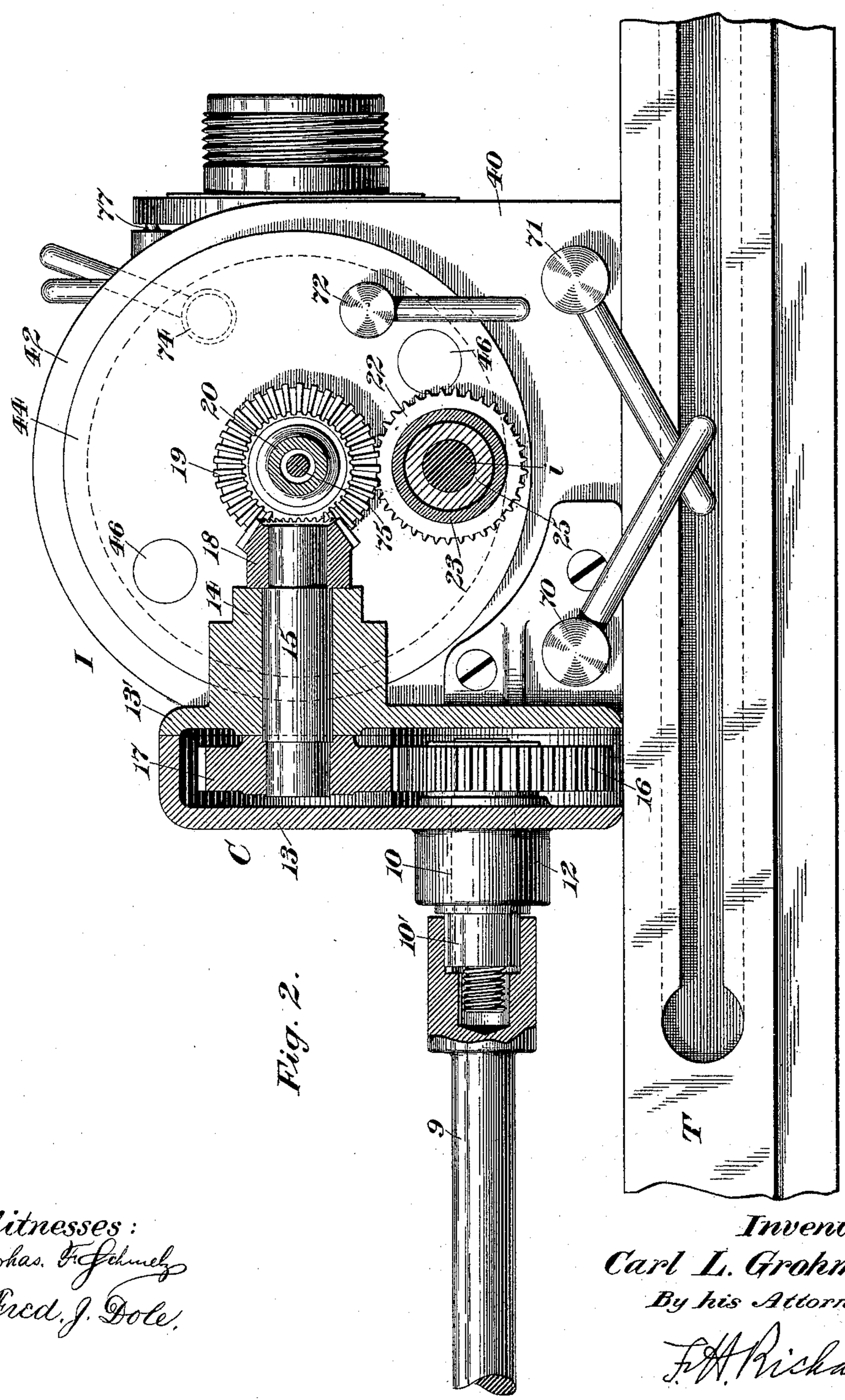

Fig. 2.

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(No Model.) 4 Sheets—Sheet 3.

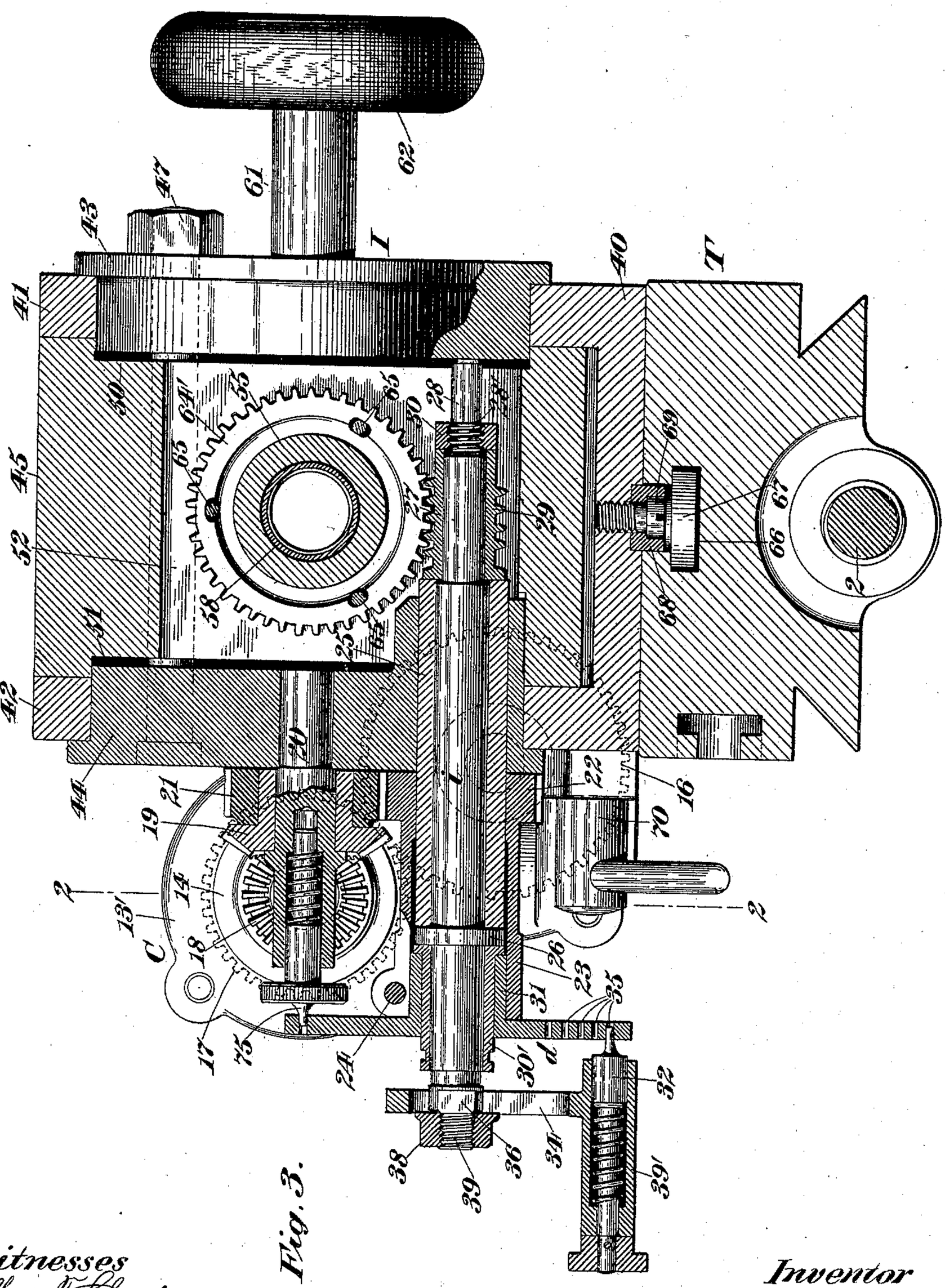

Fig. 3.

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4 Sheets—Sheet 4.

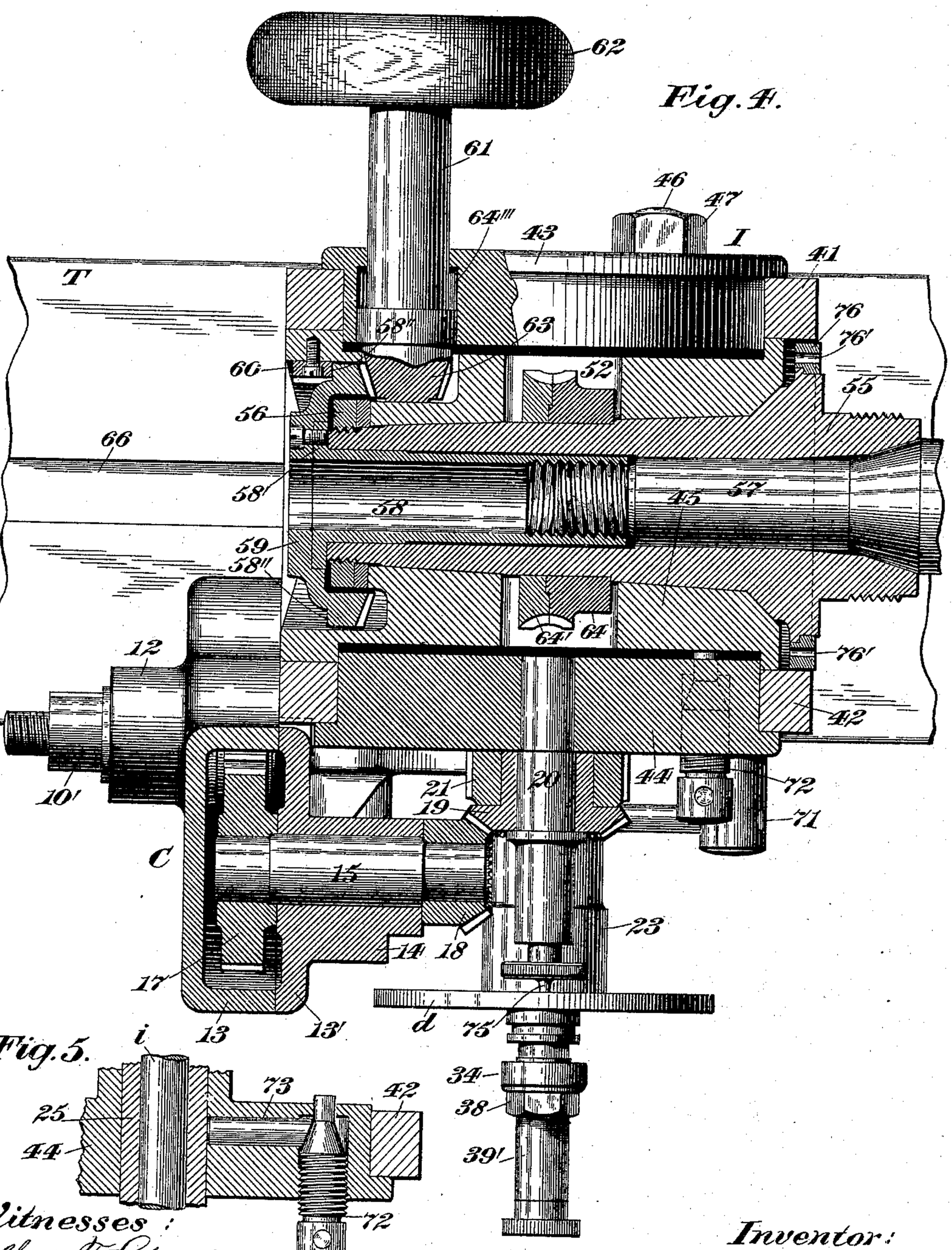

Fig. 4.

Fig. 5.

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UNITED STATES PATENT OFFICE.

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INDEX-HEAD FOR MILLING-MACHINES.

SPECIFICATION forming part of Letters Patent No. 612,412, dated October 18, 1898.

Application filed November 5, 1897. Serial No. 657,506. (No model.)

To all whom it may concern:

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

This invention relates to index-heads for milling-machines; and it has for its main object the provision of an improved device of this type capable of adjustment to all positions in which it may be desired to set the work, whether the latter be fed by hand or by power-operated feed mechanism, and in which also the connection of the driven parts with the feed mechanism can be maintained regardless of the adjustments of the index-head.

More particularly, one of the main objects of these improvements is to furnish an index-head having a movable member or head vertically adjustable in a vertical plane to and at both sides of a vertical position and throughout the major portion of a circle, so as to permit the work-holder carried on said head to be shifted to any desired angular position between two horizontal positions of such work-holder at opposite ends of the index-head. This result is accomplished by providing an index-head in which the movable member or head proper is adjustable about an axis passing substantially through its center, which axis may also intersect the axis of rotation of the work-holder carried on said head, the construction being preferably such that the work-holder may be swung with such movable head until the work-holder strikes the feed-table at one end or the other of the index-head, this movement being in the construction illustrated in the drawings of this application throughout an arc of about three hundred degrees. With such a range of adjustment as this it will be apparent that the work-holder can be adjusted not only from a horizontal to a vertical position at one end of the index-head, but also that said work-holder may be swung around end for end from one horizontal position to another.

For the purpose of maintaining the connection with the index-head at any desired point along the feed-table I make use of a driving connection between the index-head and the feeding means or feed-screw by which the transverse movement of the feed-table is usually obtained in a milling-machine. The connection between said feed mechanism and the index-head is obtained in the present case by a rotary member, such as a shaft, movable or slidable longitudinally relatively to another rotary member by which it is operated. By means of this connection of the index-head with the feeding means the former may be adjusted at will along the feed-table, this construction, in connection with that just described for adjusting the work-holder in a vertical plane, constituting a means for obtaining a universal adjustment of the work-holder toward and from the milling-tool at both sides of the axis of rotation of the latter and to any desired angle relatively to such cutter.

Another important feature of the invention is the provision of a work-holder-operating indexing-spindle having a different axis of movement from that of the adjustable head of the index-head and connected with the work-holder and with suitable feeding means in such a manner as to be at all times in operative connection therewith regardless of the position to which the movable head may be turned. This indexing-spindle will usually be supported on the movable head and will turn therewith about the axis of the movable head, the axis of the indexing-spindle being preferably in parallelism with that of said movable head. An important feature of this part of my present invention is the employment of an indexing-spindle and a work-holder operatively connected in such a manner that one member of the operating connections may be shifted to disconnect these parts and permit the work-holder to be turned freely independently of the indexing-spindle. In the construction illustrated the indexing-spindle itself constitutes such a shiftable member, the spindle being mounted in bearings in such a manner as to be movable longitudinally therein to withdraw the usual power-transmitting gear or worm from the gear, usually a worm-gear, with which it co-operates.

Other features of the invention, which will be referred to more particularly herein, relate to the positioning and adjustment of the

work-holding arbor by means of a drawing-in spindle held against longitudinal movement and rotatable by a hand-wheel or similar member through suitable intermediate connections, and they also relate to certain other mechanisms and devices, which will be hereinafter fully described.

In the drawings accompanying and forming part of this specification, Figure 1 is a perspective view of an index-head constructed in accordance with my present improvements and operatively connected with the feed-screw carried by the feed-table of a milling-machine. (Not shown.) Fig. 2 is an enlarged sectional front elevation of the same, the section being taken in line 2 2, Fig. 3. Fig. 3 is a vertical central transverse section of the same, partly in elevation. Fig. 4 is a central horizontal section of the same, partly in plan; and Fig. 5 is a detail illustrating the manner in which the sleeve or bushing for the indexing-spindle is clamped in place.

Similar characters designate like parts in all the figures of the drawings.

It will be understood, of course, that my present improvements are especially adapted and intended for use in connection with a milling-machine, and particularly with one of the "universal" type; but only so much of such a milling-machine as is necessary for the purpose of illustrating the manner in which the work-holder of an index-head is connected with and operated by the feeding means is illustrated herein.

The index-head, which is designated in a general way by I, may be mounted in the usual manner upon a feed-table, such as that shown at T, but which may be of any suitable type. The manner in which this feed-table is carried and operated by the coacting mechanism of the milling-machine is well understood and will not be described in detail herein.

The usual feed-screw for imparting transverse movement to the feed-table T is indicated herein at 2 (see Fig. 3) and carries thereon a gear 3, by means of which the rotary movement of the feed-screw may be transmitted to the work-holder on the index-head. Any suitable intermediate driving mechanism may be employed for this purpose; but in the present case the pinion 4 meshes with the teeth of one of a pair of gears 5 and 6, the latter of which drives in turn another gear 7 supported by a bracket 8 on the table T, which bracket has a long journal for a shaft or spindle, such as 9, passing through the gear 7 and on which shaft said gear is splined. This driving-spindle may be connected in any suitable manner with a rotary member of the index-head—as, for instance, by means of a key-and-slot connection with the enlarged portion 10′ of a short shaft 10, journaled in a bearing 12 in the lower side of a casing C, secured to the fixed body portion of the index-head. This casing may be made in two parts, which are indicated herein by 13 and 13′ and are suitably bolted together. The part 13 forms at 12, in the manner just described, a bearing for the shaft 10, and in a similar manner the other member 13′ of the casing forms at 14 a bearing for another short shaft or spindle 15, preferably disposed in parallelism with the shaft 10 and having its axis of rotation intersecting the axis of movement of the movable member or head of the index-head.

The two shafts 10 and 15 carry, respectively, gears 16 and 17, which are completely inclosed by the casing C and by means of which the movement of the feed-screw 2 may be transmitted to said shaft 15, which has thereon a gear or pinion, such as the bevel-pinion 18, which in the present instance meshes with a corresponding bevel-gear 19, journaled on a stud 20, carried by the movable head of the index-head, the longitudinal axis of this stud being coincident with the axis of movement of said movable head.

The bevel-gear 19 has a rather long hub, on which may be mounted a spur-gear, such as 21, this spur-gear being secured to said hub for movement in unison with the gear 19, and the movement of this spur-gear is transmitted to another spur-gear, such as that shown at 22, which last-mentioned gear may be secured to or formed integral with a long divided hub or sleeve 23, the divided ends of which may be controlled by the usual clamping-screw 24. The gear 22 is in this instance mounted for rotation on or in unison with, as the case may be, a long sleeve or bushing, such as 25, in which bushing the indexing-spindle of the index-head is intended to be supported for rotation. This indexing-spindle, which is designated in a general way by *i*, is of several diameters, none of which, however, is greater than the internal diameter of the journal-opening in the bushing, except the stop-shoulder, such as 26, which is shown herein for limiting the inward movement of said spindle. At its inner end the spindle *i* has two reduced portions, such as 27 and 28, the former of which forms the journal-surface for a power-transmitting member—such, for instance, as a worm 29—while the latter is screw-threaded at 28′ to receive a stop-nut, such as 30, for positioning said worm. At the extreme end thereof the indexing-spindle is not supported, but abuts against some suitable member of the index-head, by means of which said spindle may be positively located in position. Near the outer end thereof the spindle *i* carries a thimble 30′, in which the spindle is mounted and on which is supported the usual indexing-disk, (designated herein by *d*.) This indexing-disk has in this instance a hub 31 of the same diameter as the external diameter of the outer end of the divided sleeve 23, and the divided sleeve and the disk are intended to be connected normally by means of the clamping member 24, so as to move in unison. It will be obvious now that any movement communicated to the spur-gear 22

will of course be transmitted to the indexing-disk as long as those two members are held together; but both of these parts are so connected that they may rotate freely on the indexing-spindle *i* without rotating the latter unless some other means is provided for connecting all of these parts. This connection may be effected substantially in the usual manner by means of a suitable stop-pin, such as the spring-pressed pin 32, carried by a crank 34, secured to the indexing-spindle, this stop-pin 32 being adapted to engage, as is usual, in openings, such as 35, in the indexing-disk *d*. The crank 34 may be a slotted one, the side walls of which engage the corresponding slabbed sides, such as 36, of the outer end of said spindle, the extreme outer end of the spindle being screw-threaded, in this instance at 39, and having thereon a clamp-nut 38 for securing the crank 34 and its handle 39′ in position. Obviously now if the pin 32 is entered into any one of the openings 35 both the indexing-spindle and the spur-gear 22 will rotate in unison and the rotation of the worm 29 will be transmitted to the work-spindle controlled thereby.

The index-head embodies as its essential features some suitable support—such, for instance, as the substantially U-shaped slide 40, having a pair of parallel uprights 41 and 42, with large alined journal-openings therein. The uprights 41 and 42 are intended in this instance to receive the outer two of three members, which in the preferred form of the invention constitute the principal parts of the movable member or head proper of the index-head. These outer members are designated herein by 43 and 44, respectively, and are in the nature of a pair of complementary heads or caps, each having a body portion of one diameter, forming a journal-surface, and a flange of larger diameter, forming a stop-wall, while the third member is preferably an intermediate or block substantially of the kind illustrated at 45 in the drawings. The three members of the movable portion or head of the index-head are intended to be connected so as to form substantially a unitary structure, they being joined in this instance by means of suitable bolts, such as 46 46.

It will be obvious that the members of the movable head engage opposite sides of the support or slide and that any looseness of the parts may be taken up readily, as by means of the adjusting-nuts 47. The two heads 43 and 44 enter the journal-openings in the uprights 41 and 42 from the outer sides of said uprights, while the block 45 is positioned by inserting it directly between the uprights of the support, this block being of a width sufficient to completely fill the space between the two uprights 41 and 42, but having reduced portions, as shown at 50 and 51, to permit adjustment of the several parts of the movable head relatively to each other. The block 45 also has a large opening transversely of the feed-table, in which the driving-gears for operating the work-holder are adapted to move, as will be evident by referring to Figs. 3 and 4.

The work-holder may be of any suitable construction; but in this case it embodies as its main member a tubular spindle, such as that shown at 55, which is journaled in a preferably tapered bore in the block 45, this bore intersecting the opening 52, just mentioned. This spindle may be externally screw-threaded at its forward end to receive a face-plate and at its rear end for the purpose of permitting the spindle to be positioned longitudinally, as by means of a stop-nut 56. This spindle is also designed to receive within its tubular bore the usual arbor, such as 57, on which the work may be mounted, and a drawing-in spindle, such as 58, having internal screw-threads coöperating with the threaded inner end of the arbor 57 to wedge the latter firmly in place. At its rear end this drawing-in spindle may have a stop-flange, such as 58′, against which the rear end of the spindle 55 may abut at the inner side of said flange, while at its outer side this flange may engage one face of a bevel gear-wheel, such as 59, which may be secured to the drawing-in spindle in any suitable manner. In the construction illustrated this bevel-gear has a countersunk inner face, in which countersink the flange 58′ is seated. This gear-wheel is prevented from moving longitudinally of the spindle in one direction by the connections just described, and in the other direction its movement may be limited by a suitable stop or stops, such as that shown at 60, engaging an outer stop-wall 58″ of the gear-wheel.

For the purpose of rotating the gear-wheel 58 to wedge the arbor 57 in place and to unscrew it and eject it from the spindle 55 I have illustrated herein (see particularly Fig. 4) a rotary adjusting member carried by the movable head of the index-head and connected with the gear-wheel 58 in such a manner as to rotate the latter. This adjusting member comprises in the construction illustrated a short shaft 61, carrying a hand-wheel 62 and journaled in a suitable opening in the member or cap 43 of the movable head, this shaft 61 having at its inner end a bevel-pinion 63, adapted to mesh with the teeth of the bevel-gear 58. The opening 64‴ in the member 43 will preferably be of such length as to permit the bevel-pinion to be shifted into and out of mesh with said gear 58 by the longitudinal movement of the shaft 61. The movement of the worm 29 on the indexing-spindle *i* may be transmitted directly to the spindle 55, and in this case the latter has secured thereto a worm-gear of large size, and for the purpose of preventing backlash this worm-gear will preferably be made in two sections, such as those indicated herein at 64 and 64′, these sections being adjustable relatively to each other in a manner which is well understood and which will be obvious by referring to Figs. 3 and 4, suitable pins, such as 65, be-

ing passed therethrough to hold the parts together.

Suitable clamping devices will of course be employed for securing the several main parts of the index-head in their adjusted positions. The index-head is mounted in the usual manner on the feed-table, the latter having in the upper side thereof a longitudinal T-slot, such as 66, while the index-head has T-bolts, such as 67, projecting into said slots. Moreover, the index-heads may have detachable keys or blocks, such as 68, secured thereto, as by means of screws 69, these blocks being of a width sufficient to prevent lateral movement of the index-head. The index-head will be clamped to the feed-table when adjusted, suitable clamping means, such as those shown at 70 and 71, being employed for this purpose.

For the purpose of holding the sleeve or bushing 25 in the cap or member 44 of the index-head I may employ a clamping device, such as that shown in detail in Fig. 5, in which a clamping-screw 72, having a cam-face, operates upon a follower-bolt or shoe 73, engaging the sleeve. The main driving-spindle 55 may be held in place in a substantially similar manner by means of a clamp-screw, such as 74, operating upon a similar follower or shoe. (Not shown.) For the purpose of clamping the movable portion of the head to the support therefor it is only necessary to tighten the adjusting-nuts 47 to the proper extent, no additional clamping devices being necessary for holding the block 45 and the caps 43 and 44 in their adjusted position.

For the purpose of preventing turning of the indexing-spindle and the index-disk relatively to the bushing in which said spindle is supported I may employ in connection with the stop-pin 32 a second spring-pressed stop-pin of the usual construction, such as that shown at 75, for holding the index-disk at a second point. In this instance the stop-pin 75 is mounted in a longitudinal bore in the stud 20 and has its longitudinal axis coincident with the axis of movement of the movable head of the index-head. This spring-pressed stop-pin should be so constructed that it can be set back and held out of engagement with the index-disk when it is desired to turn the latter by means of the power-operated feed mechanism.

As it is frequently found desirable to disconnect the work-holder from the feed mechanism by means of which it is rotated usually, the indexing-spindle, as hereinbefore described, is so organized with respect to the other parts that when the clamp-screws 24 and 72 are loosened the indexing-spindle, the bushing therefor, and the other parts carried thereby may be shifted longitudinally to withdraw the worm 29 from engagement with the teeth of the worm-gear 64 64′, and in connection with the work-holder I have provided indicating means for enabling the operator to adjust such work-holder to any desired angular position without the employment of the feed connections to the spindle 55. In this instance this indicating device, which may be of any suitable construction, embodies an indexing-ring 76, having a circuit of openings 76′ therein, into any one of which may be projected a stop-pin, such as 77, (see Figs. 1 and 2,) carried by the block 45 and having an operating arm or handle 77′, by means of which the pin 77 may be forced out of the ring 76. This stop-pin will normally be spring-advanced, so as to prevent the spindle 55 of the work-holder from rotating freely, and when the pin is withdrawn from one of the openings in the ring 76 it will be locked in place in some suitable manner—as, for example, by pulling out the handle 77′ and hooking the latter over a stop member 78 of the block 45. (See Fig. 1.)

The operation of an index-head constructed in accordance with this invention, as illustrated in the present application, is as follows: The index-head is first shifted to any desired position along the feed-table T and then clamped in place by means of the clamping devices 70 and 71, the shaft 9 sliding in the gear 7 and maintaining its driving connection therewith. The nuts 47 are then loosened and the movable head swung to the desired angular position, whereupon said nuts are tightened to hold said movable head firmly locked to its support. The clamping member or screw 24 is then turned to bind the divided sleeve 23 firmly against the hub 31 of the index-disk *d*. If it is desired to turn the spindle by power from the feed mechanism, the stop-pin 75 should be set back out of engagement with the disk *d*, the clamping device 74 being of course loosened at this time to permit rotation of the work-holder and the clamping device 72 tightened to hold the sleeve 25 in place.

If it is desired to turn the work through successive arcs controlled by the setting of the pin 32 into the proper openings in the index-disk *d* and to prevent rotation of the work-holder while the feed-table is advancing under the arbor containing the cutter, (not shown,) the clamping-screw 24 should be loosened and the stop-pin 75 set in one of the openings in said disk, whereupon the divided sleeve 23 will of course rotate loosely on the sleeve 25 and on the hub 31.

The setting of the work to successive positions will be effected in the usual manner by withdrawing the pin 32 from one of the openings in the disk and resetting it. When the index-head is set in this way, the spindle 55 may of course be secured in place by a clamping device 74.

The manner in which the work-holder may be turned when the worm-gear thereof is released from the worm on the indexing-spindle has been clearly pointed out, and an additional description is considered unnecessary.

Having described my invention, I claim—

1. In a milling-machine, the combination, with a feed-table and with feeding means for

actuating the same, of an index-head adjustable longitudinally of said feed-table and having a rotary work-holder, and driving means for maintaining an operative connection between said rotary work-holder and the feeding means in all adjusted positions of the work-holder.

2. In a milling-machine, the combination, with a feed-table and with feeding means for actuating the same, of an index-head adjustable longitudinally of said feed-table and having a rotary work-holder adjustable in a vertical plane, and driving means for maintaining an operative connection between said rotary work-holder and the feeding means in all adjusted positions of the work-holder.

3. In a milling-machine, the combination, with a feed-table and with feeding means for actuating the same, of an index-head adjustable longitudinally of said feed-table and having a rotary work-holder; and a driving-shaft slidable relatively to the feeding means and operatively connected therewith and with the work-holder.

4. In an index-head, the combination, with a support, of a head mounted to turn thereon; a rotary work-holder carried by said support; an indexing-spindle; and driving means for connecting said work-holder and indexing-spindle and embodying a member shiftable for disconnecting said work-holder and the spindle.

5. In an index-head, the combination, with a support, of a head mounted to turn thereon; a rotary work-holder carried by said head and having a driving-gear; and an indexing-spindle having a gear coöperative with that of the work-holder and shiftable to disconnect said gears.

6. In an index-head, the combination, with a support, of a head mounted to turn thereon; a rotary work-holder carried by said head and having a driving-gear rotatable about an axis intersecting that of said head; and an indexing-spindle carried by said head and having a gear coöperative with that of the work-holder and shiftable to disconnect said gears.

7. In an index-head, the combination, with a support, of a head mounted to turn thereon; a rotary work-holder carried by said head and having a gear rotatable about an axis intersecting that of the head; and an indexing-spindle carried by, and having its axis of rotation in parallelism with that of, said head, and carrying a gear coöperative with that of the work-holder and shiftable to disconnect said gears.

8. In an index-head, the combination, with a support, of a head mounted to turn thereon; a rotary work-holder carried by said head and having a worm-gear; and an indexing-spindle having a worm adapted to coöperate with the worm-gear and of a diameter not greater than that of the spindle, said spindle being shiftable longitudinally in its bearings to disconnect said worm and worm-gear.

9. In a milling-machine, the combination, with a feed-table and with feeding means for actuating the same, of an index-head carried by said feed-table and having a support; a head mounted to turn on said support; a rotary work-holder; an indexing-spindle having a different axis of movement from that of said head; and driving connections joining the feeding means, the indexing-spindle, and the work-holder.

10. In a milling-machine, the combination, with a feed-table and with feeding means for actuating the same, of an index-head carried by said feed-table and having a support; a head mounted to turn on said support; a rotary work-holder; an indexing-spindle carried by said head and having a different axis of movement from that of said head; connecting means between the work-holder and the indexing-spindle; and a rotary power-transmitting member connected with the feeding means and with the indexing-spindle and having its axis of rotation coincident with the axis of said head.

11. In an index-head, the combination, with a plurality of supports having alined bearings therein, of a head carried by said supports and mounted to turn about an axis passing substantially through its center, and comprising a central member in engagement with the inner sides of said supports, and two outer members in engagement with the outer sides of said supports and adjustably connected with said inner member.

12. In an index-head, the combination, with a support, of a head mounted to turn thereon; a tubular driving-spindle carried by said head; an arbor carried in said spindle; a drawing-in spindle having screw-threads engaging corresponding screw-threads of the arbor; a gear secured to said drawing-in spindle; means for preventing movement of said gear longitudinally of said spindle; and a rotary adjusting member carried by the aforesaid head and having a gear in mesh with that on the drawing-in spindle.

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