No. 685,934.

Patented Nov. 5, 1901.

H. McC. NORRIS.

MILLING MACHINE.

(Application filed Mar. 6, 1901.)

(No Model.)

2 Sheets—Sheet 1.

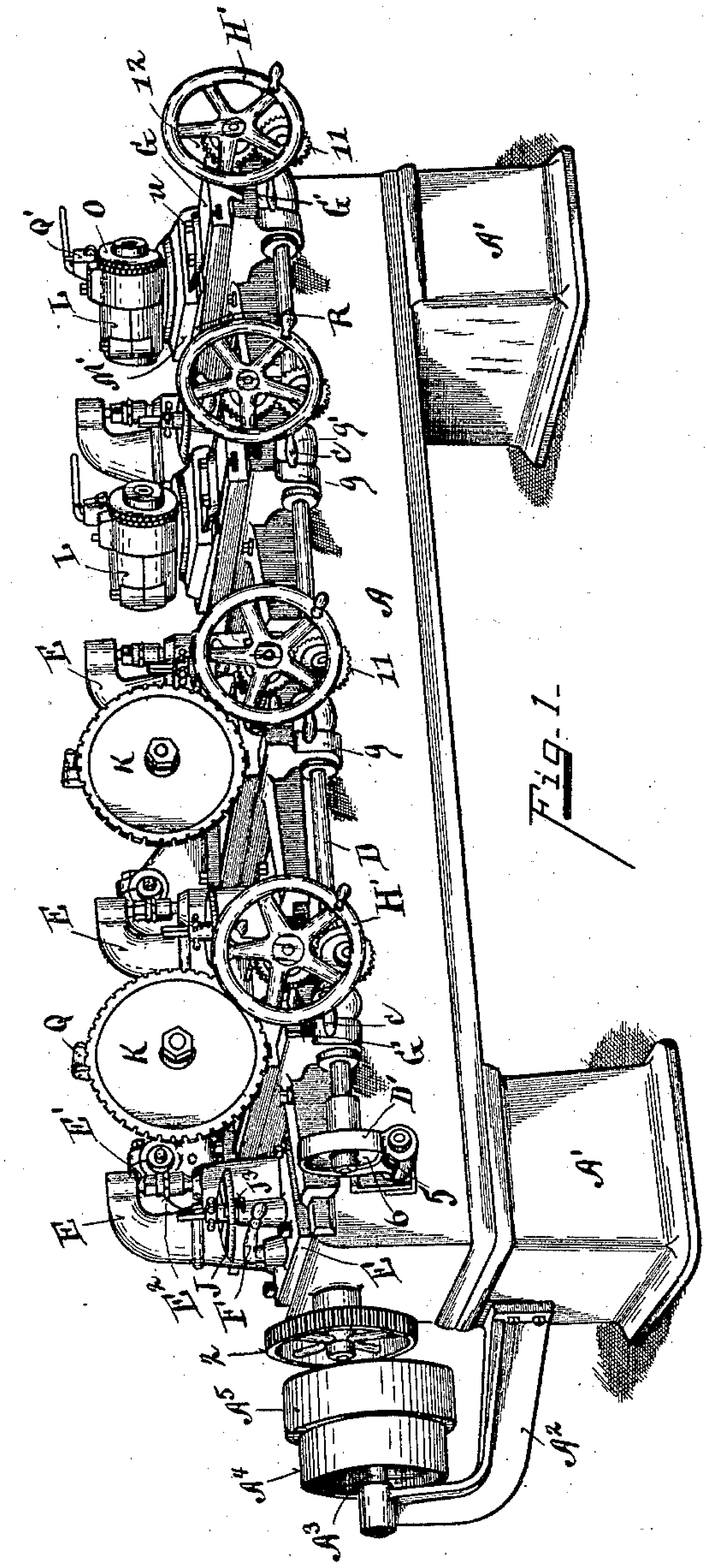


Fig. 1.

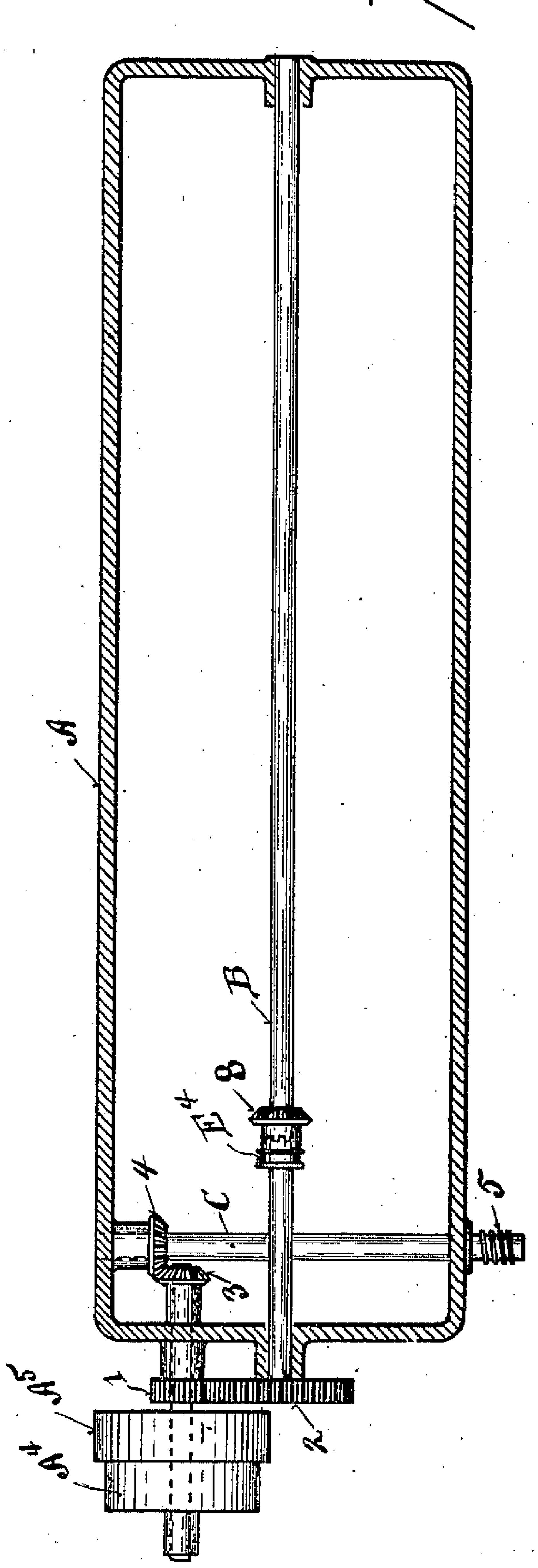


Fig. 2.

Inventor

Henry McCoy Norris

By Wood & Wood

Attorneys

Witnesses

Oliver B. Kaiser

Pearl McMichael

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

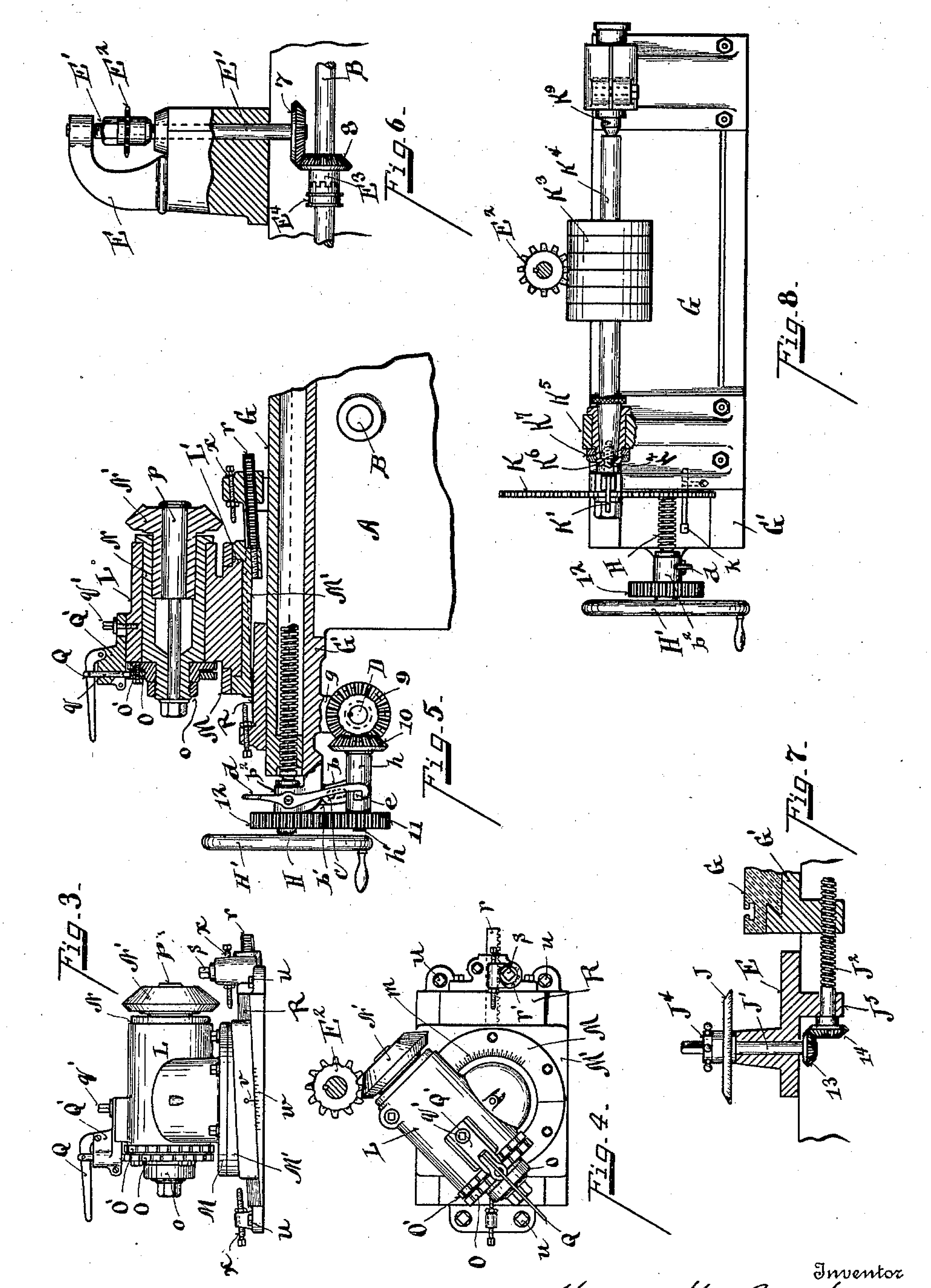
No. 685,934. Patented Nov. 5, 1901.

H. McC. NORRIS.

MILLING MACHINE.

(Application filed Mar. 6, 1901.)

(No Model.) 2 Sheets—Sheet 2.



Witnesses
Oliver B. Kaiser
Pearl N. McMichael

Inventor
Henry McCoy Norris
By Wood & Wood
Attorneys

UNITED STATES PATENT OFFICE.

HENRY McCOY NORRIS, OF CINCINNATI, OHIO.

MILLING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 685,934, dated November 5, 1901.

Application filed March 6, 1901. Serial No. 50,073. (No model.)

To all whom it may concern:

Be it known that I, HENRY McCOY NORRIS, 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 Milling-Machines, of which the following is a specification.

My invention relates to an improvement in milling-machines.

One of the objects of my invention is to provide a multiple of cutter-spindles in a single machine mounted in the same horizontal plane and driven from a common power-shaft.

Another object of my invention is to provide a multiple of traversing platens driven from a common power-shaft.

Other objects of my invention are to provide new adjustable devices for the work, platen, and cutter, whereby the work is more conveniently and efficiently performed than in prior machines of this class.

Another object of my invention is to provide a new and improved head attachment for supporting the work to be cut adapted to be manipulated and adjusted to conveniently meet any and every condition required to properly present the work to the tool.

The features of my invention are more fully set forth in the description of the accompanying drawings, making a part of this specification, in which—

Figure 1 is a perspective view of my multiple-spindle gear-cutter. Fig. 2 is a horizontal section of the bed, showing the position of the main driving-shaft. Fig. 3 is a side elevation of the swivel-head for supporting the work. Fig. 4 is a top plan view thereof. Fig. 5 is a central section of the platen and swivel-head. Fig. 6 is a sectional elevation of the cutter-head. Fig. 7 is a detail sectional view of the longitudinal platen-adjustment means. Fig. 8 is a top plan view of the spur-gear head-stock.

A represents the bed of the machine sitting upon the pedestals A′ A′, to one end of which is attached the bracket-arm A^2, supporting the pulley-shaft A^3, on which are mounted the belt-pulleys A^4 A^5. This pulley-shaft projects through the end frame of the machine. (See Fig. 2.) Between the outer face of this end frame and the pulley-wheels is mounted a gear-wheel 1.

B represents a shaft journaled in each end of the bed-plate, having one end projected through the end of the frame. Upon this projected end is fixed a gear-wheel 2, in mesh with gear-wheel 1. This shaft B represents the common spindle-operating shaft. Upon the inner end of the belt-shaft A^3 is a bevel-gear 3.

C represents a shaft journaled in the sides of the frame transversely to the shaft B. Upon the inner end of this shaft C, within the frame, is fixed the bevel gear-wheel 4, in mesh with the bevel gear-wheel 3. Upon the outer end of shaft C, projected through the front side of the frame, is formed a worm 5.

D represents a shaft exteriorly journaled in the frame of the machine longitudinally, upon the front end of which is a worm-wheel 6, in mesh with the worm 5, from which it is driven. D′ represents a guard covering the worm 5 and worm-wheel 6. This shaft D represents the common feed-shaft for traversing the multiple platens. (See Fig. 1.)

As the machine is illustrated there are four separate cutters. As the mechanisms entering into each of these cutter-heads is the duplicate of the other, a description of one of them will suffice.

Looking at Fig. 1, E represents the head-stock, in which the vertical spindle E′ is mounted, upon which spindle is the gear-cutter E^2. This vertical spindle extends from the interior of the frame upwardly, as shown in Fig. 6. Upon the lower end of the spindle is fixed a bevel-gear 7, meshing with bevel-gear 8, mounted on a sleeve E^3 on the common spindle-driving shaft B. Upon shaft B is a sliding clutch member E^4. Sleeve E^3 and clutch E^4 have teeth adapted to intermesh, whereby spindle E′ is connected and disconnected to and from shaft B. To the sliding clutch member E^4 is attached a lever F, projected upwardly above the bed, as shown in Fig. 1, and it is obvious that the operation of this lever controls the driving relationship between the common spindle-shaft B and the spindle-shaft E′. This cutter, it will be observed, is rotary on a vertical axis. This allows a multiple of head-stocks to be all mounted entirely above the bed, enabling the work to be presented to each spindle by means of an ordinary traversing platen instead of having to be raised and lowered on a framework, as in the conventional style of milling-machines.

The feature of employing in a milling-machine a multiple of spindles each carrying a cutting-tool rotary on a vertical axis and all mounted above the bed and receiving power from devices interior to the bed is a novel and very useful feature, giving the greatest possible capacity and efficiency with the least possible mechanism and space. The machine embodying this feature of my said invention is a result that is possessed of superior mechanical and commercial value.

A description of one of the series of four platens with its driving mechanisms will also suffice for all.

G represents the platens, mounted on transverse ways G', (see Fig. 5,) arranged on the frame or bed. Upon the front corner of the ways G' is located a depending bracket *g*, carrying at its lower end a swinging bracket *g'*, within which is a bevel gear-wheel 9, adapted to turn with said common platen-driving shaft D and to slide thereon as the platen is adjusted longitudinally. (See Figs. 1 and 5.)

H represents the feed-screw for the platen. (See Fig. 5.) 12 represents a spur gear-wheel, fixed to the outer end of said feed-screw, and H' represents a hand-wheel on said feed-screw. *h* represents a stud-sleeve in which is a stud-shaft *h'*. Upon the inner end of this stud-shaft is fixed a bevel gear-wheel 10, meshing with bevel gear-wheel 9 on shaft D. 11 represents a spur gear-wheel fixed to the front end of said stud-shaft *h'*, meshing with spur gear-wheel 12 to drive by power the feed-shaft H. (See Fig. 5.) Gears 11 and 12 may be taken off and be substituted by gears of other ratios in order to vary the rate of feed. The sleeve *h* is connected to and forms a part of the swinging bracket *g'*, the entire bracket being pivoted on shaft D and its outer or swinging end being detachably supported for engaging and disengaging spur-gears 11 and 12 by the following mechanisms:

b^2 represents a sleeve on screw H, attached to the ways G'. From this sleeve is suspended a slotted link *b'*, engaging and supporting a lug on the depending link *b*, attached to the side of the sleeve *h*. (See Fig. 5.) A depending lever *d* is pivoted to the sleeve b^2, the lower end of which forms a catch engaging a lug formed on the stud-sleeve opposite to the link-support. When this lever, supporting the front end of sleeve *h*, is depressed, the bracket *g'*, with its supported sleeve *h*, stud-shaft *h'*, and gear 11, swings down to the lower end of the slotted link-support. It may be raised by hand for reëngaging gears 11 and 12.

Thus far means have been described for independently controlling the relationship between the common spindle-shaft and its separate spindles and the driving relationship between the common platen-driving shaft and its several platen-feed shafts. It is of course obvious that these means could be variously modified for accomplishing these ends without departing from the scope of my improvement.

To adjust the longitudinal relationship of the platen to the cutter, and hence determine the depth of the cut, I provide a peripherally-graduated disk J, horizontally mounted above the frame. (See Figs. 1 and 7.) This disk is fixed to a vertical shaft J', upon the lower end of which is fixed a bevel gear-wheel 13.

J^2 represents an adjusting-screw one end of which has screw-threaded engagement with the support G', tapping the same longitudinally, the said support being adapted to slide in a longitudinal direction on the frame or bed. To the front end of adjusting-screw J^2 is fixed bevel gear-wheel 14, meshing with bevel gear-wheel 13.

J^3 represents an index-finger supported over the dial, as shown in Fig. 1.

J^4 represents a clamp-lock on the shaft J' for locking the disk against rotation after the proper longitudinal adjustment of the platen is obtained.

The front end of screw-shaft J^2 is journaled in a depending apron J^5 of the head-stock E. When the supporting-ways are adjusted longitudinally, the bracket *g*, with its swinging bracket *g'* and contained gears for driving the platen-feed screw, slide with said ways G' on the machine-bed.

In Fig. 8 is shown an automatic stop for the platen-feed shaft H. It consists of a lug *k*, fixed on the platen in position to engage and depress lever *d* at the end of the power-driven travel of the platen and to disengage it, so that the platen may be reciprocated by hand.

Fig. 8 illustrates the means preferably employed for supporting the spur-gears. K represents a peripherally-notched tooth-spacing disk, mounted on an internally-tapered sleeve K^6, the said sleeve being supported in the bearing-collar K^5 on the platen G. K^4 represents the work-supporting shaft, the rear end of which is supported by the tail-stock K^9, the front end being externally tapered to fit the tapered sleeve K^6, the end of the said tapered shaft K^4 being screw-threaded to receive the screw K^2, which passes from a point outside of the spacing-disk K through the said sleeve K^6 to engage into the end of shaft K^4. K^3 represents the gears to be cut fixed to the shaft K^4. When the screw K^2 is turned up, the shaft K^4 is clamped into the sleeve K^6 and it may be fixed against rotation by turning up the clamp-nut K^7, which engages the tapered sleeve K^6 and clamps the flanged head of said sleeve against the abutting face of the bearing-collar K^5.

I will now describe the support for the miter-gear work. It consists in a swiveling head L, mounted on a turret L' and adapted to rotate thereon. The turret is supported on bedplates M M′, bolted together, the upper face of the bed-plate M having an index m, adapted to show the degree of rotation of the swiveled head. Within the head is mounted a barrel N, rotative on its axis and centrally bored to receive the work N′. The work-supporting end of this barrel is upturned and forms an end bearing against the surrounding end of the swiveled head. The other end of this barrel is screw-threaded to receive the notched disks O O′, which bear against the front end of the swiveled head. o represents a clamp-nut secured on the screw-threaded end of said barrel after the notched disks to secure them in position. p represents a bolt passing centrally through the barrel, its outer end being screw-threaded into the work and clamping it in position in the barrel. The swiveled head is rotated horizontally until the bottom of the cut to be made is in parallel vertical plane with the vertical edge of the platen, which movement is gaged by index m. The notched disks O O′ are shown as set with the edge of one tooth abutting the middle of a tooth on the adjacent disk. These disks are fixed to the barrel, so that by their rotation the work may be revolved in vertical plane.

Q represents a stop or lock lever pivoted to the lock-supporting block Q′, secured on the top of the swiveled head centrally, to which lever is pivoted a plunger-finger q, passing downwardly through an orifice in the lock-supporting block and adapted to engage into the notches of the disks O O′ to lock the work to different positions, whereby different portions of the periphery are successively and measurably presented to the tool. By this means the number of teeth to be cut is determined. The block Q′ is secured by means of a bolt q' passing through a slot in the block and tapping into the head L. This bolt and slot allow the block to be clamped to a forward or rearward position for engaging either of the disks O O′, as may be desired. When the lock engages one of these disks, one side of each gear-tooth is successively presented to the cutter, and when the lock engages the opposite disk the opposite sides of the gear-teeth, respectively, are successively presented to the tool.

In order to determine the degree of taper of the cone gear-teeth in vertical plane, I have provided the following devices: The under side of the supporting-plate M′ is inclined and seats upon a correspondingly-inclined bed R. The plate M′ and all of its superimposed parts slide as a unit upon base R. Attached to plate M′ is a rack r, meshing with a gear-wheel r', journaled in post s. The head L, as shown, is slid on its bed by turning the gear r'. (Shown in dotted lines, Fig. 4.) The base R is secured upon the platen by bolts u u. The center of the plate M′ is provided with an index-mark, and the contiguous face of the base R is provided with an index. When the index-mark v of the sliding head L is opposite the central index-mark w on the base R, the center of the work supported in the swiveled head is on the same horizontal line with the center of the cutter on the spindle. The cutter is provided with means for adjusting it in vertical plane delicately to facilitate the properly centering the work and tool. In order to give the appropriate taper to the faces of the teeth, so that the teeth and spaces will be wider at the greatest diameter of the cone and least at the smallest diameter, as required in miter-gears, the gear is rotated on its axis until the face of the tooth to be cut is in a true horizontal plane, which can be readily determined by gaging it with the face of the platen. This rotating of the gear to bring the line of the face to be cut into a horizontal plane turns the gear so that this horizontal line either falls above or below the horizontal line in which the tool operates. To compensate for this, the swiveled head is longitudinally slid on its tapered base in either direction to raise or lower the work to bring the horizontal line to be cut opposite to the edge of the tool. Having once determined this adjustment for a given piece of work, it is known that the same work requires a movement so many notches above and below center for the opposite faces of the teeth.

x x represent stop-screws in the base-plate R, which may be set to limit the direction of movement of the swiveled head on its base R in either direction.

The employment of an elongated longitudinal bed with the elongated longitudinal power and feed shafts, head-stock elevated above the bed, having a vertical spindle extending down into the bed and having connections with the power-shaft and controlling mechanism, and the mounting of a platen on ways transverse to the bed, having connections with the feed-shaft, and means for connecting and disconnecting the same not only enables gear-blanks to be cut in a horizontal plane, but it forms an elemental structure and primary operative elements, enabling a multiple of cutting tools and carriages to be operated independently on the same machine. By this means a number of different gears or different kinds of gears or different kinds of milling-work can be done on the same machine at the same time, the work all being on the same level, the entire top of the machine being free from the driving mechanisms, giving the greatest possible space and efficiency for the shopwork. Such a machine is of immense practical value, and I do not wish to be limited to the details, except in so far as they are expressly made part of the claims.

Having described my invention, I claim—

1. In a milling-machine employing a tool rotary on a vertical axis, a platen, an inclined bed on said platen, a head formed with an inclined base seated on said inclined bed, an index on said inclined members adapted to register the alinement of the axis of the work

with the cutter, means for adjusting said head above or below said center, and means on the head for supporting and rotating a miter-gear, substantially as specified.

2. In a milling-machine, a platen, a tapered base mounted on said platen, a work-support mounted on said taper base, means for vertically alining the center of the cutter with the center of the work, an index registering such alinement, and means for vertically adjusting the work-support to predetermined positions either side of said position of alinement, substantially as specified.

3. In a miter-gear milling-machine, a work-support, a sleeve journaled therein adapted to hold a miter-gear at one of its ends, a pair of notched disks secured to the other end of said sleeve, the notches of one disk being adapted to present the right-hand edges of the gear-teeth successively to the tool, and the abutting-disk being adapted to present the left-hand edges of the gear successively to the tool, and means on the work-support for engaging and locking either of said disks, substantially as specified.

4. In a milling-machine employing a tool rotary on a vertical axis, a platen, an inclined base on said platen, a head adjustable longitudinally on said base and adapted to be rotated in a horizontal plane, and a miter-gear support rotatively mounted in said head, substantially as specified.

5. In a milling-machine employing a tool rotary on a vertical axis, a platen, an inclined bed thereon, a head longitudinally adjustable on said base, whereby the work may be centered with, and raised and lowered relative to the tool, means for rotating said head horizontally, a miter-gear support in said head adapted to be rotated in vertical plane, and means for securing said head and gear-support in different positions of adjustment, substantially as specified.

In testimony whereof I have hereunto set my hand.

HENRY McCOY NORRIS.

Witnesses:
OLIVER B. KAISER,
PEARL McMICHAEL.